

IBM TotalStorage FAStT900  
Fibre Channel Storage Server



# Installation Guide

**Read Before Using**

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IBM TotalStorage FAStT900  
Fibre Channel Storage Server



# Installation Guide

**Note:**

Before using this information and the product it supports, be sure to read the general information under “Notices” on page 61.

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## Safety

Before installing this product, read the Safety information.

مج، يجب قراءة دات السلامة

Antes de instalar este produto, leia as Informações de Segurança.

在安裝本產品之前，請仔細閱讀 **Safety Information** (安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

The following Danger notices and Caution notices are printed in English throughout this document. For translations of these notices, see *IBM Safety Information*.

**Statement 1:**



<p><b>DANGER</b></p> <p><b>Electrical current from power, telephone, and communication cables is hazardous.</b></p> <p><b>To avoid a shock hazard:</b></p> <ul style="list-style-type: none"><li>• <b>Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.</b></li><li>• <b>Connect all power cords to a properly wired and grounded electrical outlet.</b></li><li>• <b>Connect to properly wired outlets any equipment that will be attached to this product.</b></li><li>• <b>When possible, use one hand only to connect or disconnect signal cables.</b></li><li>• <b>Never turn on any equipment when there is evidence of fire, water, or structural damage.</b></li><li>• <b>Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.</b></li><li>• <b>Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.</b></li></ul>
--

<b>To Connect:</b>	<b>To Disconnect:</b>
<ol style="list-style-type: none"><li>1. Turn everything OFF.</li><li>2. First, attach all cables to devices.</li><li>3. Attach signal cables to connectors.</li><li>4. Attach power cords to outlet.</li><li>5. Turn device ON.</li></ol>	<ol style="list-style-type: none"><li>1. Turn everything OFF.</li><li>2. First, remove power cords from outlet.</li><li>3. Remove signal cables from connectors.</li><li>4. Remove all cables from devices.</li></ol>

**Statement 2:**



**CAUTION:**

When replacing the lithium 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.

**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.

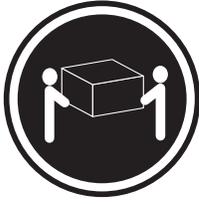
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

**Class 1 Laser statement**

Class 1 Laser Product  
Laser Klasse 1  
Laser Klass 1  
Luokan 1 Laserlaite  
Appareil À Laser de Classe 1

**Statement 4:**



		
≥ 18 kg (39.7 lb)	≥ 32 kg (70.5 lb)	≥ 55 kg (121.2 lb)

**CAUTION:**

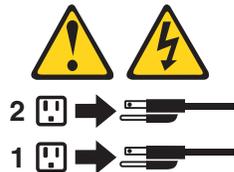
Use safe practices when lifting.

**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.



**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.



## About this document

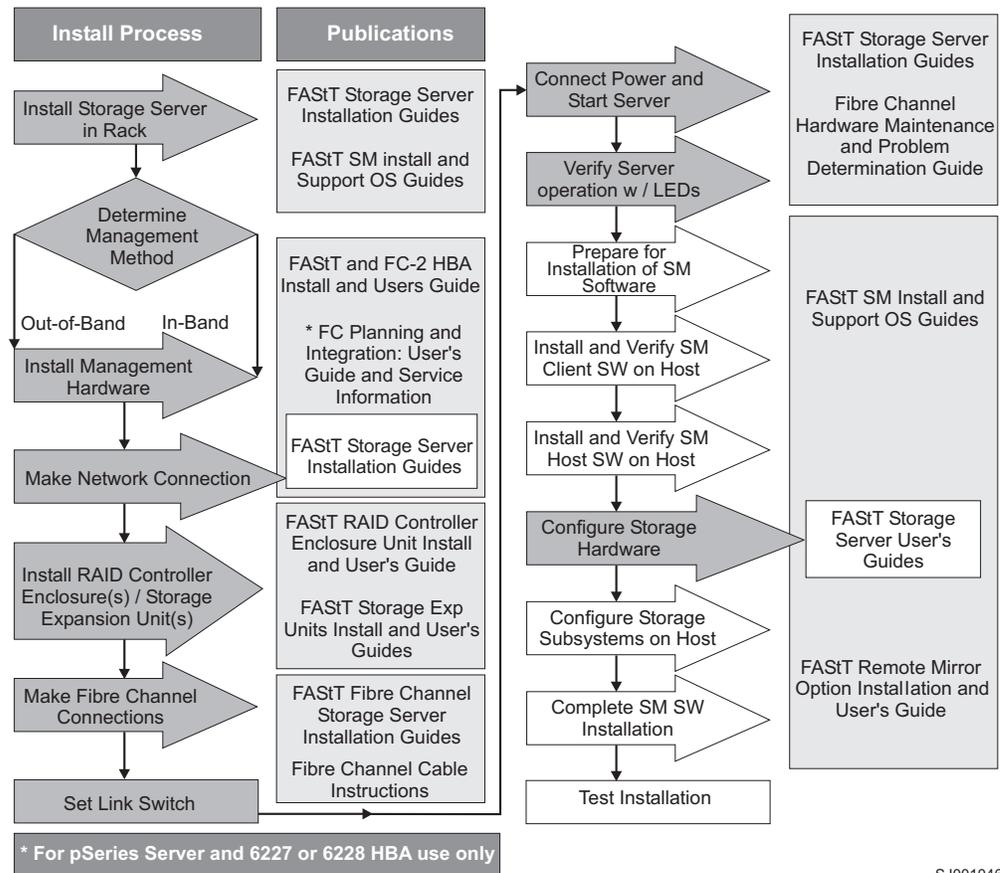
This document provides information about setting up, installing, and connecting the IBM TotalStorage™ FAST900 Fibre Channel Storage Server.

## Who should read this document

This document is intended for system operators and service technicians who have extensive knowledge of fibre channel and network technology.

## FAST installation process overview

The following flow chart gives an overview of the installation process for the FAST hardware and the FAST Storage Manager. The arrows in the flow chart indicate the current publications that cover, in detail, each step in the installation process.



SJ001046

Figure 1. FAST hardware and FAST Storage Manager installation process overview by publication

## FAST documentation

The following three tables present an overview of the FAST900 Fibre Channel Storage Server and FAST Storage Manager document libraries, as well as related publications. Each table lists documents that are included in the libraries and where to locate information that you need to accomplish common tasks.

## FAStT900 Fibre Channel Storage Server library

Table 1 associates each document in the FAStT900 Fibre Channel Storage Server library with its related common user tasks.

Table 1. TotalStorage FAStT900 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
FAStT900 Installation and Support Guide, GC26-7530	X	X		X		
FAStT900 Fibre Channel Cabling Instructions, 24P8135	X	X				
FAStT900 User's Guide, GC26-7534				X	X	X
FAStT Host Adapter Installation and User's Guide, 59P5712		X			X	
FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		X			X	
FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		X			X	
Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	X	X			X	X
FAStT Management Suite Java User's Guide, 32P0081					X	X
Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						X

## FAST Storage Manager Version 8.3 library

Table 2 associates each document in the FAST Storage Manager library with its related common user tasks.

Table 2. TotalStorage FAST Storage Manager Version 8.3 titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
Installation and Support Guide for Windows NT and Windows 2000, GC26-7522	X		X	X		
Installation and Support Guide for Linux, GC26-7519	X		X	X		
Installation and Support Guide for Novell NetWare, GC26-7520	X		X	X		
Installation and Support Guide for UNIX and AIX Environments, GC26-7521	X		X	X		
FAST Remote Mirror Option Installation and User's Guide, 48P9821	X		X	X	X	
IBM FAST Storage Manager Script Commands (see Product CD)				X		
IBM FAST Storage Manager Version 7.10 Concepts Guide, 25P1661	X	X	X	X	X	X

## FAST Storage Manager related documents

Table 3 associates each of the following documents related to FAST Storage Manager operations with its related common user tasks.

Table 3. TotalStorage FAST Storage Manager related document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance

Table 3. TotalStorage FAStT Storage Manager related document titles by user tasks (continued)

IBM FAStT500 RAID Controller Enclosure Unit Installation Guide, 59P6244		X			X	
IBM FAStT500 RAID Controller Enclosure Unit User's Reference, 48P9847		X			X	
IBM Netfinity Fibre Channel Cabling Instructions, 19K0906		X				
IBM FAStT200 and FAStT200 HA Storage Servers Installation and User's Guide, 59P6243		X			X	
IBM FAStT200 Fibre Channel Cabling Instructions, 21P9094		X				
IBM TotalStorage FAStT EXP700 Storage Expansion Unit Installation and User's Guide, 32P0178		X		X		
IBM FAStT EXP500 Installation and User's Guide, 59P5637		X		X		
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	X		X	X	X	

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## How this document is organized

Chapter 1, "Introduction and installation", on page 1 introduces the IBM FAStT900 Fibre Channel Storage Server and contains set up instructions. This chapter also includes an overview of the IBM FAStT900 Fibre Channel Storage Server features and components.

Chapter 2, “Connecting the FASt900 Storage Server”, on page 27 provides information about the components that connect the FASt900 Storage Server to the fibre channel network and instructions for connecting the FASt900 Storage Server to other fibre channel devices.

Chapter 3, “Starting the FASt900 Storage Server”, on page 53 provides information about connecting the power cords, turning the power on and off, checking the indicator lights, and installing the IBM FASt Storage Manager software.

“Notices” on page 61 provides product notices.

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## Notices used in this document

This document contains the following notices designed to highlight key information:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

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## Getting information, help, and service

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

## Before you call

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

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Check for technical information, hints, tips, and new device drivers at the IBM Support Web site:  
[www.ibm.com/pc/support](http://www.ibm.com/pc/support)
- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documents that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries

and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

## Using the documentation

Information about your xSeries or IntelliStation system and preinstalled software, if any, is available in the documents that come with your system. This includes printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software.

## Web sites

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

- For FAStT information, go to the web site at:  
[www.ibm.com/pc/support](http://www.ibm.com/pc/support)  
The support page has many sources of information and ways for you to solve problems, including:
  - Diagnosing problems, using the IBM Online Assistant
  - Downloading the latest device drivers and updates for your products
  - Viewing frequently asked questions (FAQ)
  - Viewing hints and tips to help you solve problems
  - Participating in IBM discussion forums
  - Setting up e-mail notification of technical updates about your products
- You can order publications through the IBM Publications Ordering System at:  
[www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi](http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi)
- For the latest information about IBM xSeries products, services, and support go to the Web site at:  
[www.ibm.com/eserver/xseries](http://www.ibm.com/eserver/xseries)
- For the latest information about the IBM IntelliStation information go to the Web site at:  
[www.ibm.com/pc/intellistation](http://www.ibm.com/pc/intellistation)

## Software service and support

Through IBM Support Line, for a fee you can get telephone assistance with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to the following Web site:  
[www.ibm.com/services/sl/products](http://www.ibm.com/services/sl/products)

For more information about the IBM Support Line and other IBM services, go to the following Web sites:

- [www.ibm.com/services](http://www.ibm.com/services)
- [www.ibm.com/planetwide](http://www.ibm.com/planetwide)

## Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to the following Web site for support telephone numbers:  
[www.ibm.com/planetwide](http://www.ibm.com/planetwide)

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

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## How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this document, you can submit them in one of the following ways:

- E-mail

Submit your comments electronically to:

[starpubs@us.ibm.com](mailto:starpubs@us.ibm.com)

Be sure to include the name and order number of the document and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.

- Mail or fax

Fill out the Readers' Comments form (RCF) at the back of this document and return it by mail or fax (1-800-426-6209) or give it to an IBM representative. If the RCF has been removed, you can address your comments to:

International Business Machines Corporation  
RCF Processing Department  
Dept. M86/Bldg. 050-3  
5600 Cottle Road  
San Jose, CA 95193-0001  
U.S.A

When you send information to IBM, you grant IBM a nonexclusive right to use or distribute the information in any way it believes appropriate without incurring any obligation to you.



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## Chapter 1. Introduction and installation

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

This document is written for designers familiar with basic hardware installation practices and fibre channel principles.

Fibre channel is a technology similar to a high-speed network that connects large amounts of disk storage to a server or cluster of servers. Fibre channel technology helps increase performance, scalability, availability, and the distance that attached storage subsystems can be from network servers. The IBM FAStT900 Fibre Channel Storage Server (machine type 1742, models 90U and 90X) supports fibre channel disk drives to maximize performance and redundancy.

Fibre channel technology supports applications that require large amounts of disk storage shared by two or more servers. With fibre channel, higher throughput rates over longer distances (up to 10 km) are possible than with small computer system interface (SCSI) or Serial Storage Architecture (SSA) technology.

The IBM FAStT900 Fibre Channel Storage Server (referred to throughout this document as FAStT900 Storage Server) is a high-performance unit that provides dual, redundant RAID controllers with fibre channel interfaces to both the host and drive loops. The FAStT900 Storage Server has redundant cooling, redundant power, and battery backup of the controller cache.

Designed to provide maximum host and drive-side redundancy, the FAStT900 Storage Server supports direct attachment of up to four hosts containing two host adapters each. Using external fibre channel switches in conjunction with the FAStT900 Storage Server, you can attach up to 64 hosts with two adapters each to a FAStT900 Storage Server.

The FAStT900 Storage Server functions with at least one external fibre channel drive Expansion unit containing fibre channel hard drives. The FAStT900 Storage Server supports a maximum of 224 fibre channel hard drives when using IBM FAStT EXP700 drive enclosures. If the fibre channel drives are configured in FAStT EXP500 drive expansion units, a maximum of 220 hard drives are supported.

This chapter provides descriptions of the primary components of the FAStT900 Storage Server and contains setup instructions for the FAStT900 Storage Server. The FAStT900 Storage Server is used with rack-mounted drive enclosures (also referred to as expansion units). Figure 2 on page 2 shows the IBM FAStT900 Fibre Channel Storage Server.

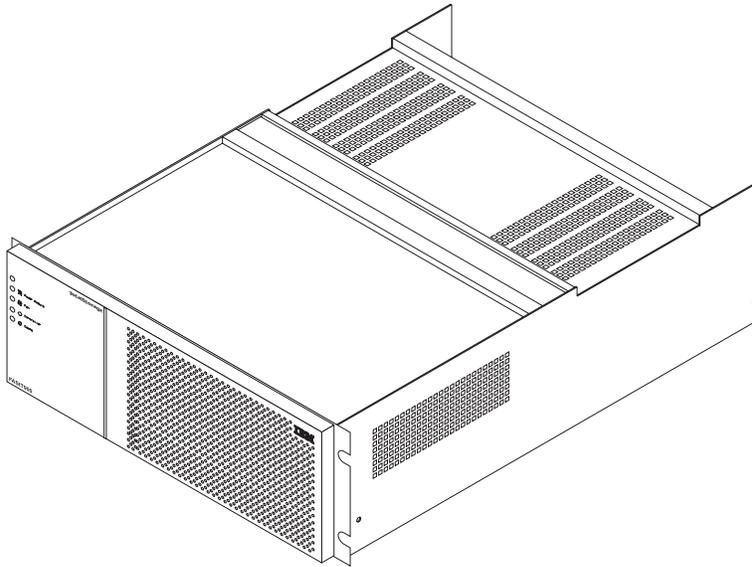


Figure 2. FAStT900 Storage Server

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## Inventory checklist

The FAStT900 Storage Server comes with the following hardware:

- Two power cords
- One rack-mounting hardware kit:
  - Two rails (right and left)
  - Eight black M6 hex-head screws
  - Eight clip nuts
  - Eight cage nuts

The FAStT900 Storage Server comes with the following software and documentation:

- FAStT Storage Manager version 8.3 CD including:
  - FAStT Storage Manager version 8.3
  - Publications in Adobe Acrobat Portable Document Format (PDF)
- Rack mounting assembly kit including:
  - Rack Mounting Instructions
  - Rack Mounting Template
  - White tape dots
- *FAStT900 Fibre Channel Cabling Instructions*

To connect the FAStT900 Storage Server to other devices, you might need the following hardware options, which are purchased separately:

- IBM Small Form-Factor Pluggable (SFP) Module
- IBM LC-LC Fibre Channel Cable
- IBM LC-SC Fibre Channel Cable Adapter
- IBM FAStT900 Mini Hub

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## FAST900 Storage Server components

The FAST900 Storage Server has the following removable components, called customer replaceable units (CRUs). All CRUs are accessible from the front or back of the FAST900 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)

**Attention:** The FAST900 controller units are not compatible with the controller units from the FAST700 or FAST500 Fibre Channel Storage servers. FAST900 controller units normally have the metallic gold latch handle. Do not mix the FAST900 controller units with IBM FAST700 or FAST500 controller units in the same storage server units. The FAST900 controller units are also keyed to prevent them from being mistakenly inserted in the non-supported storage server units. Do not force the controller units or the backplane might be damaged.

Figure 3 shows the FAST900 Storage Server front bezel. The bezel is a removable front cover with holes for viewing status lights and for boosting air circulation. Figure 4 on page 4 also shows the IBM FAST900 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 cache battery, battery charger circuitry, and status indicator lights for the controllers
- **Controllers** - Two removable units that each contain one RAID controller with 1 Gb cache memory and status indicator lights

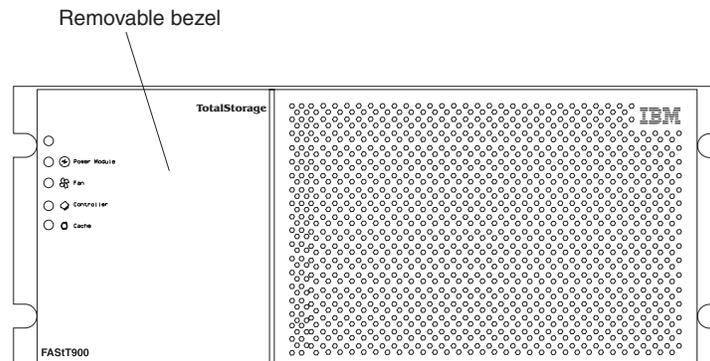


Figure 3. Storage server with bezel

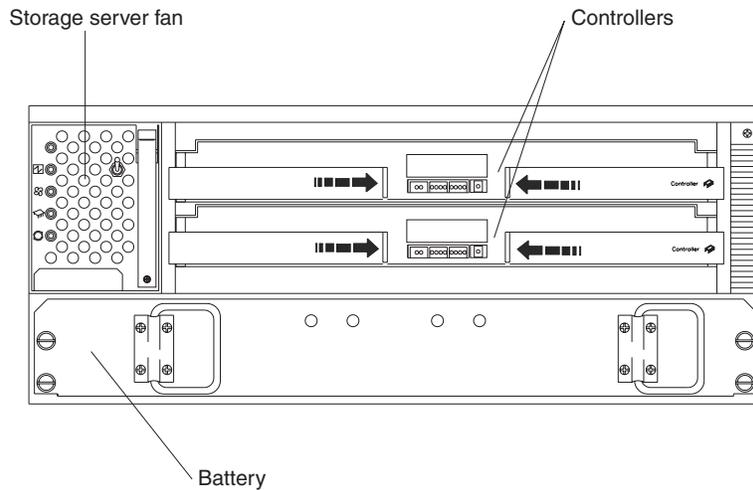


Figure 4. FAST900 Storage Server - front view

Figure 5 shows the FAST900 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 insert Small Form-Factor Pluggable (SFP) modules and connect fiber-optic host and drive interface cables to the FAST900 Storage Server (the standard FAST900 configuration includes two host and two drive mini hubs)
- **Power supplies** - Two removable units that each contain a power supply and an indicator light
- **Fan and communications module** - A removable unit that contains the power supply cooling fans, an indicator light, and Ethernet ports

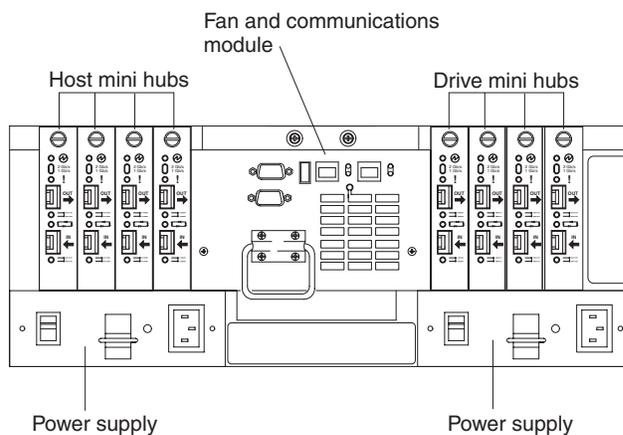


Figure 5. FAST900 Storage Server - back view

## Operating specifications

Table 4 summarizes the operating specifications of the FAStT900 Storage Server.

Table 4. IBM FAStT900 Fibre Channel Storage Server operating specifications

<p><b>Size (with front panel and without mounting rails):</b></p> <ul style="list-style-type: none"> <li>• Depth: 63.5 cm (25 in.)</li> <li>• Height: 17.45 cm (6.87 in.)</li> <li>• Width: 48.2 cm (18.97 in.)</li> </ul> <p><b>Weight:</b></p> <p>Typical FAStT900 Storage Server fully configured: 43.99 kg (97 lbs)</p> <p><b>Electrical input:</b></p> <ul style="list-style-type: none"> <li>• Sine-wave input (50 to 60 Hz) is required</li> <li>• Input voltage:             <ul style="list-style-type: none"> <li>– Low range:                 <ul style="list-style-type: none"> <li>- Minimum: 90 V ac</li> <li>- Maximum: 136 V ac</li> </ul> </li> <li>– High range:                 <ul style="list-style-type: none"> <li>- Minimum: 198 V ac</li> <li>- Maximum: 257 V ac</li> </ul> </li> <li>– Input kilovolt-amperes (kVA) approximately: 0.214 kVA</li> </ul> </li> </ul>	<p><b>Environment:</b></p> <ul style="list-style-type: none"> <li>• Air temperature:             <ul style="list-style-type: none"> <li>– Altitude: 0 to 914 m (3000 ft): 10° to 35°C (50° to 95°F)</li> <li>– Altitude: 914 m (3000 ft) to 2133 m (7000 ft): 10° to 32°C (50° to 90°F)</li> </ul> </li> <li>• Humidity: 20% to 80%</li> </ul>	<p><b>Acoustical noise emissions values:</b></p> <p>For typical system configurations:</p> <ul style="list-style-type: none"> <li>• Sound power (idling and operating): 6.5 bels</li> <li>• Sound pressure (idling and operating): 65 dBA</li> </ul> <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 the location might exceed the average 1-meter values stated because of room reflections and other nearby noise.</p>
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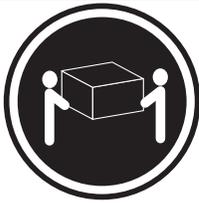
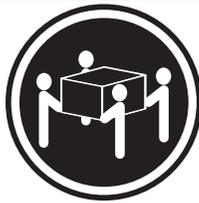
## Preparing for installation

Use the following procedure to prepare the FASt900 Storage Server for installation into a rack cabinet:

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Operating specifications” on page 5.
2. Move the FASt900 Storage Server and its rack cabinet to the site.

**Statement 4:**



		
≥ 18 kg (39.7 lb)	≥ 32 kg (70.5 lb)	≥ 55 kg (121.2 lb)

**CAUTION:**

**Use safe practices when lifting.**

3. Remove the FASt900 Storage Server from its shipping container and check the contents (see “Inventory checklist” on page 2). If any items are missing, contact an IBM reseller before proceeding.
4. Assemble the tools and equipment you will need for installation. These might include:
  - Power cords (comes with the FASt900 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 FASt900 Storage Server)
  - IBM FASt Storage Manager software to configure the storage subsystems (comes with the FASt900 Storage Server)

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## Handling static-sensitive devices

**Attention:** Static electricity can damage electronic devices and systems. 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, the installer should hold the device and touch 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 the 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 the 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.

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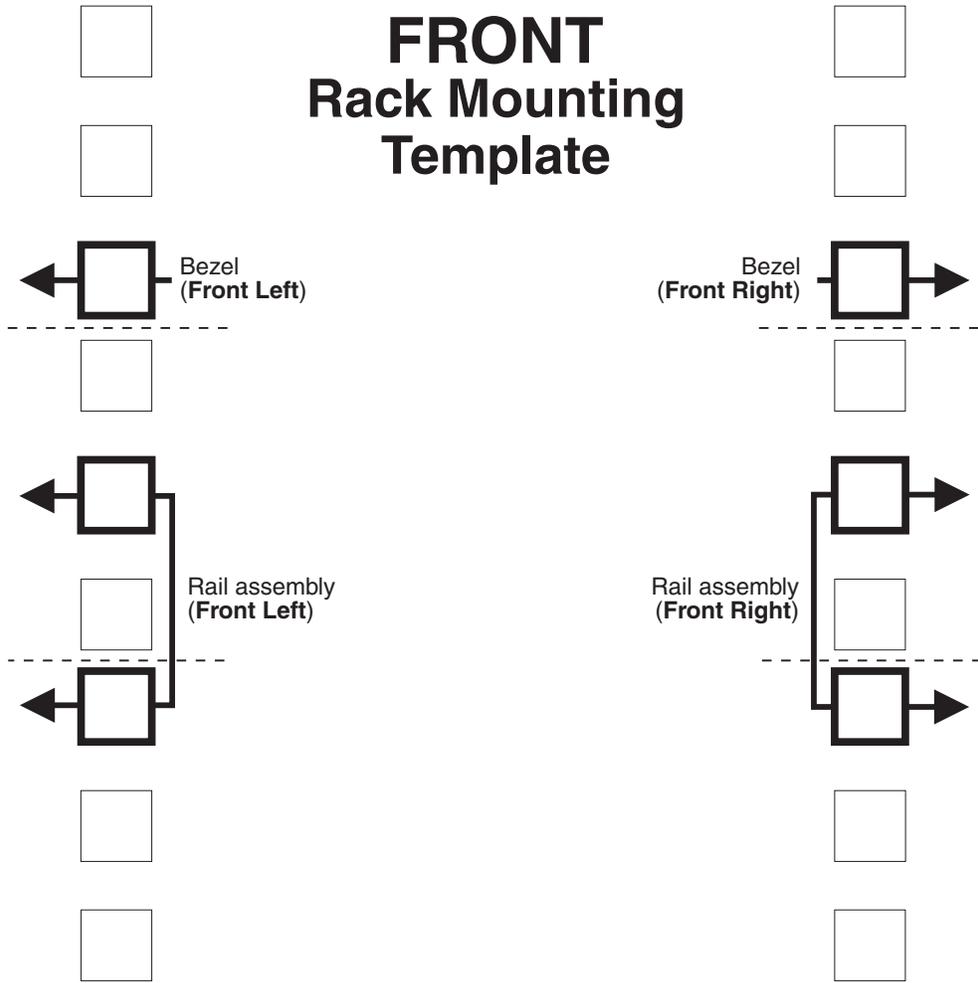
## Installing the FASt900 Storage Server in a rack cabinet

This section provides information on installing the controller unit in a rack cabinet. If you will not be installing the server in a rack, proceed to “Determining additional hardware requirements” on page 21.

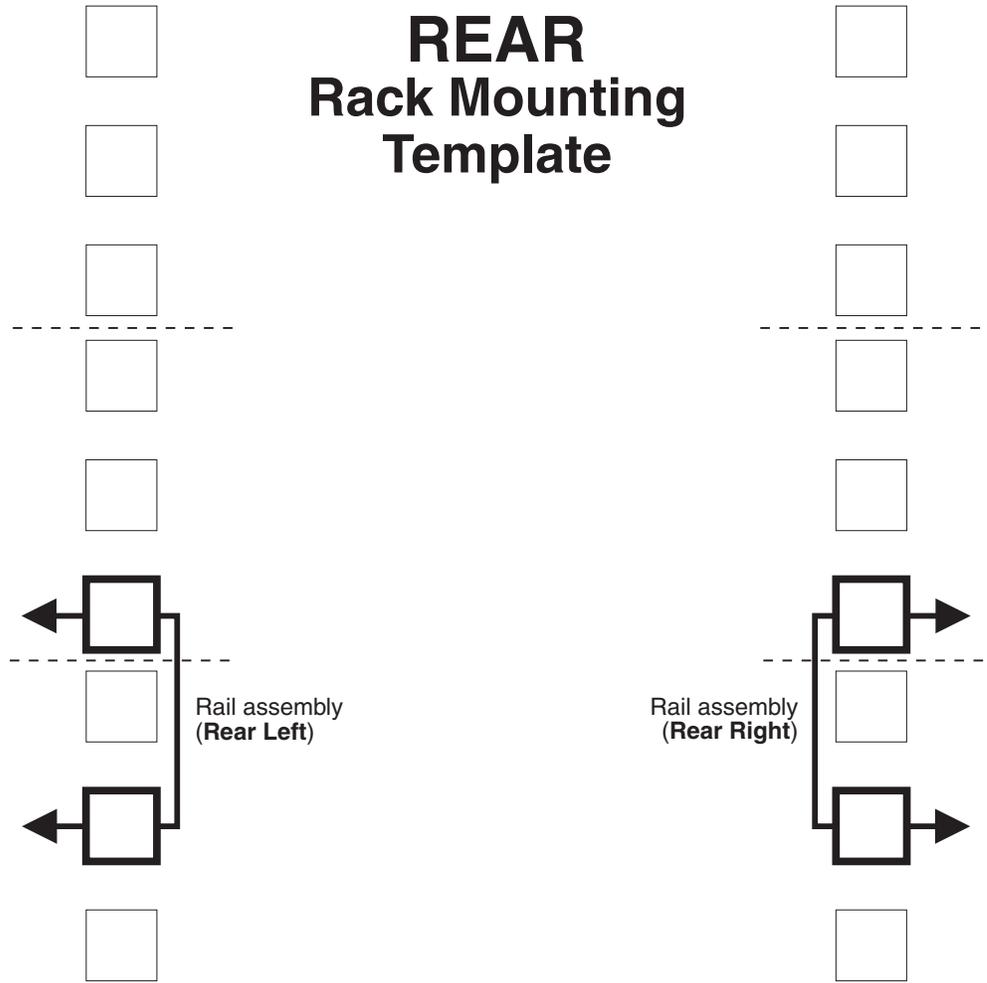
The FASt900 Storage Server comes with a rack-mounting hardware kit for installation into a rack cabinet. It is easier to lift the FASt900 Storage Server and install it in a rack cabinet if you remove all CRUs first. A fully loaded FASt900 Storage Server with a storage server fan, battery, fan and communications 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.

A rack mounting template and instructions come with the storage server. If you have misplaced these items, use the following template and instructions. If you have not already done so, read “Preparing for installation” on page 6 before you begin.

# FRONT Rack Mounting Template



# REAR Rack Mounting Template



Prior to installing the controller unit, ensure you have addressed the following:

- Review the documentation that comes with the rack cabinet
- Maintain 15 cm (6 in.) of clearance around the controller unit for air circulation
- Ensure the room air temperature is below 35 °C (95 °F)
- Plan the controller unit installation starting from the bottom of the rack
- Remove the rack doors and side panels to provide easier access during installation
- Position the template to the rack so that the edges of the template do not overlap any other devices
- Use the stickers included with the rack mounting template to mark the holes on the front and rear of the rack in the locations indicated by the arrows on the template
- Connect all power cords to properly wired and grounded electrical outlets
- Take precautions to prevent overloading the power outlets when you install multiple devices in a rack

The following is a list of items that come with the controller unit. If any items are missing or damaged, contact the place of purchase.

- Cage nuts (8)
- Clip nuts (8)
- Black M6 hex screws (8)
- Side rails (2)

Proceed with steps 1 through 12 to install the controller unit in a rack cabinet.

1. Carefully pull out the bottom of the bezel on the front of the controller unit to release the pins; then, slide the bezel downward and set it aside for later.

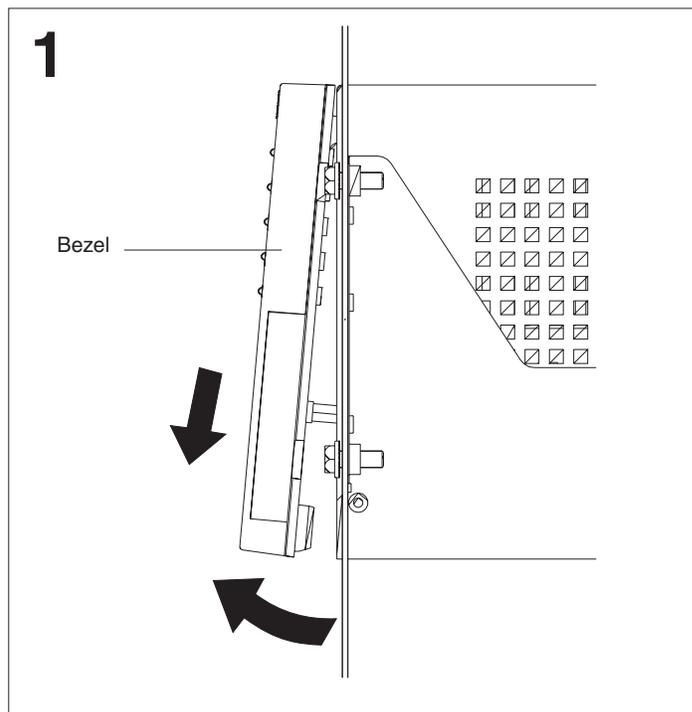


Figure 6. Bezel removal

2. Pull up on the controller fan lever to unlock it; then, grasp the fan handle and pull out firmly to remove the fan and save it for later reinstallation.

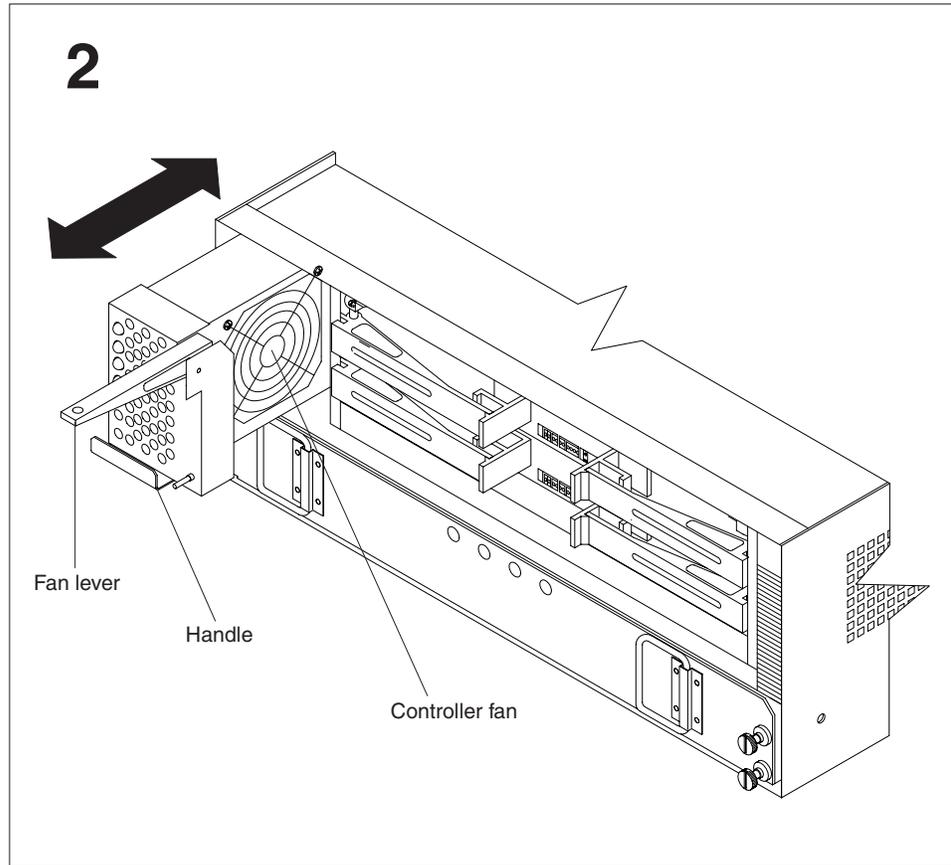


Figure 7. Fan removal

3. Unlock and open the controller levers; then, use the levers to pull the controller out slightly. Grasp both sides of the controller to remove and save it for later reinstallation. Repeat step 3 for each controller.

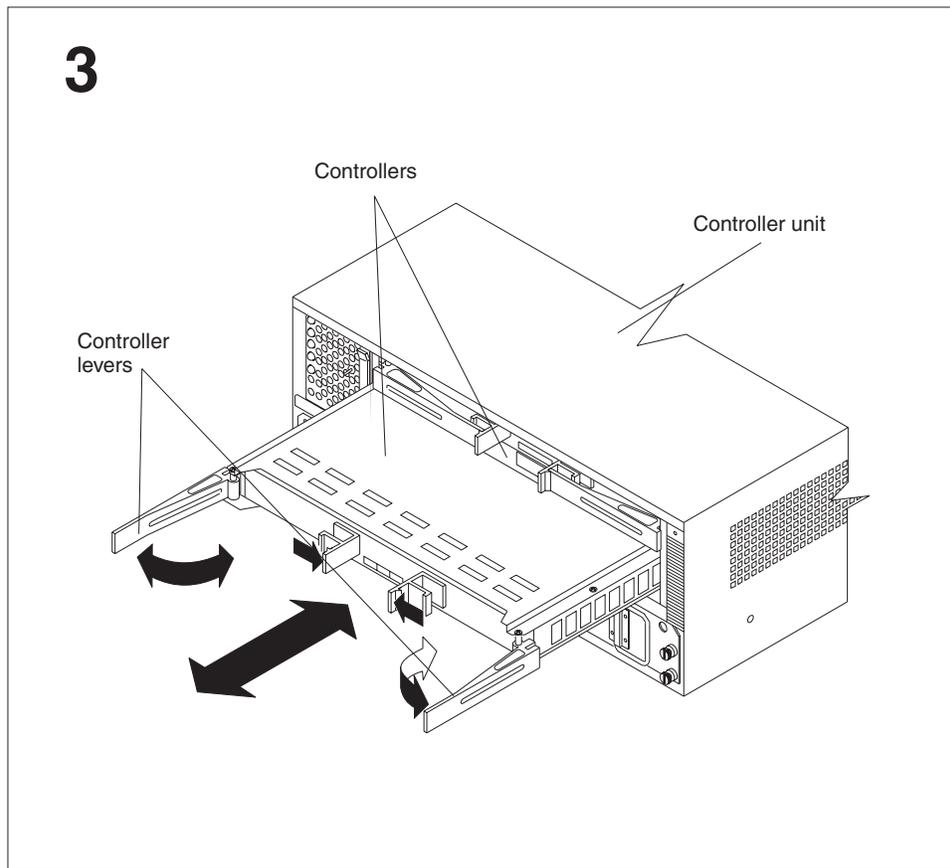


Figure 8. Controller removal

4. Loosen the four screws that secure the battery inside the controller unit; then, pull the battery out a few inches. Grasp both sides of the battery to remove it and save it for later reinstallation.

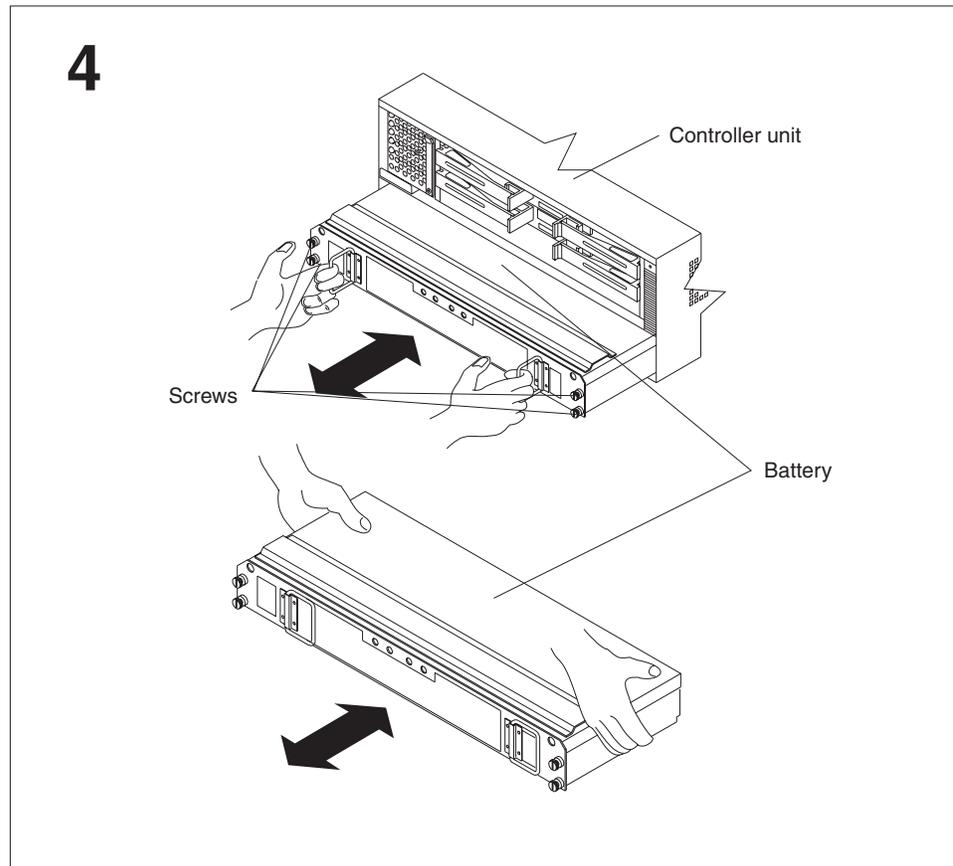


Figure 9. Battery removal

5. Using the pull handle on a power supply, lift up and pull to release the power supply; then, slide the power supply out and save it for later reinstallation. Repeat step 5 for each power supply.

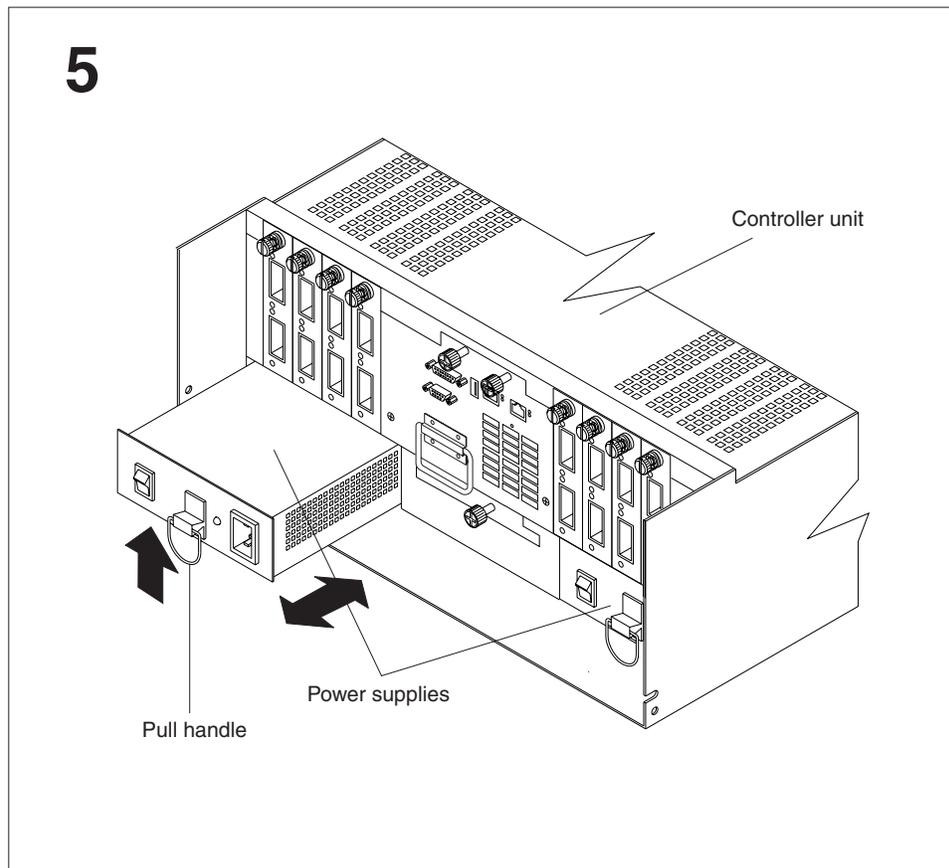


Figure 10. Power supply removal

6. Loosen the three captive screws on the fan and communications module; then, grasp the pull handle and pull firmly to remove the module and save it for later reinstallation.

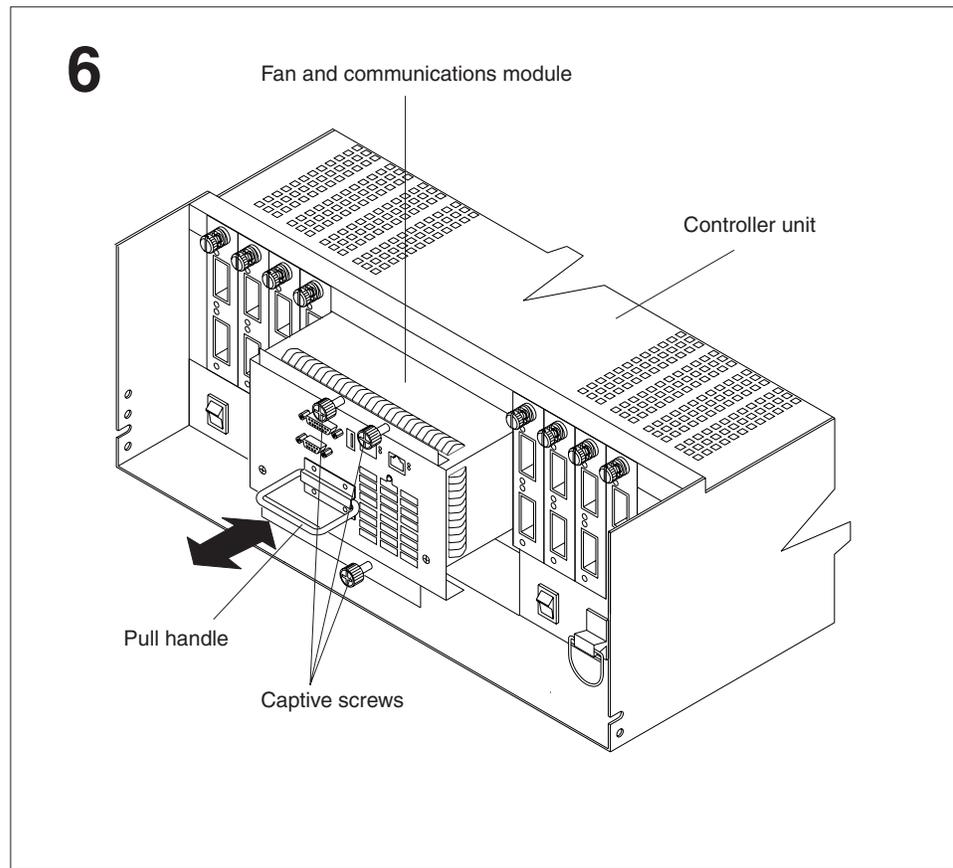


Figure 11. Fan and communications module removal

7. Loosen the captive screw on a mini-hub; then, grasp the screw to remove the mini-hub from the controller unit. Repeat step 7 for each mini-hub.

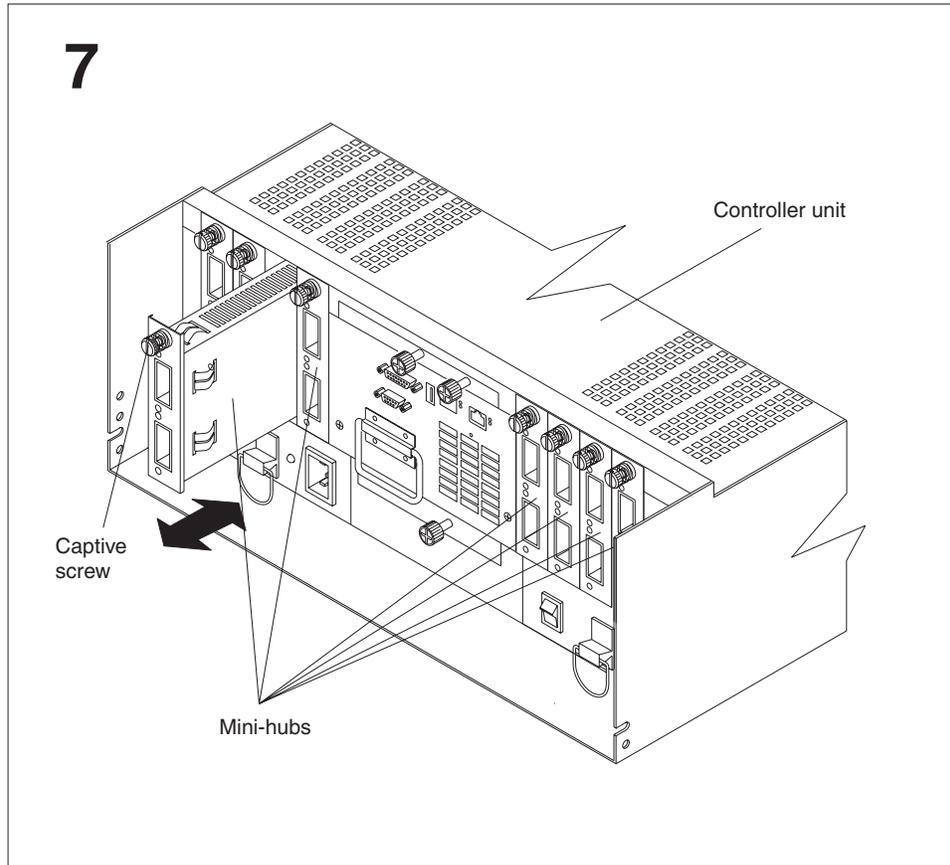


Figure 12. Mini-hub removal

8. Insert cage nuts or slide clip nuts, as required for the rack, into all of the marked holes. Use the cage nut insertion tool or a flat-blade screwdriver to insert cage nuts.

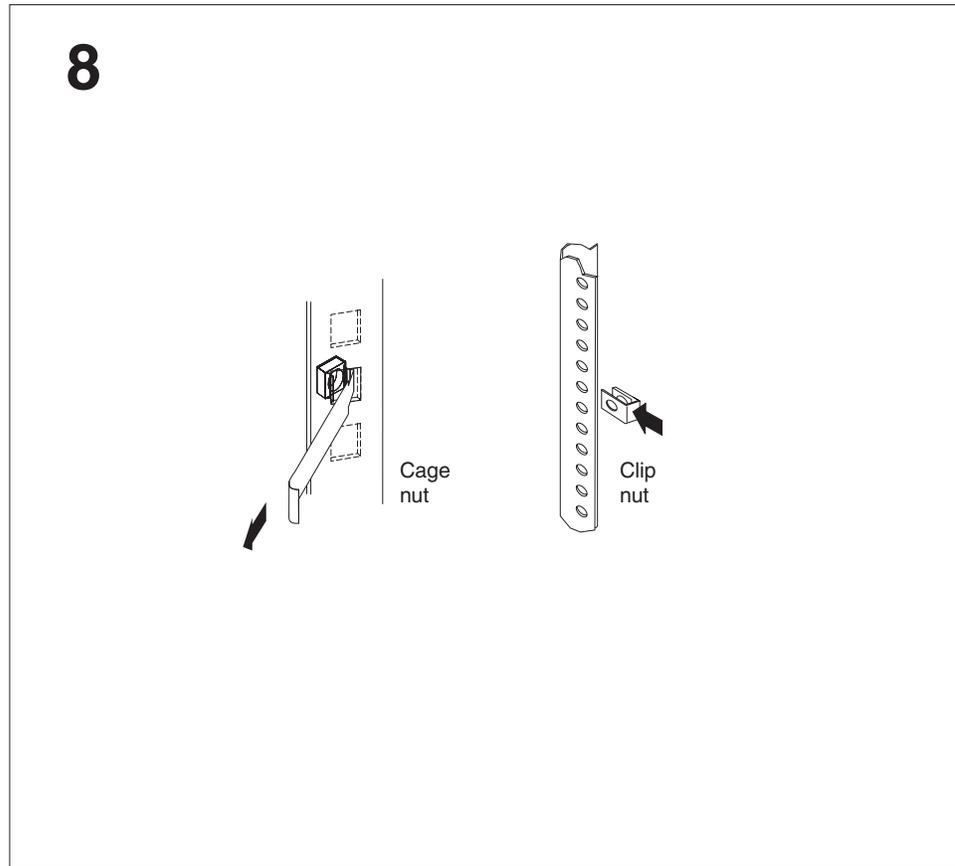


Figure 13. Cage nut and slide clip nut insertion

9. On the rail marked **R**, loosen both screws on the inside of the rail; then, extend the rail outside the rear rack mounting flange. Hold the front of the rail against the outside of the rack mounting flange and loosely insert the two front screws; then, insert and tighten the two rear screws and adjustment screws. Repeat step 9 for the rail marked **L**.

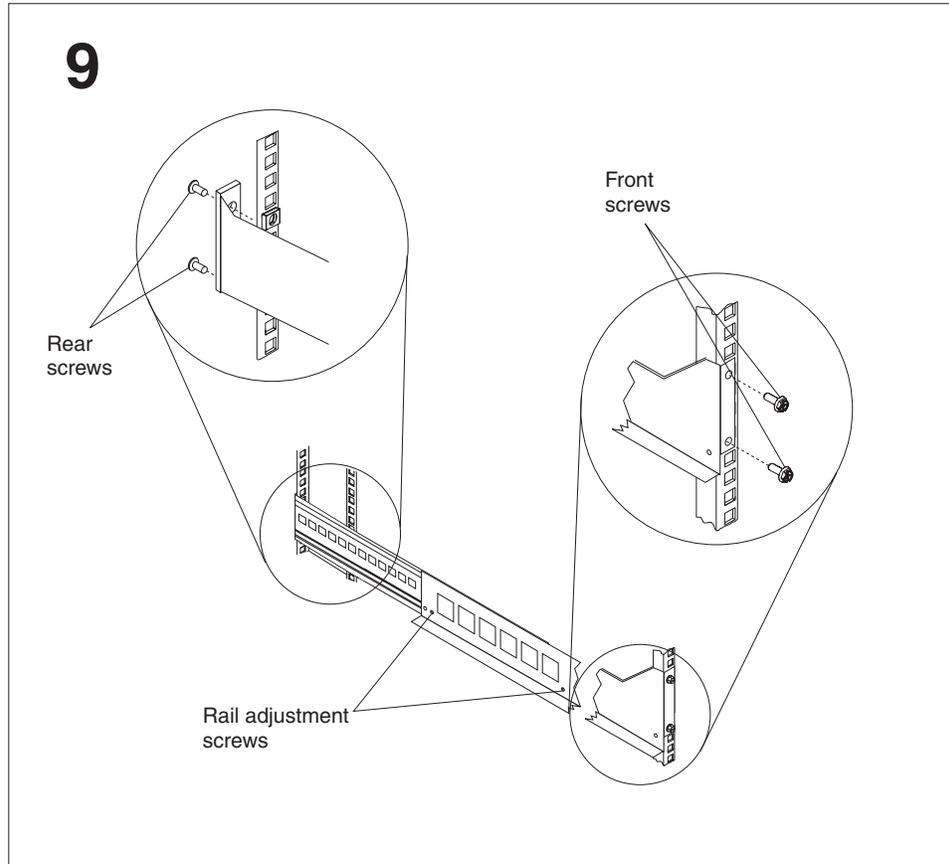


Figure 14. Rail mounting

10. Remove the front and rear controller unit screws and save them to secure the controller unit to the rails.

**Note:** Front screws and rear screws are different sizes. Keep them separate when you remove them.

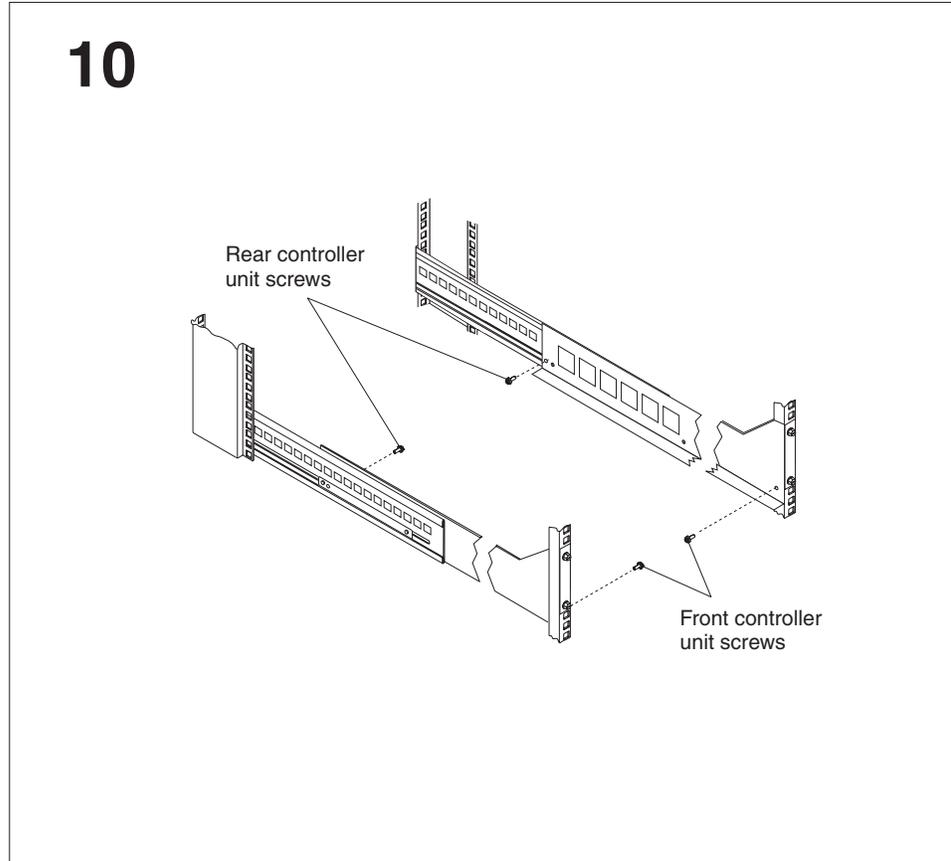


Figure 15. Controller unit screw removal

11. Slide the controller unit into the rack; then, secure the rear of the controller unit with two of the screws removed in step 10 on page 19. Secure the front of the unit with the other two screws.

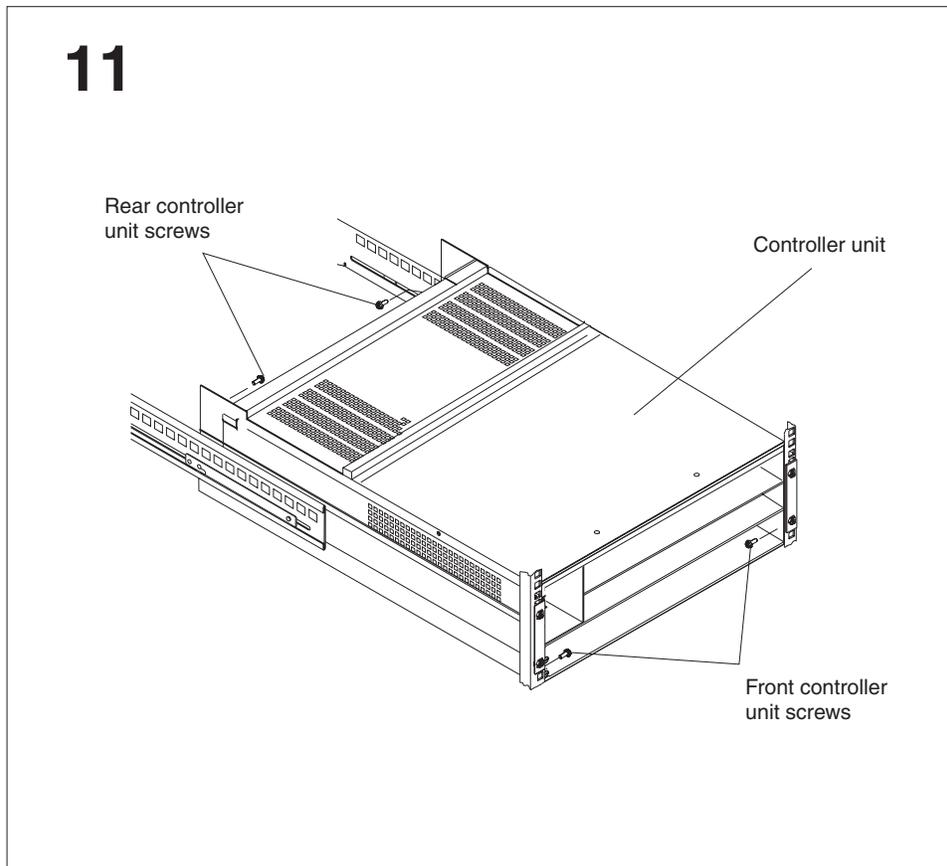


Figure 16. Controller unit mounting

12. Reverse step 2 on page 11 through step 7 on page 16 to reinstall all of the devices that you removed; then, reinstall the bezel by sliding the top edge under the lip on the controller unit. Push the bezel bottom until it snaps into place.

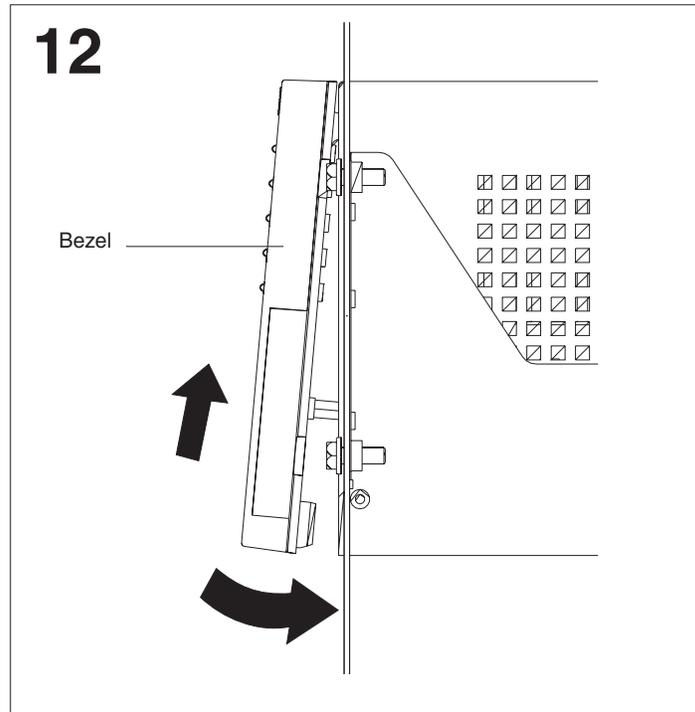


Figure 17. Bezel installation

Refer to the documentation that comes with the controller unit for further information on configuring and operating the controller unit.

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## Determining additional hardware requirements

You might need to install additional hardware if the fibre channel network is configured for the following topologies:

- Host-agent (in-band) management of storage subsystem
- Direct (out-of-band) management of storage subsystem
- Cluster server environment

Use the information in the following sections to determine the additional hardware that you might need.

## Hardware and software requirements for host-agent (in-band) management

If you are using the host-agent (in-band) method to manage storage subsystems, the following items are required:

- The host-agent software must be installed on a designated host computer. Install at least one management station and one host computer. For instructions, refer to the document appropriate for operating systems used by the host and management station:
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Microsoft® Windows NT® and Windows® 2000*
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Novell NetWare*
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Red Hat Linux*
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for UNIX® and AIX®*
- Ethernet cables from the host computer are attached to the management station.
- You will connect fiber-optic cables to each controller later in the installation process. This information is contained in Chapter 2, "Connecting the FASt900 Storage Server", on page 27.

Figure 18 on page 23 shows host-agent (in-band) managed storage subsystems.

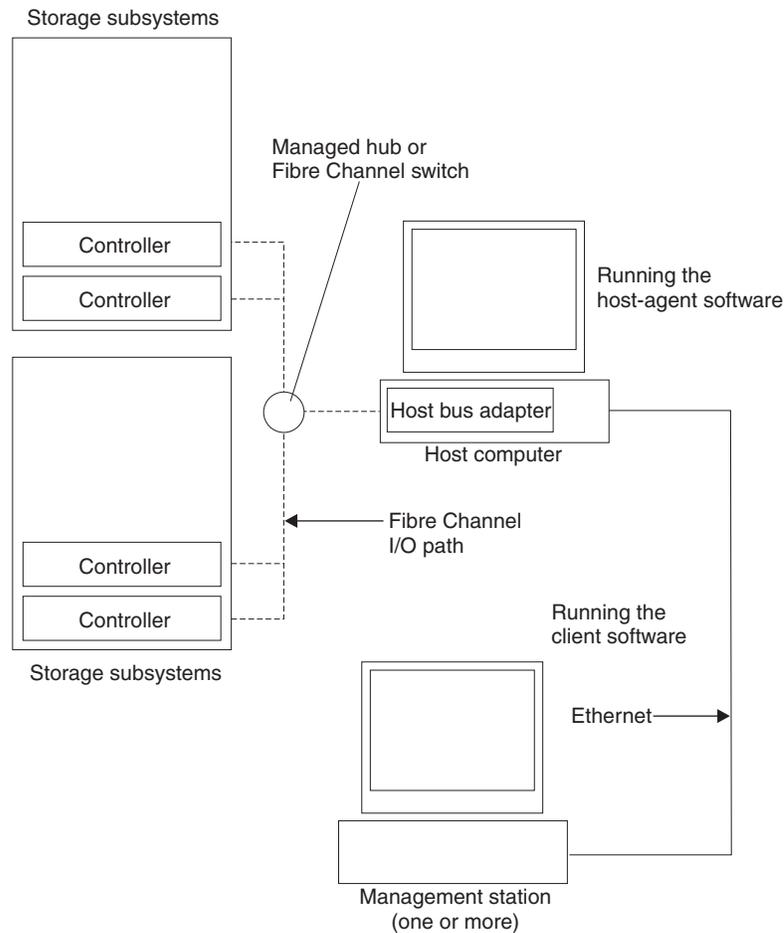


Figure 18. Host agent (in-band) managed storage subsystems

After you install the hardware, if the fibre channel network environment is configured for cluster servers, go to “Hardware for cluster servers” on page 24.

If you are installing drive enclosures in a rack cabinet, go to “Installing drive enclosures in a rack cabinet” on page 26. Otherwise, proceed straight to Chapter 2, “Connecting the FAStT900 Storage Server”, on page 27.

## Hardware and software requirements for direct (out-of-band) management

If you are using the direct (out-of-band) method to manage storage subsystems, the following items are required:

- The host-agent software must be installed on a designated host computer. Install at least one management station and one host computer. For instructions, refer to the document appropriate for operating systems used by the host and management station:
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Microsoft Windows NT and Windows 2000*
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Novell NetWare*
  - *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for Red Hat Linux*

– *IBM FAStT Storage Manager Version 8.3 Installation and User's Guide for UNIX and AIX*

- Ethernet connections must be made between a management station and each controller. You must install at least one management station and then attach Ethernet cables to each management station and two Ethernet cables per FAStT900 Storage Server. Refer to “Connecting Ethernet cables” on page 51.
- You will connect fiber-optic cables to each controller later in the installation process. This information is contained in Chapter 2, “Connecting the FAStT900 Storage Server”, on page 27.

Figure 19 shows direct (out-of-band) managed storage subsystems.

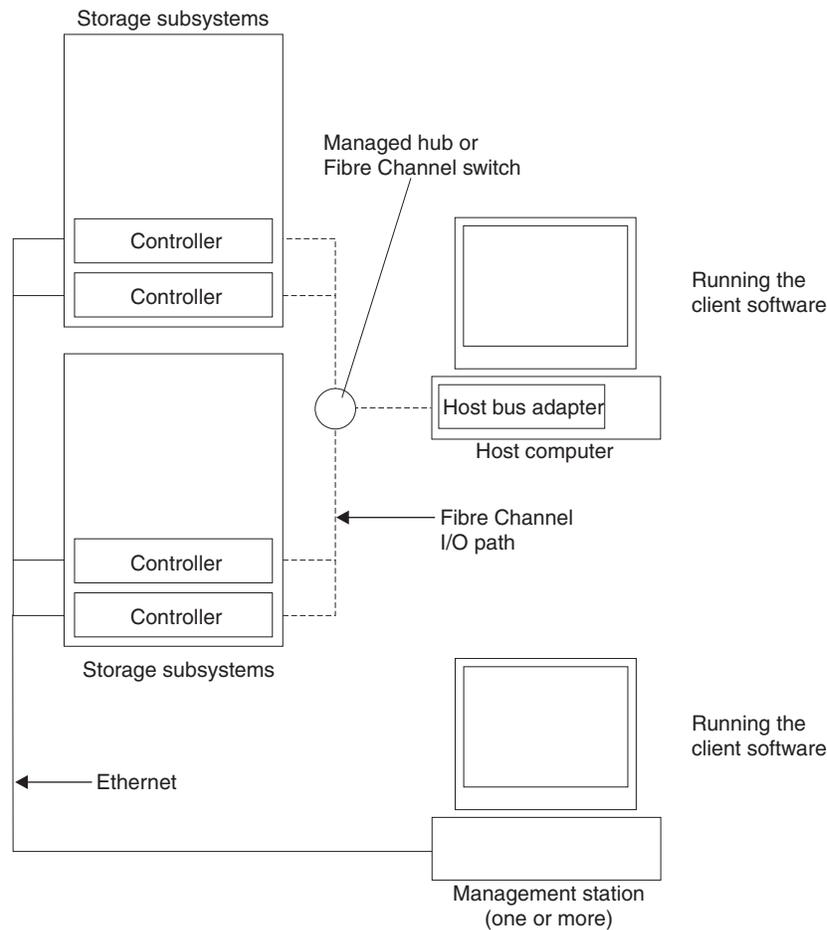


Figure 19. Direct (out-of-band) managed storage subsystems

After you install the hardware, if the fibre channel network environment is configured for cluster servers, go to “Hardware for cluster servers”.

If you are installing drive enclosures in a rack cabinet, go to “Installing drive enclosures in a rack cabinet” on page 26. Otherwise, go to Chapter 2, “Connecting the FAStT900 Storage Server”, on page 27.

## 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. For complete information about installing host bus adapters, refer to the *IBM TotalStorage FAST FC2-133 Dual Port Host Bus Adapter Installation and User's Guide*.

Figure 20 shows fibre channel connections using a dual-path configuration for fully redundant environments.

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

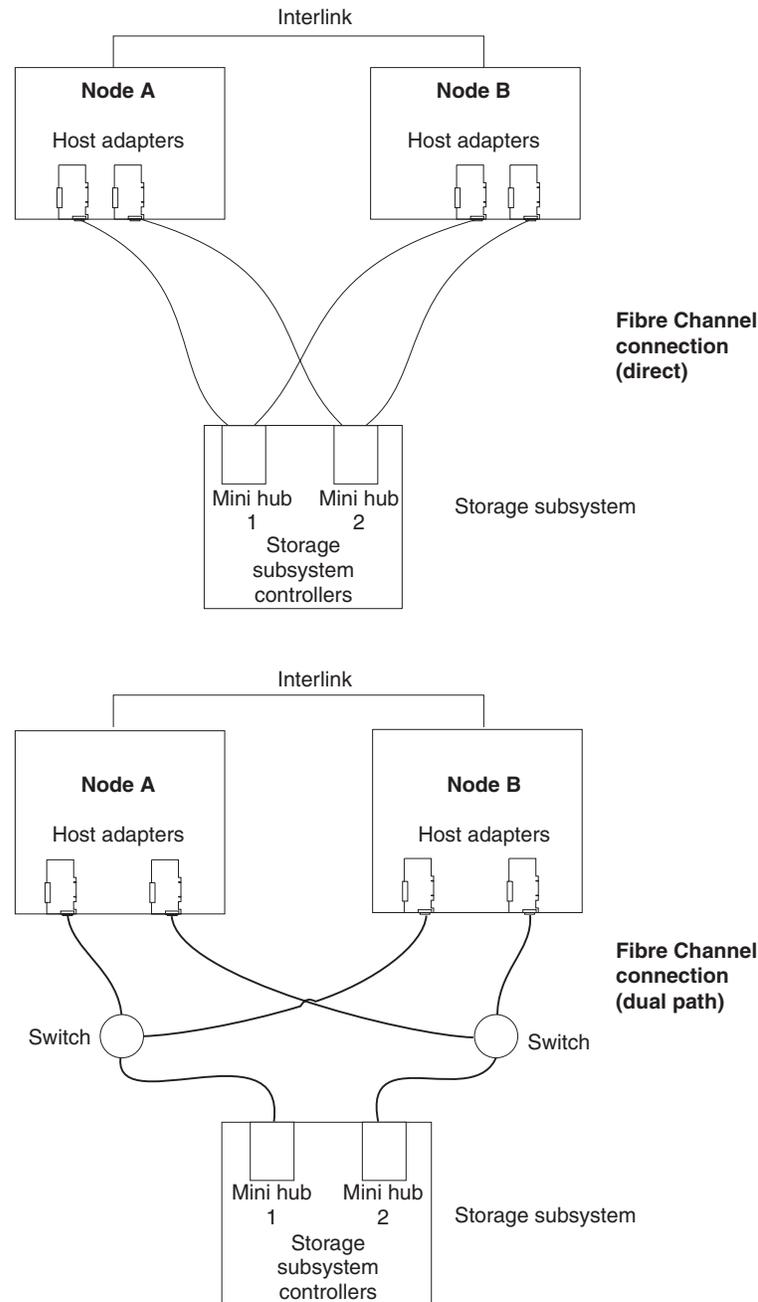


Figure 20. Host adapters in storage subsystems on a fibre channel network

Before you install the host adapters, note the following reminders 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 FAStT 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. You can find this information on the IBM FAStT Storage Manager installation CD or at the following Web site:  
[www.ibm.com/pc/support/](http://www.ibm.com/pc/support/)  
Make sure each host adapter and controller has a unique fibre channel ID. This is the value set in the adapter Hard Loop ID field.

After you install the cluster server hardware, continue with “Installing drive enclosures in a rack cabinet” if you have drive enclosures, or go to Chapter 2, “Connecting the FAStT900 Storage Server”, on page 27.

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## Installing drive enclosures in a rack cabinet

Install the drive enclosures that you are attaching to the FAStT900 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. After you install the drive enclosures, go to Chapter 2, “Connecting the FAStT900 Storage Server”, on page 27.

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## Chapter 2. Connecting the FASt900 Storage Server

This chapter provides information about connecting the FASt900 Storage Server to other fibre channel devices. It contains information about the interface connections and installing SFP modules and fiber-optic cables. This chapter also provides detailed information about configuring drive loops and connecting the FASt900 Storage Server to hosts and drive enclosures.

---

### 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 FASt900 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 or drive enclosure. 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. Figure 21 shows the mini-hub interface connections.

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

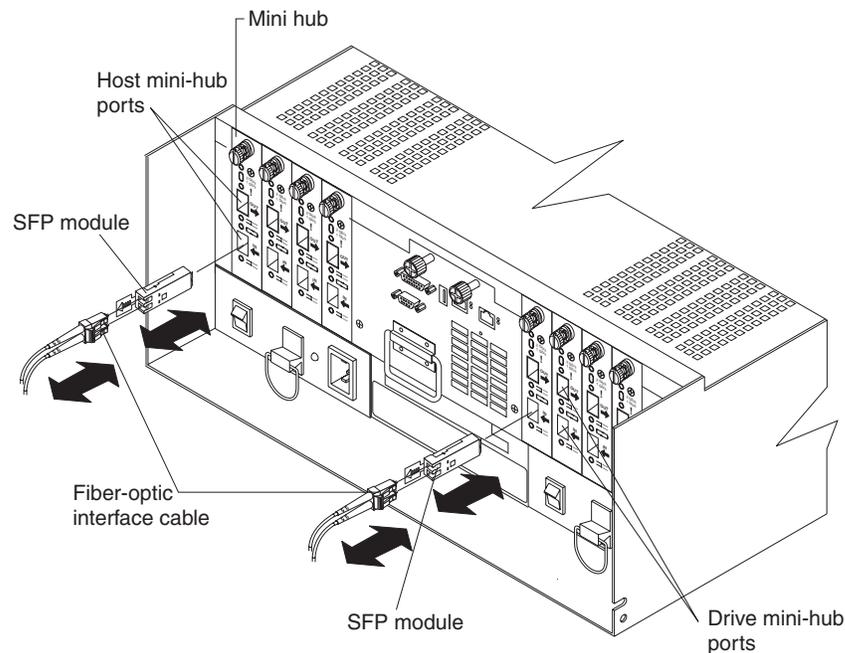


Figure 21. Mini-hub interface connections

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### Interface ports

The SFP mini-hub ports are used for data transfer between hosts or drive enclosures and RAID controllers in the FASt900 Storage Server. Ethernet ports are available for storage subsystem-management. The FASt900 Storage Server interface ports are shown in Figure 22 on page 28.

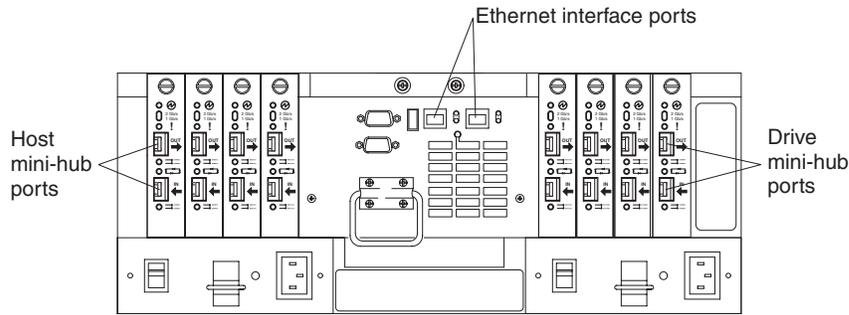


Figure 22. FASt900 Storage Server interface ports

## Host interface ports

The FASt900 Storage Server comes 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 Figure 23. To ensure redundancy, you must connect each host to both controllers through the appropriate mini hub.

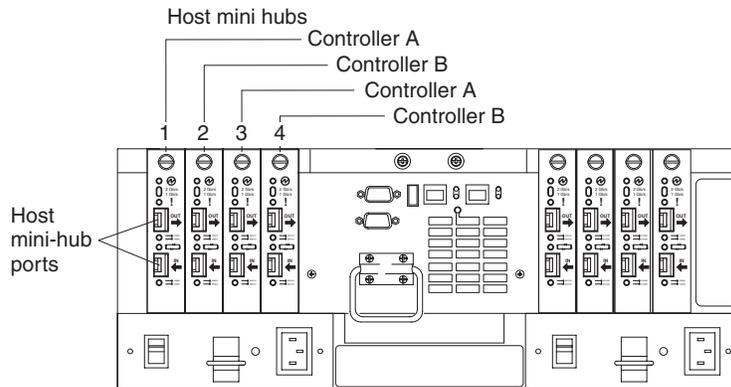


Figure 23. Host mini-hub ports

## Drive interface ports

The FASt900 Storage Server comes with drive-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 must be set up in pairs to support redundant drive loop configurations (two data paths per drive enclosure).

The maximum number of drive expansion units that can be connected per pair of redundant drive loops is dependant upon the IBM FAStT drive expansion unit models used. There are two possible types: IBM FAStT EXP500 and IBM FAStT EXP700. Drive expansion unit models can be mixed in the same storage server or even the same pair of drive loops. However, the maximum fibre channel transfer speed in the storage server drive minihubs and the IBM FAStT EXP700 Environmental Card units must be set at 1Gbps instead of 2Gbps. This is due to the fact that the maximum FC transfer speed of the IBM FAStT EXP500 drive expansion units is 1Gbps. See Table 5 on page 29 for the possible combinations of EXP500 and EXP700 drive expansion units per drive loop.

A fully configured FASt900 Storage Server supports a maximum of 16 IBM FAStT EXP700 drive expansion units (8 drive expansion units per drive-loop pair), or 224 drives using dual pair of redundant drive loops.

Table 5. IBM FAStT EXP500 and EXP700 drive combinations per dual redundant drive-loop pairs

Number of EXP500 Units	Number of EXP700 Units	Total Expansion Units	Total Number of Drives
0	8	8	112
1	7	8	108
2	6	8	104
3	6	9	114
4	5	9	110
5	4	9	106
6	3	9	102
7	3	10	112
8	2	10	108
9	1	10	104
10	0	10	100
11	0	11	110

**Important:** These large configurations are for capacity purposes and might not provide the best performance. FASt900 Storage Servers use only redundant drive-loop configurations.

Figure 24 shows the drive mini-hub ports.

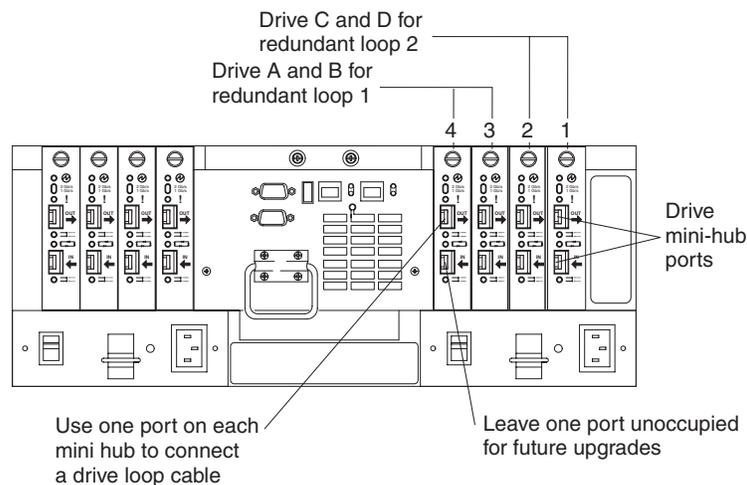


Figure 24. Drive mini-hub ports

Fibre channel cables connect to either the upper or lower port on each drive-side mini hub through SFP modules. The remaining port on each mini hub should remain unoccupied for future upgrades.

## 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. Figure 25 shows the location of these ports.

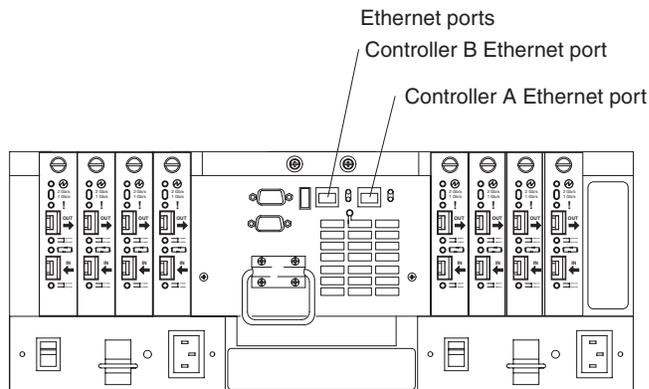


Figure 25. Ethernet ports

---

## Installing SFP modules

The FAST900 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 FAST900 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 32 for more information.

To install an SFP module, perform 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 6.

1. Remove the SFP module from its static-protective package.
2. Remove the protective cap from the SFP module, as shown in Figure 26. Save the protective cap for future use.

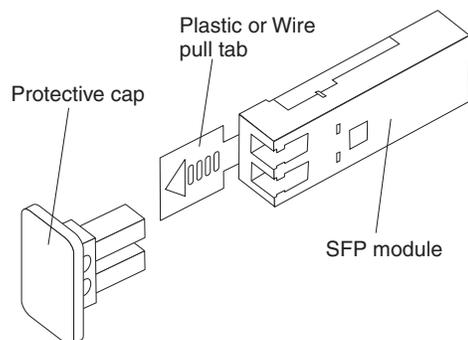


Figure 26. Small Form-Factor Pluggable (SFP) Module

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.

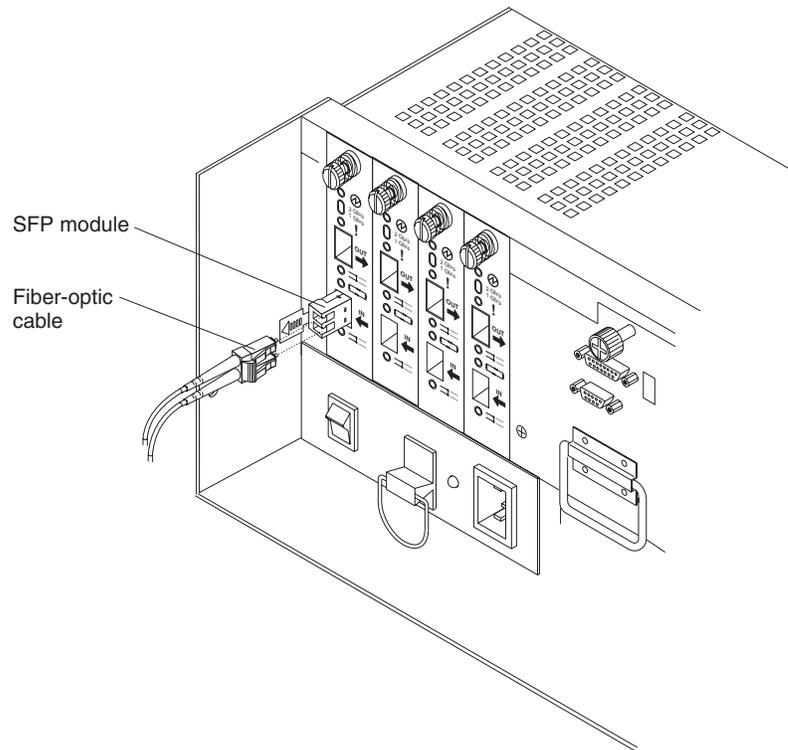


Figure 27. Installing an SFP module in a mini hub

5. Connect an LC-LC fibre channel cable. For information about the LC-LC cable, see “Using LC-LC fibre channel cables” on page 33.

---

## Removing SFP modules

To remove the SFP module from the mini hub, perform the following steps.

**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 33 and “Using LC-LC fibre channel cables” on page 33.
2. Unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 28 on page 33.

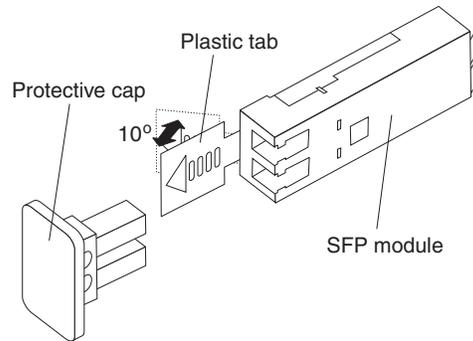


Figure 28. Unlocking the SFP module latch

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 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 FAST900 Storage Server mini hub
- SFP module installed in an IBM fibre channel switch
- Optical interface connector on an IBM FAST single port FC2 Host Bus Adapter (Part number 19K1246), IBM FAST single port FC2-133 Host Bus Adapter (Part number 24P0960), or IBM FAST dual port FC2-133 Host Bus Adapter (Part number 24P8053)

Figure 29 shows an LC-LC fibre channel cable.

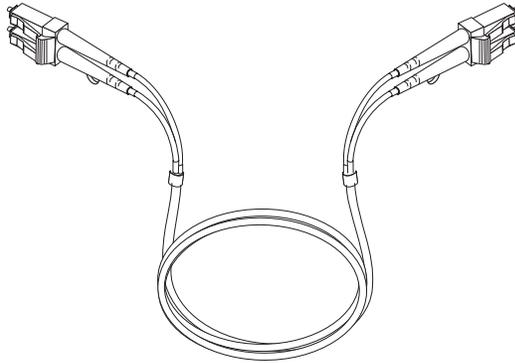


Figure 29. LC-LC fibre channel cable

The following sections provide the procedures for properly connecting and removing an LC-LC fibre channel cable.

**Note:** If you are connecting a FASt900 Storage Server to a FASt EXP500 expansion unit or to an IBM FASt 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 37.

## Connecting an LC-LC cable to an SFP module

Complete the following steps to connect an LC-LC fibre channel cable to an SFP module.

### 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 33.
2. If necessary, remove the protective cap from the SFP module, as shown in Figure 26 on page 31. Save the protective cap for future use.
3. Remove the two protective caps from one end of the LC-LC cable, as shown in Figure 30. Save the protective caps for future use.

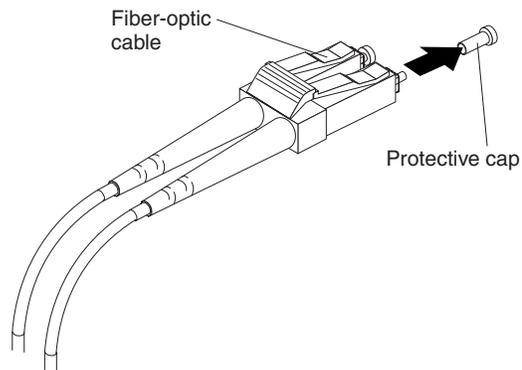


Figure 30. Removing fiber-optic cable protective caps

4. Carefully insert the end of the LC cable into an SFP module that is installed in a FAST900 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.

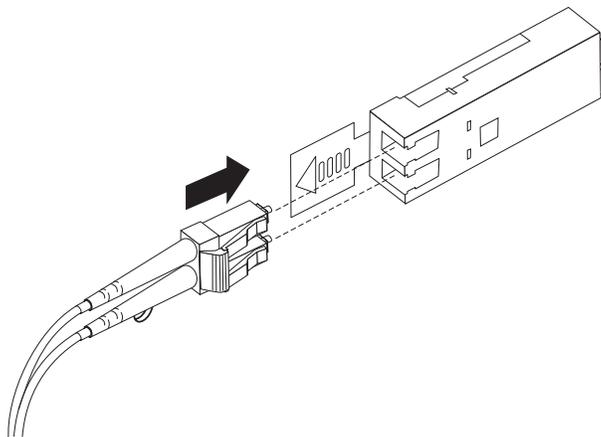


Figure 31. Inserting an LC-LC fibre channel cable into an SFP module

Figure 32 shows an LC-LC fibre channel cable connecting into an SFP module that is installed in a FAST900 Storage Server mini hub.

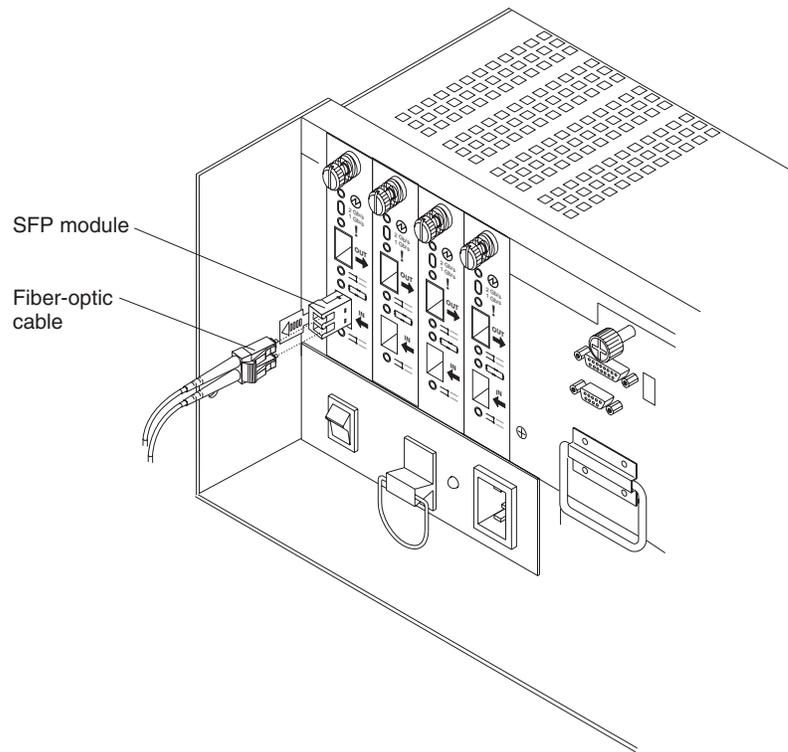


Figure 32. Inserting an LC-LC fibre channel cable into an installed SFP module

5. Remove the two protective caps from the other end of the LC-LC cable, as shown in Figure 30 on page 35. 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 FAST single port FC2 Host Bus Adapter (Part number 19K1246), IBM FAST single port FC2-133 Host Bus Adapter (Part number 24P0960), or IBM FAST dual port FC2-133 Host Bus Adapter (Part number 24P8053)
  - 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 37.)

## 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 using the SFP with the pull tab, make sure you do not grasp the SFP module plastic tab when removing the cable.

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 Figure 33 on page 37. Carefully pull on the connector to remove the cable from the SFP module, as shown in Figure 34 on page 37.

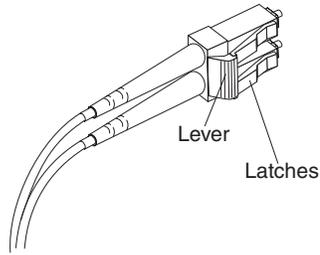


Figure 33. LC-LC fibre channel cable lever and latches

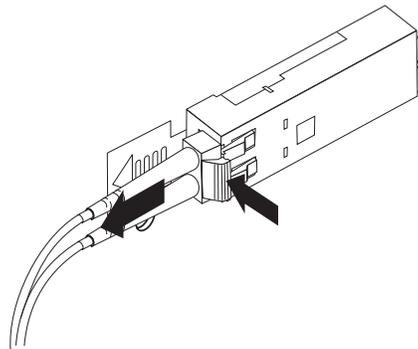


Figure 34. Removing the LC-LC fibre channel cable

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 bus adapter (Part number 00N6881)
- FASTT EXP500 expansion unit (Machine type 3560)
- 1 Gb fibre channel switch (Machine type 2109)
- Managed hub (Machine type 3534)

Figure 35 shows an LC-SC fibre channel cable.

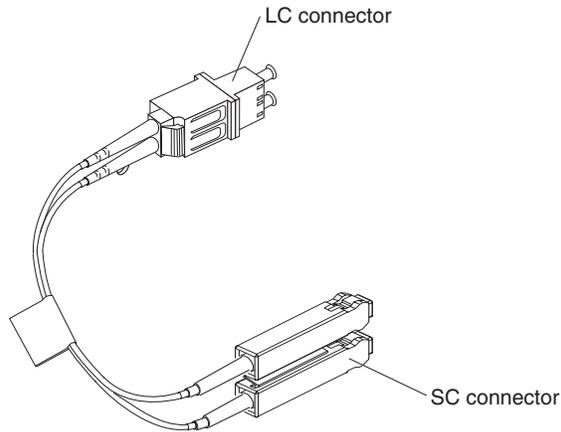


Figure 35. LC-SC fibre channel cable

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 33.

2. Connect an LC-LC cable to an SFP module in the FAST900 Storage Server mini hub. For instructions, see “Connecting an LC-LC cable to an SFP module” on page 34.
3. Remove the two protective caps from the LC connector end of the LC-SC cable, as shown in Figure 36. Save the protective caps for future use.

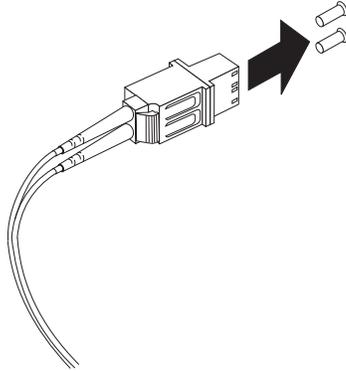


Figure 36. Removing the LC-SC cable adapter protective caps

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.

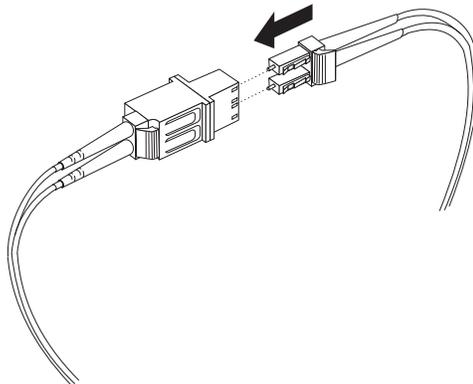


Figure 37. Connecting an LC-LC cable into the LC-SC cable adapter

5. Connect the SC connector end of the LC-SC cable to one of the following devices:
  - Optical interface connector on an IBM FAST Host Bus Adapter (Part number 00N6881)
  - GBIC installed in a FAST EXP500 expansion unit (Machine type 3560)
  - 1 Gb fibre channel switch (Machine type 2109)

## Removing an LC-LC cable from an LC-SC cable adapter

To remove an LC-LC cable from an LC-SC cable adapter, perform the following steps:

**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. Figure 38 shows the location of the lever and latches.

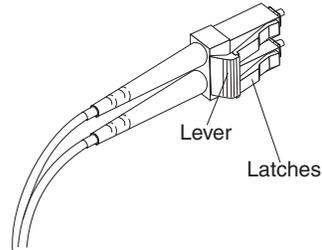


Figure 38. LC-LS fibre channel cable lever and latches

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.

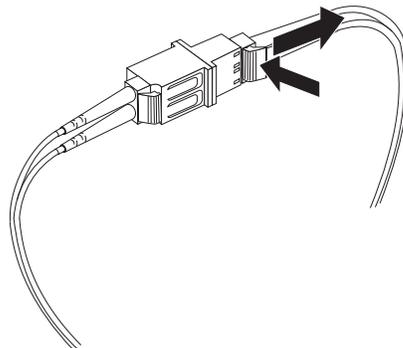


Figure 39. Removing the LC-LC fibre channel cable from an LC-SC fibre channel cable adapter

3. Replace the protective caps on the cable ends.

---

## FAST900 Storage Server and drive enclosure cabling overview

The FAST900 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.

Figure 40 on page 41 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 FAST900 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 Figure 40.

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

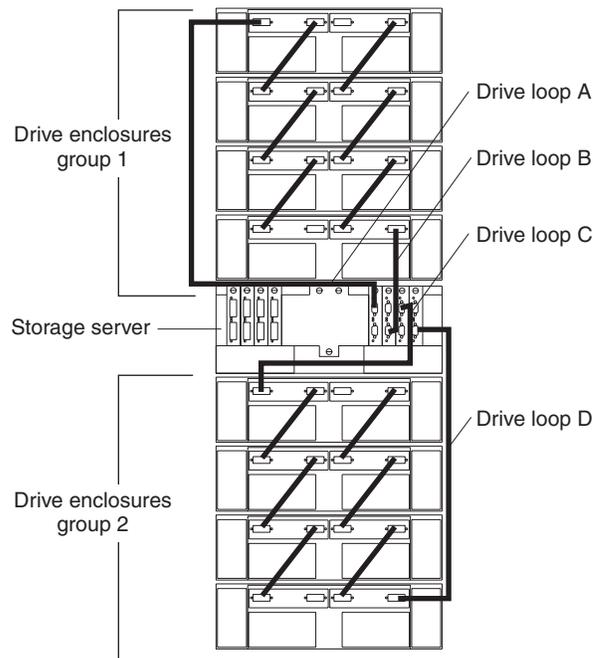


Figure 40. Redundant drive loop cabling overview

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## Configuring the drive loops

The procedure and illustrations in this section show 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 Figure 41 on page 42.

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.

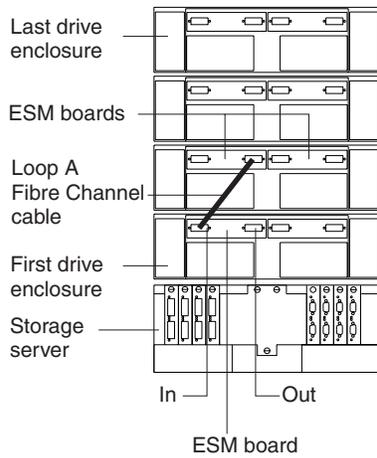


Figure 41. Connecting two drive enclosures into drive loop A

For the location of the ports on the drive enclosure ESM board, see Figure 42.

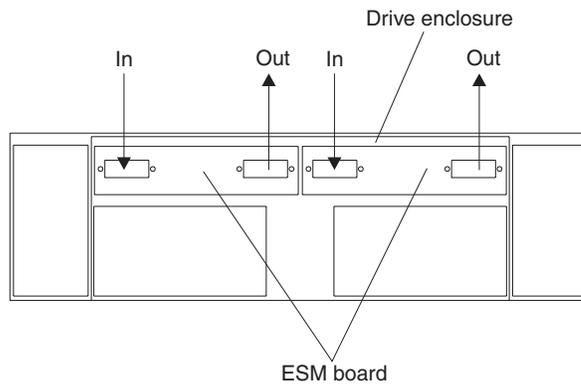


Figure 42. Drive enclosure environmental services monitor (ESM) board in and out ports

2. Connect the same first two drive enclosures to drive loop B, as shown in Figure 43 on page 43.

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.

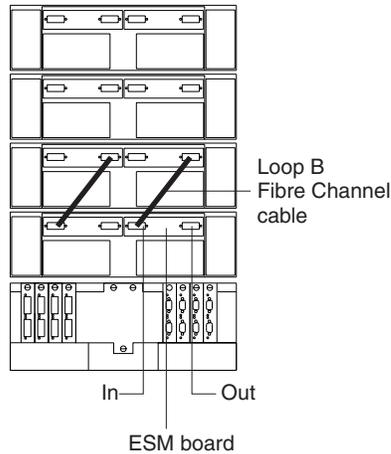


Figure 43. Connecting two drive enclosures into redundant drive loop B

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 FASiT900 Storage Server” on page 44.

3. Connect additional drive enclosures to drive loops A and B, as shown in Figure 44.

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.

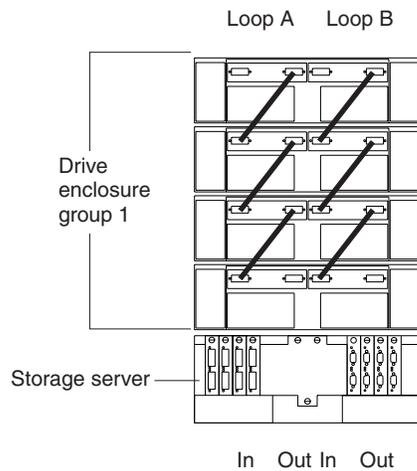


Figure 44. Connecting additional drive enclosures to drive loops A and B

If you want to connect a second drive enclosure group, repeat Step 1 on page 41 through Step 3. Otherwise, go to “Connecting a redundant drive loop to the FASiT900 Storage Server” on page 44. Figure 45 on page 44 shows a second redundant drive enclosure group (loop C and loop D on drive enclosure group 2).

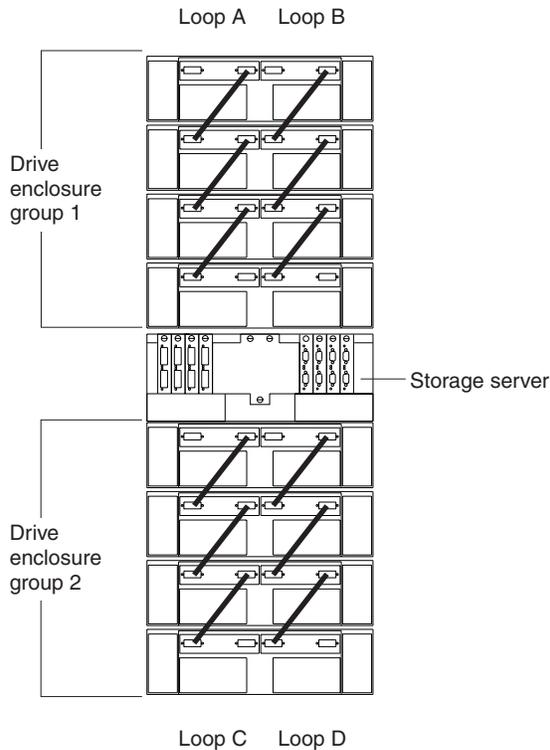


Figure 45. Connecting a second redundant drive enclosure group (loops C and D)

## Connecting a redundant drive loop to the FAST900 Storage Server

Use the following procedure to connect a redundant drive loop to the FAST900 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 FAST900 Storage Server.

1. Connect drive loop A to the FAST900 Storage Server, as shown in Figure 46 on page 45.

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 FAST900 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.

Loop A Fibre Channel cables

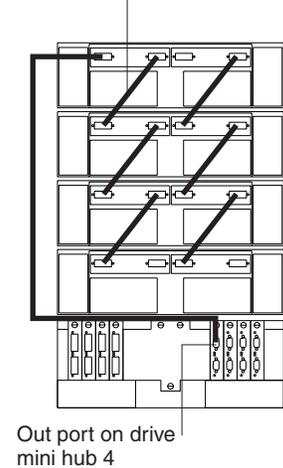


Figure 46. Connecting drive loop A to the FAST900 Storage Server

2. Connect drive loop B to the FAST900 Storage Server, as shown in Figure 47. 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.

Loop B Fibre Channel cables

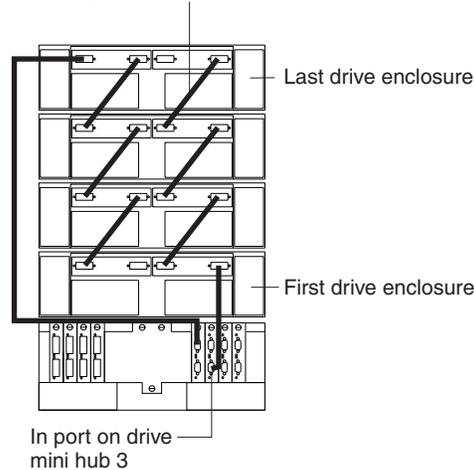


Figure 47. Connecting redundant drive loops to the FAST900 Storage Server

To connect a second redundant drive enclosure group to the FAST900 Storage Server, continue with Step 3. Otherwise, go to “Connecting hosts directly to the FAST900 Storage Server” on page 46.

3. Connect drive loop C to the FAST900 Storage Server, as shown in Figure 48 on page 46. 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 FAST900 Storage Server, as shown in Figure 48 on page 46.

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.

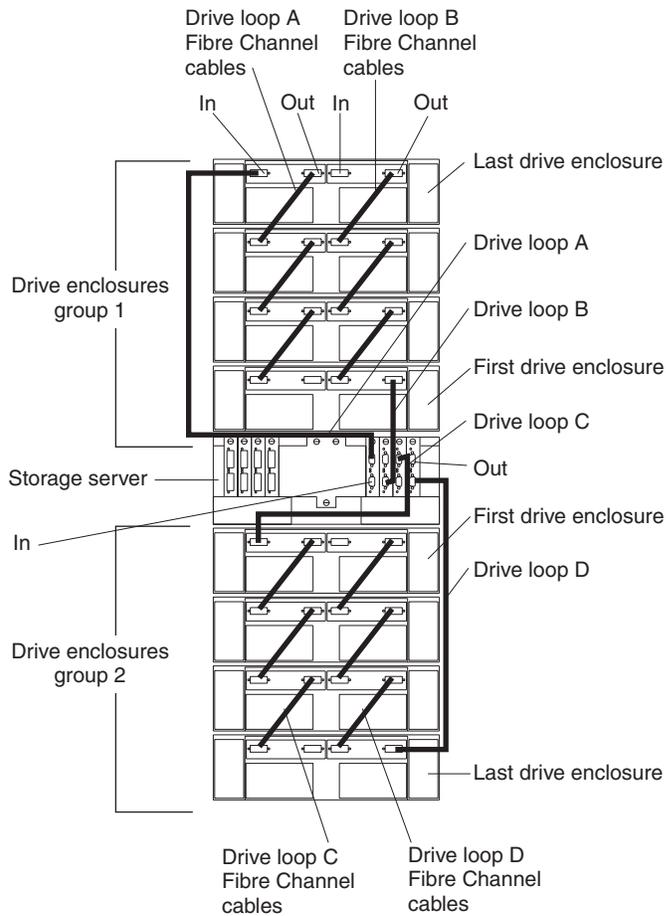


Figure 48. Connecting two redundant drive enclosure groups

## Connecting hosts directly to the FAST900 Storage Server

Use this procedure to connect up to four hosts, with two host adapters each, directly to the FAST900 Storage Server. If you are connecting five or more hosts to the FAST900 Storage Server, go to “Connecting hosts by using external devices” on page 48.

Before proceeding, make sure that you connect fiber-optic cables to all host adapters that you are connecting to the FAST900 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 FAST900 Storage Server, as shown in Figure 49.  
 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 50.
2. Connect a second host (Host 2) to the FAST900 Storage Server, as shown in Figure 49.  
 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 50.
3. Connect a third host (Host 3) to the FAST900 Storage Server, as shown in Figure 49.  
 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 50.
4. Connect a fourth host (Host 4) to the FAST900 Storage Server, as shown in Figure 49.  
 Attach HA1 and HA2 from Host 4 to the two unoccupied ports on mini hub 3 and mini hub 4.

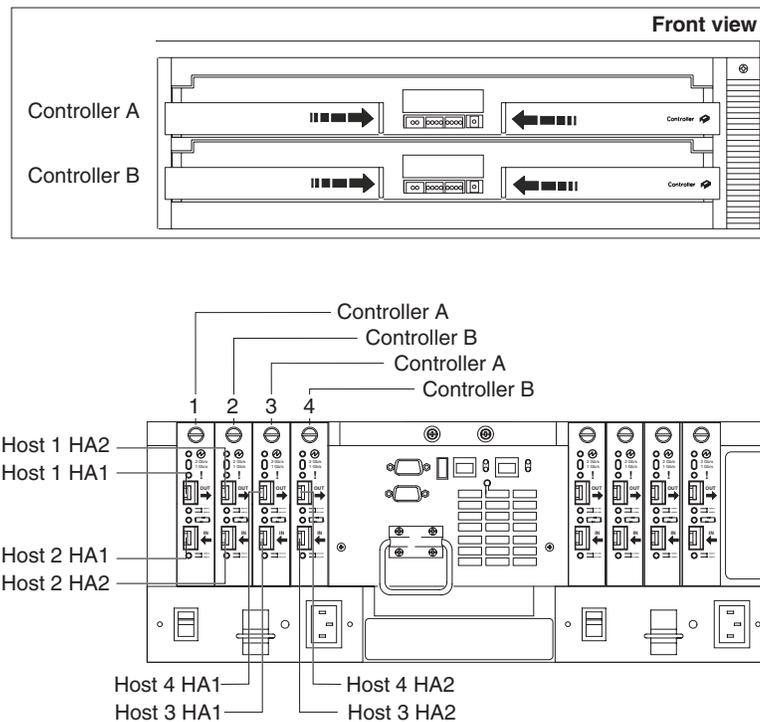


Figure 49. Connecting hosts directly to the controller

5. Go to “Setting the Link Rate Interface switch” on page 50.

## Connecting hosts by using external devices

Use the information in this section to connect five or more hosts to the FASt900 Storage Server. When you use external fibre channel switches, the FASt900 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 FASt900 Storage Server by adding host-side mini hubs and fibre channel switches, (one fibre channel switch for each mini hub).

Figure 50 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.

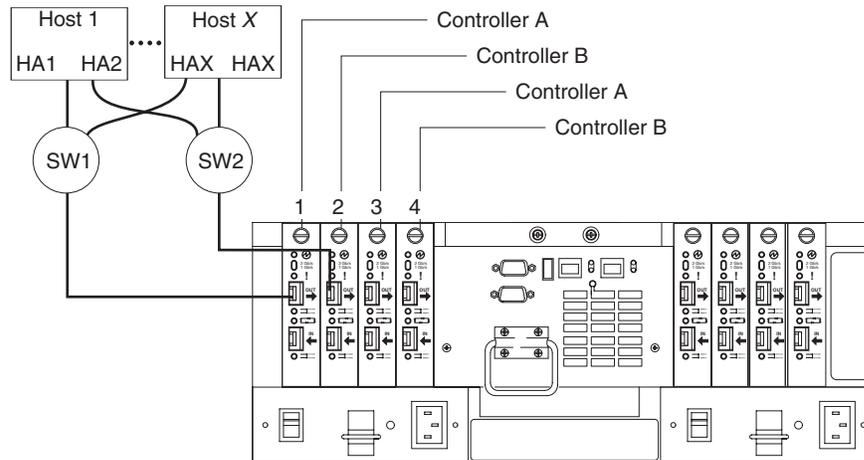


Figure 50. Using two fibre channel switches to connect a host

You can directly attach up to four fibre channel switches (one per mini hub) to a FASt900 Storage Server. Figure 51 on page 49 shows an example of attaching four fibre channel switches.

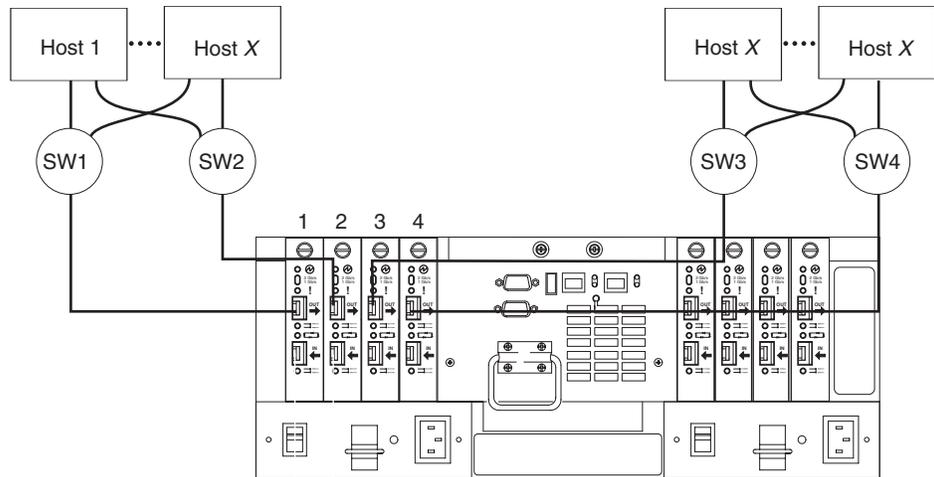


Figure 51. Using four fibre channel switches to connect multiple hosts

Most fibre channel switches support eight to sixteen hosts. If the configuration requires more hosts than four fibre channel switches can support, you must add cascading switches, as shown in Figure 52.

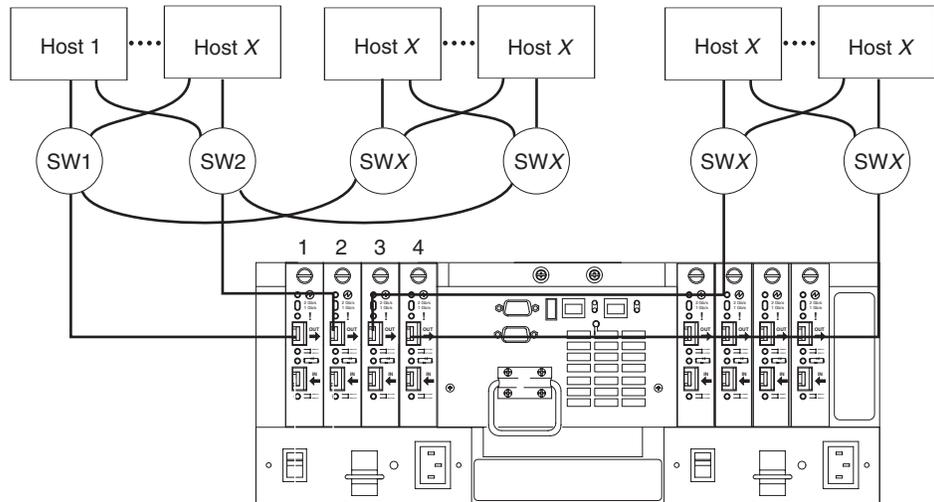


Figure 52. Adding hosts by using cascading switches

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## Setting the Link Rate Interface switch

Each FASt900 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 Figure 53.

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. Figure 53 shows the location of the Link Rate switch and indicator light.

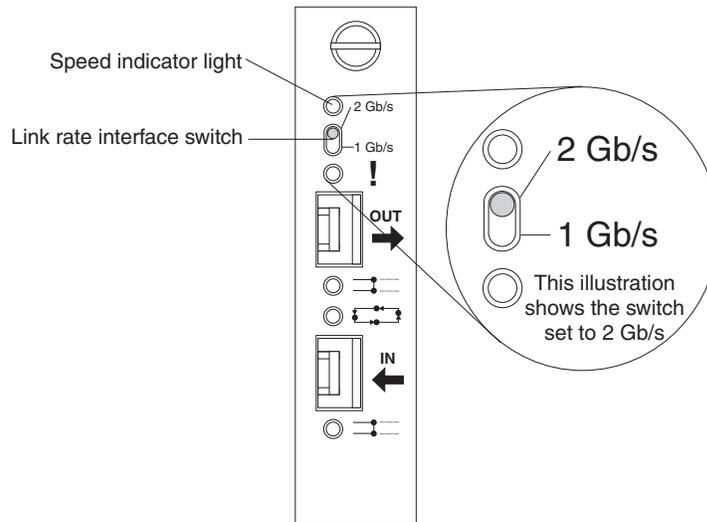


Figure 53. Mini-hub Link Rate Interface switch and Speed indicator light

## 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, perform the following steps:

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.

**Note:** The data transfer rate of all drives minihubs must be set to operate at either 1Gbps or 2 Gbps. If you have one set of drive loops using IBM FAStT EXP500 drive expansion enclosures (data transfer speed of 1Gbps) and the other set of drive loops using IBM FAStT EXP700 drive expansion enclosures (data transfer speed of 2Gbps), the speed of all drive minihubs must be set to 1Gbps. Not doing so will result in drive channel minihub data rate mismatch errors.

---

## 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 FAStT900 Storage Server. For an illustration of direct (out-of-band) management, see Figure 19 on page 24.

Figure 54 shows the location of the Ethernet ports.

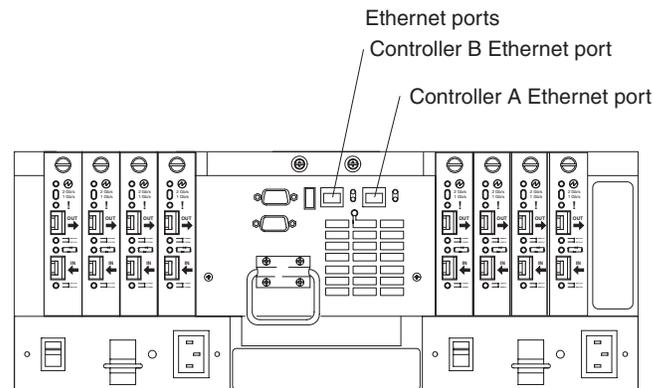


Figure 54. Ethernet port locations



---

## Chapter 3. Starting the FAST900 Storage Server

After you install the FAST900 Storage Server in a rack cabinet and connect it to the fibre channel arbitrated loop, you are ready to complete the installation. This chapter describes how to connect the power cords, turn on and off the power, turn on the alarm, check the indicator lights, and install the FAST Storage Manager software.

---

### Connecting the power cords

To connect the power cords to the FAST900 Storage Server and to the ac power source, perform the following steps:

1. Make sure both power switches on the FAST900 Storage Server are off.
2. Plug both FAST900 Storage Server power cords into the FAST900 Storage Server, as shown in Figure 55.

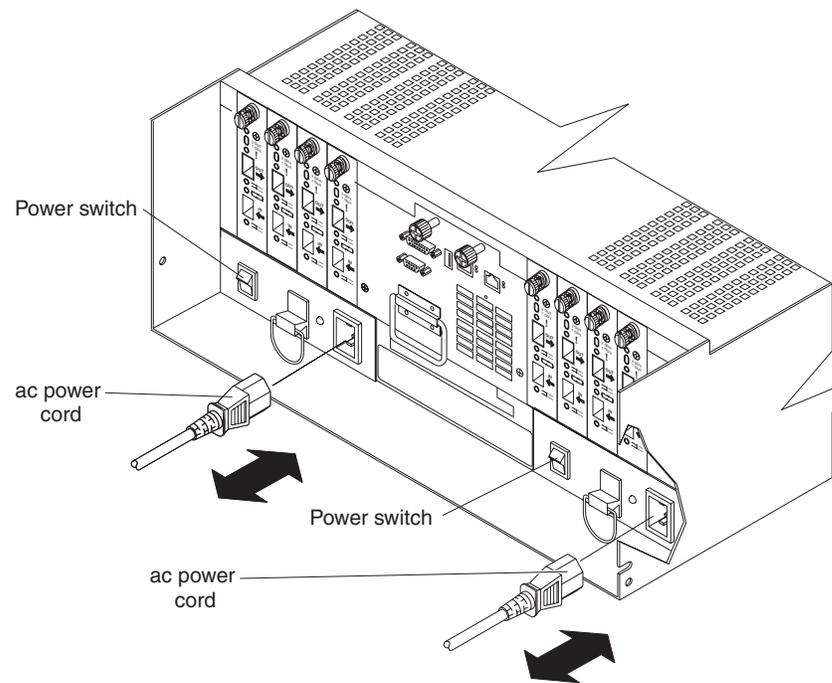


Figure 55. Connecting the power cords and turning the power on and off

3. Plug both FAST900 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 5.

---

### Turning on the power

**Important:** You must turn on the drive enclosures *before* you turn on the FAST900 Storage Server. The controllers might not recognize the correct configuration if the hard disk drives are powered up after the FAST900 Storage Server. For instructions on how to power 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 FAStT900 Storage Server:

1. Verify that all communication and power cables are plugged into the back of the FAStT900 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* you turn on the FAStT900 Storage Server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server.
  - 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 by using the following power-on sequence. To turn on power to the FAStT900 Storage Server, turn on the power-supply switches on the back of the FAStT900 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 FAStT900 Storage Server and its components.

---

## Turning off the power

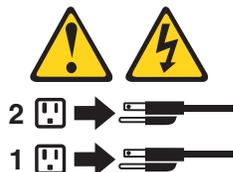
**Attention:** The FAStT900 Storage Server is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power even if any FAStT900 Storage Server fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before turning off the power. This precaution ensures that the FAStT900 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 FAStT900 Storage Server.

1. Make sure that all amber fault indicator lights on the FAStT900 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 FAStT900 Storage Server for shutdown, as follows:
  - a. Stop all I/O activity to the FAStT900 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 FAStT900 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 FAStT900 Storage Server front panel and all drive active indicator lights on each drive enclosure front panel are off (not blinking).
- d. Disconnect the FAStT900 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 FAStT900 Storage Server.

- a. Turn off power to the host before you turn the power off for 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 FAStT900 Storage Server alarm

The FAStT900 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 Figure 56 on page 56.

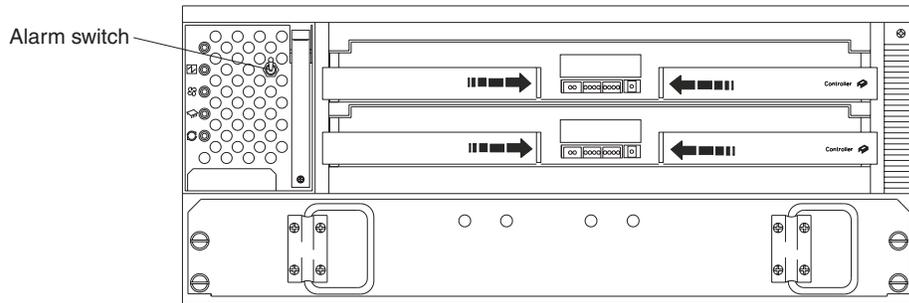


Figure 56. FASt900 Storage Server alarm switch

## FASt900 Storage Server indicator lights

The indicator lights on the front of the FASt900 Storage Server are shown in Figure 57 through Figure 60 on page 58.

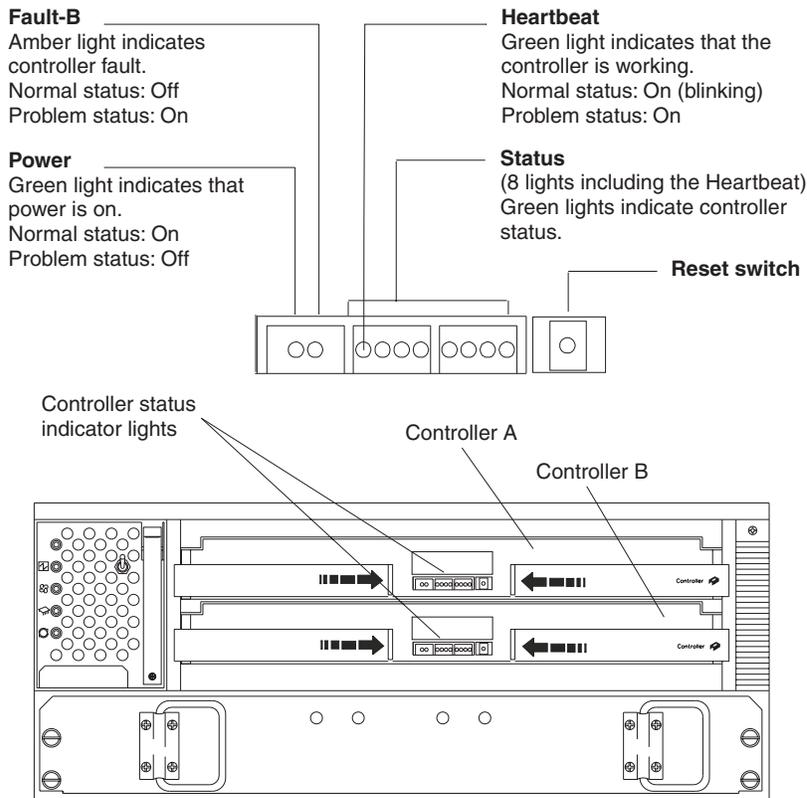


Figure 57. RAID controller indicator lights

The RAID controller 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 (online) or passive (offline). For more information, refer to *IBM FASt900 TotalStorage Fibre Channel Storage Server User's Guide* and the *IBM FASt Storage Manager Installation and Support Guide* for the operating system.

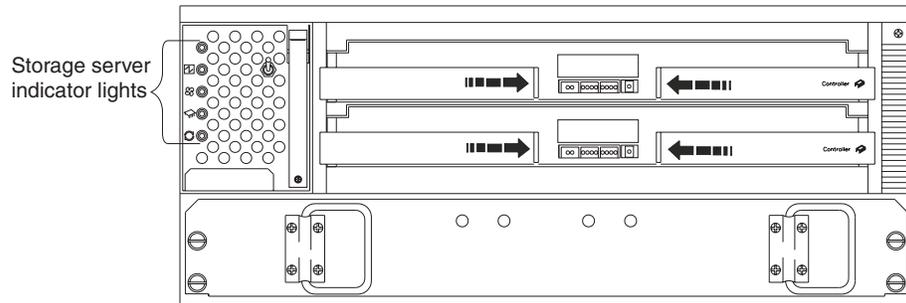


Figure 58. FASiT900 Storage Server indicator lights

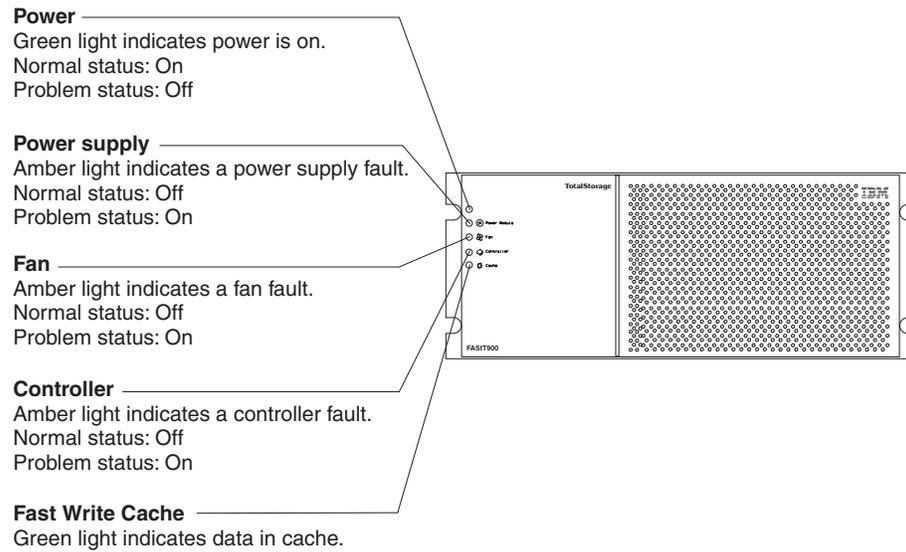


Figure 59. FASiT900 Storage Server indicator lights

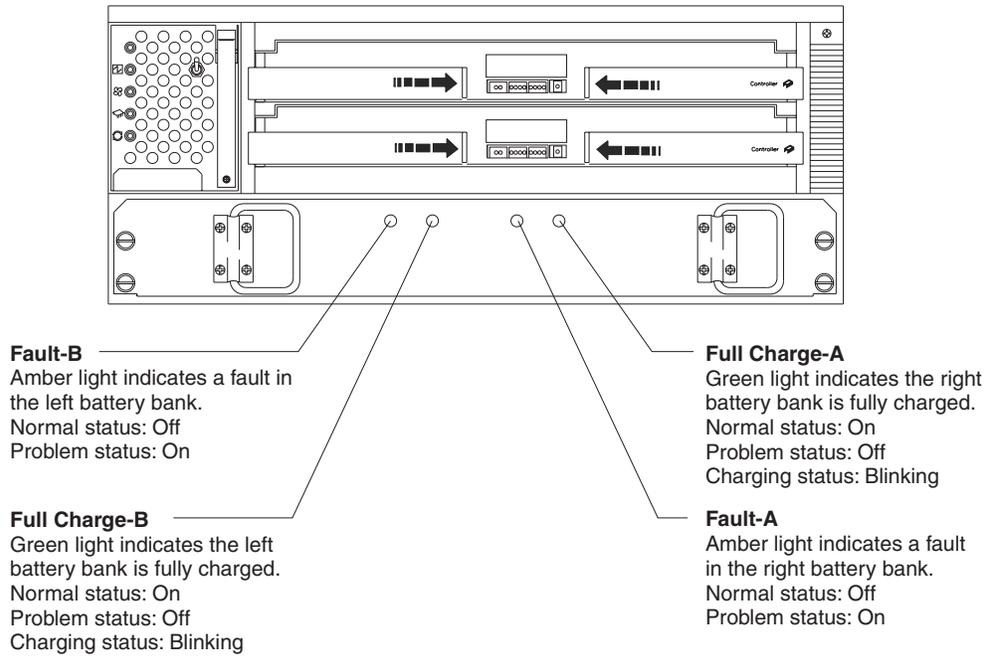


Figure 60. Battery indicator lights

The indicator lights on the back of the FAST900 Storage Server are shown in Figure 61 and Figure 62 on page 59.

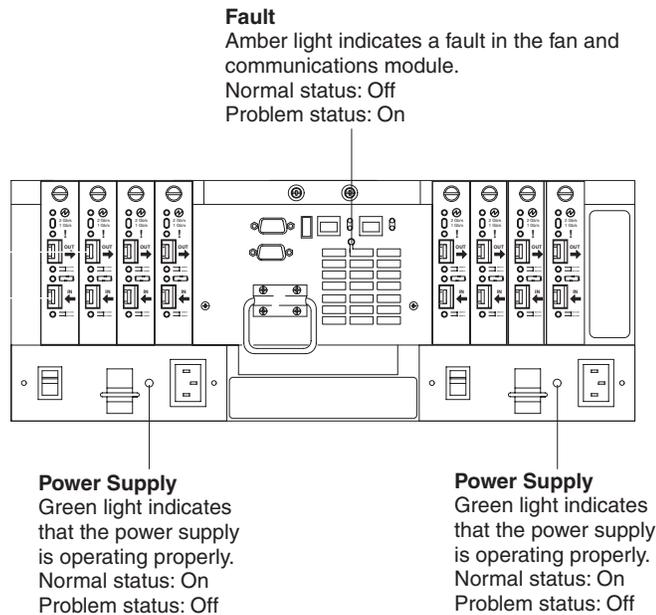


Figure 61. Power supply and fan and communications module indicator lights

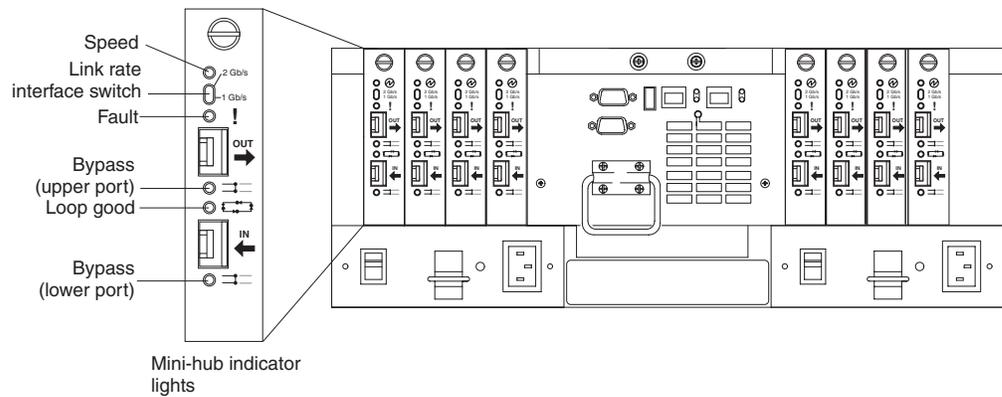


Figure 62. Mini-hub indicator lights

Table 6 describes the mini-hub indicator lights.

Table 6. Mini-hub indicator lights

Icon	Indicator light	Color	Normal operation	Problem indicator	Condition indicated
None	Speed	Green	On for 2 Gb Off for 1 Gb	None	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	There is a fault in the mini hub.
⇌	Bypass	Amber	Off	On	The upper mini-hub port is bypassed.
↻	Loop good	Green	On	Off	The drive loop is operational.
⇌	Bypass (lower port)	Amber	Off	On	The lower mini-hub port is bypassed.

## 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 FAST900 Storage Server. Install the software using the procedures in the FAST Storage Manager Installation and Support Guide for the operating system. Use that document and the online help to configure the logical drives, partitions, and so on for the RAID controllers. Use the operating system documentation to make the new logical drives accessible to the operating system.



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## Important notes

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

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

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1000000 bytes, and GB stands for approximately 1000000000 bytes.

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

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## **Industry Canada Class A emission compliance statement**

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

### **Avis de conformité à la réglementation d'Industrie Canada**

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

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

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

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

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

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

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, Macao S.A.R. of the PRC, 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

<b>IBM power cord part number</b>	<b>Used in these countries and regions</b>
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, Cyprus, Dubai, Fiji, Ghana, Hong Kong S.A.R. of the PRC, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952301	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

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## Glossary

This glossary provides definitions for the terminology used for the IBM TotalStorage FASiT900. This glossary also provides definitions for the terminology used for the IBM TotalStorage FASiT Storage Manager.

This glossary defines technical terms and abbreviations used in this document. If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at: [www.ibm.com/networking/nsg/nsgmain.htm](http://www.ibm.com/networking/nsg/nsgmain.htm)

This glossary also includes terms and definitions from:

- *Information Technology Vocabulary* by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- *IBM Glossary of Computing Terms*. New York: McGraw-Hill, 1994.

The following cross-reference conventions are used in this glossary:

**See** Refers you to (a) a term that is the expanded form of an abbreviation or acronym, or (b) a synonym or more preferred term.

### See also

Refers you to a related term.

**Abstract Windowing Toolkit (AWT).** A Java graphical user interface (GUI).

**accelerated graphics port (AGP).** A bus specification that gives low-cost 3D graphics cards faster access to main memory on personal computers than the usual PCI bus. AGP reduces the overall cost of creating high-end graphics subsystems by using existing system memory.

**access volume.** A special logical drive that allows the host-agent to communicate with the controllers in the storage subsystem.

**adapter.** A printed circuit assembly that transmits user data (I/Os) between the internal bus of the host system and the external fibre channel link and vice versa. Also called an I/O adapter, host adapter, or FC adapter.

**advanced technology (AT) bus architecture.** A bus standard for IBM compatibles. It extends the XT bus architecture to 16 bits and also allows for bus mastering, although only the first 16 MB of main memory are available for direct access.

**agent.** A server program that receives virtual connections from the network manager (the client program) in an SNMP-TCP/IP network-managing environment.

**AGP.** See *accelerated graphics port*.

**AL\_PA.** See *arbitrated loop physical address*.

**arbitrated loop.** A shared 100 MBps fibre channel transport structured as a loop and supporting up to 126 devices and one fabric attachment. A port must successfully arbitrate before a circuit can be established.

**arbitrated loop physical address (AL\_PA).** One of three existing fibre channel topologies, in which two to 126 ports are interconnected serially in a single loop circuit. Access to the FC-AL is controlled by an arbitration scheme. The FC-AL topology supports all classes of service and guarantees in-order delivery of FC frames when the originator and responder are on the same FC-AL. The default topology for the disk array is arbitrated loop. An arbitrated loop is sometimes referred to as Stealth Mode.

**auto volume transfer/auto disk transfer (AVT/ADT).** A function that provides automatic failover in case of controller failure on a storage subsystem.

**AVT/ADT.** See *auto volume transfer/auto disk transfer*.

**AWT.** See *Abstract Windowing Toolkit*.

**basic input/output system (BIOS).** Code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

**BIOS.** See *basic input/output system*.

**BOOTP.** See *bootstrap protocol*.

**bootstrap protocol (BOOTP).** A Transmission Control Protocol/Internet Protocol (TCP/IP) protocol that a diskless workstation or network computer use to obtain its IP address and other network information such as server address and default gateway.

**bridge.** A SAN device that provides physical and transport conversion, such as fibre channel to SCSI bridge.

**bridge group.** A bridge and the collection of devices connected to it. Bridge Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**broadcast.** A method of sending an SNMP request for information to all the devices on a subnet that use a single special request. Because of its efficiency, the SANavigator tool sets its default method of discovery to broadcast. However, a network administrator might disable this method on the network router.

**cathode ray tube (CRT).** An electrical device for displaying images by exciting phosphor dots with a scanned electron beam. CRTs are found in computer VDUs and monitors, televisions, and oscilloscopes.

**CDPD.** See *cellular digital packet data*.

**cellular digital packet data (CDPD).** A wireless standard that provides two-way, 19.2 kbps packet data transmission over existing cellular telephone channels.

**CGA.** See *color graphics adapter*.

**client.** A computer system or process that requests a service of another computer system or process that is typically referred to as a server. Multiple clients can share access to a common server.

**color graphics adapter (CGA).** An early, now obsolete, IBM video display standard for use on IBM PCs. CGA displays 80 x 25 or 40 x 25 text in 16 colors, 640 x 200 pixel graphics in two colors or 320 x 200 pixel graphics in four colors.

**command.** Any selection on a dialog box or elsewhere in the user interface that causes the SANavigator tool to perform a task.

**community strings.** The name of a community contained in each SNMP message. SNMP has no standard mechanisms for verifying that a message was sent by a member of the community, keeping the contents of a message private, or for determining if a message has been changed or replayed.

**CRC.** See *cyclic redundancy check*.

**CRT.** See *cathode ray tube*.

**cyclic redundancy check (CRC).** (1) 1) A redundancy check in which the check key is generated by a cyclic algorithm. (2) 2) An error detection technique performed at both the sending and receiving stations.

**dac.** See *disk array controller*.

**dar.** See *disk array router*.

**DASD.** See *Direct-Access Storage Device*.

**device type.** Identifier used to place devices in the physical map, such as the switch, hub, storage.

**direct access storage device (DASD).** IBM mainframe terminology for a data storage device by which information can be accessed directly, instead of by-passing sequentially through all storage areas. For example, a disk drive is a DASD, in contrast with a tape drive, which stores data as a linear sequence.

**direct memory access (DMA).** The transfer of data between memory and an input/output (I/O) device without processor intervention.

**disk array controller (dac).** A disk array controller device that represents the two controllers of an array. See also *disk array controller*.

**disk array router (dar).** A disk array router that represents an entire array, including current and deferred paths to all logical unit numbers (LUNs) (hdisks on AIX). See also *disk array controller*.

**DMA.** See *direct memory access*.

**domain.** The most significant byte in the N\_Port Identifier for the FC device. It is not used in the FC-SCSI hardware path ID. It is required to be the same for all SCSI targets logically connected to an FC adapter.

**DRAM.** See *dynamic random access memory*.

**dynamic random access memory (DRAM).** A storage in which the cells require repetitive application of control signals to retain stored data.

**E\_Port.** An expansion port that connects the switches for two fabrics (also used for McData ES-1000 B ports).

**ECC.** See *error correction coding*.

**EEPROM.** See *Electrically Erasable Programmable Read-Only Memory*.

**EGA.** See *enhanced graphics adapter*.

**electrically eErasable programmable read-only memory (EEPROM).** A type of non-volatile storage device that can be erased with an electrical signal. Writing to EEPROM takes much longer than reading. It also can only be reprogrammed a limited number of times before it wears out. Therefore, it is appropriate for storing small amounts of data that are changed infrequently.

**electrostatic discharge (ESD).** The flow of current that results when objects that have a static charge come into close enough proximity to discharge.

**enhanced graphics adapter (EGA).** An IBM video display standard that provides text and graphics with a

resolution of 640 x 350 pixels of 16 colors. It emulates the Color/Graphics Adapter (CGA) and the Monochrome Display Adapter (MDA) and was superseded by the Video Graphics Display (VGA).

**enhanced small disk interface (ESDI).** A hard disk controller standard that allows disks to communicate with computers at high speeds. ESDI drives typically transfer data at about 10 megabits per second, although they are capable of doubling that speed.

**error correction coding (ECC).** A method for encoding data so that transmission errors can be detected and corrected by examination of the data on the receiving end. Most ECCs are characterized by the maximum number of errors they can detect and correct.

**error detection coding.** A method for encoding data so that errors that occur during storage or transmission can be detected. Most error detection codes are characterized by the maximum number of errors they can detect. The simplest form of error detection is by using a single added parity bit or a cyclic redundancy check. Adding multiple parity bits can detect not only that an error has occurred, but also which bits have been inverted, thereby indicating which bits should be re-inverted to restore the original data.

**ESD.** See *electrostatic discharge*.

**ESDI.** See *enhanced small disk interface*.

**eXtended graphics array (XGA).** An IBM advanced standard for graphics controller and display mode design introduced in 1990. XGA, used mostly on workstation-level systems, supports a resolution of 1024 x 768 pixels with a palette of 256 colors, or 640 x 480 with high color (16 bits per pixel). XGA-2 added 1024 x 768 support for high color and higher refresh rates, improved performance, and supports 1360 x 1024 in 16 colors.

**F\_Port.** A port that supports an N\_Port on a fibre channel switch.

**fabric group.** A collection of interconnected SAN devices discovered by the SANavigator tool and displayed with a blue background on the Physical and Data Path Maps.

**fibre channel.** A bi-directional, full-duplex, point-to-point, serial data channel structured for high performance capability. Physically, fibre channel interconnects devices, such as host systems and servers, FC hubs and disk arrays, through ports, called N\_Ports, in one of three topologies: a point-to-point link, an arbitrated loop, or a cross point switched network, which is called a fabric. FC can interconnect two devices in a point-to-point topology, from two to 126 devices in an arbitrated loop. FC is a generalized transport mechanism that can transport any existing protocol, such as SCSI, in FC frames.

**Fibre Channel Protocol for SCSI (FCP).** A high-level fibre channel mapping layer (FC-4) that uses lower-level fibre channel (FC-PH) services to transmit SCSI command, data, and status information between a SCSI initiator and a SCSI target across the FC link by using FC frame and sequence formats.

**field replaceable unit (FRU).** An assembly that is replaced in its entirety when any one of its components fails. In some cases, a FRU might contain other field replaceable units.

**FRU.** See *field replaceable unit*.

**general purpose interface bus (GPIB).** An 8-bit parallel bus developed for the exchange of information between computers and industrial automation equipment.

**GPIB.** See *general purpose interface bus*.

**graphical user interface (GUI).** A type of computer interface that presents a visual metaphor of a real-world scene, often of a desktop, by combining high-resolution graphics, pointing devices, menu bars and other menus, overlapping windows, icons, and the object-action relationship.

**GUI.** See *graphical user interface*.

**HBA.** See *host bus adapter*.

**hdisk.** An AIX term representing a logical unit number (LUN) on an array.

**host.** A system that is directly attached to the storage subsystem through a fibre-channel I/O path. This system is used to serve data (typically in the form of files) from the storage subsystem. A system can be both a storage management station and a host simultaneously.

**host bus adapter (HBA).** An interface between the fibre channel network and a workstation or server.

**host computer.** See *host*.

**host group.** The collection of HBAs and NASs in a fabric discovered by the SANavigator tool and displayed with a yellow background on the Physical and Data Path Maps.

**hub.** In a network, a point at which circuits are either connected or switched. For example, in a star network, the hub is the central node; in a star/ring network, it is the location of wiring concentrators.

**IC.** See *integrated circuit*.

**IDE.** See *integrated drive electronics*.

**In-band.** Transmission of management protocol over the fibre channel transport.

**Industry Standard Architecture (ISA).** A bus standard for IBM compatibles that allows components to be added as cards plugged into standard expansion slots. ISA was originally introduced in the IBM PC/XT with an 8-bit data path. It was later expanded to permit a 16-bit data path when IBM introduced the PC/AT.

**initial program load (IPL).** The part of the boot sequence during which a computer system copies the operating system kernel into main memory and runs it.

**integrated circuit (IC).** Also known as a *chip*. A microelectronic semiconductor device that consists of many interconnected transistors and other components. ICs are constructed on a small rectangle cut from a silicon crystal or other semiconductor material. The small size of these circuits allows high speed, low power dissipation, and reduced manufacturing cost compared with board-level integration.

**integrated drive electronics (IDE).** Also known as an Advanced Technology Attachment Interface (ATA). A disk drive interface based on the 16-bit IBM PC ISA in which the controller electronics reside on the drive itself, eliminating the need for a separate adapter card.

**integrated services digital network (ISDN).** A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data. ISDNs are used in public and private network architectures.

**interrupt request (IRQ).** A type of input found on many processors that causes the processor to suspend normal instruction execution temporarily and start executing an interrupt handler routine. Some processors have several interrupt request inputs that allow different priority interrupts.

**Internet Protocol address.** The unique 32-bit address that specifies the location of each device or workstation on the Internet. For example, 9.67.97.103 is an IP address.

**IP address.** See *Internet Protocol address*.

**IPL.** See *initial program Load*.

**IRQ.** See *interrupt request*.

**ISA.** See *Industry Standard Architecture*.

**ISDN.** See *Integrated Services Digital Network*.

**isolated group.** A collection of isolated devices not connected to the SAN but discovered by the SANavigator tool. The Isolated Group displays with a gray background near the bottom of the Physical and Data Path Maps.

**Java Runtime Environment (JRE).** A subset of the Java Development Kit (JDK) for end users and developers who want to redistribute the Java Runtime

Environment (JRE). The JRE consists of the Java virtual machine, the Java Core Classes, and supporting files.

**JRE.** See *Java Runtime Environment*.

**label.** A discovered or user entered property value that is displayed underneath each device in the Physical and Data Path Maps.

**LAN.** See *local area network*.

**LBA.** See *logical block addressing*.

**local area network (LAN).** A computer network located on a user's premises within a limited geographic area.

**logical block addressing (LBA).** A hard disk sector addressing scheme in which the addressing conversion is performed by the hard disk firmware. LBA is used on all SCSI hard disks and on ATA-2 conforming IDE hard disks.

**logical unit number (LUN).** An identifier used on a small computer systems interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

**loop address.** The unique ID of a node in fibre channel loop topology sometimes referred to as a Loop ID.

**loop group.** A collection of SAN devices that are interconnected serially in a single loop circuit. Loop Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**loop port (FL\_Port).** An N-Port or F-Port that supports arbitrated loop functions associated with an arbitrated loop topology.

**LUN.** See *logical unit number*.

**man pages.** In UNIX-based operating systems, online documentation for operating-system commands, subroutines, system calls, file formats, special files, stand-alone utilities, and miscellaneous facilities. Invoked by the **man** command.

**management information base (MIB).** The information that is on an agent. It is an abstraction of configuration and status information.

**MCA.** See *micro channel architecture*.

**MIB.** See *management information base*.

**micro channel architecture (MCA).** IBM's proprietary bus that is used in high-end PS/2 personal computers. Micro Channel is designed for multiprocessing and functions as either a 16-bit or 32-bit bus. It eliminates potential conflicts that arise when installing new peripheral devices.

**MIDI.** See *musical instrument digital interface*.

**model.** The model identification assigned to a device by its manufacturer.

**musical instrument digital interface (MIDI).** A protocol that allows a synthesizer to send signals to another synthesizer or to a computer, or a computer to a musical instrument, or a computer to another computer.

**NDIS.** See *network device interface specification*.

**network device interface specification (NDIS).** An application programming interface (API) definition that allows DOS or OS/2 systems to support one or more network adapters and protocol stacks. NDIS is a 16-bit, Ring O (for the OS/2 operating system) API that defines a specific way for writing drivers for layers 1 and 2 of the OSI model. NDIS also handles the configuration and binding of these network drivers to multiple protocol stacks.

**network management station (NMS).** In the Simple Network Management Protocol (SNMP), a station that executes management application programs that monitor and control network elements.

**NMI.** See *non-maskable interrupt*.

**NMS.** See *network management station*.

**non-maskable interrupt (NMI).** A hardware interrupt that another service request cannot overrule (mask). An NMI bypasses and takes priority over interrupt requests generated by software, the keyboard, and other such devices and is issued to the microprocessor only in disastrous circumstances, such as severe memory errors or impending power failures.

**N\_Port.** A node port. A fibre channel defined hardware entity that performs data communications over the fibre channel link. It is identifiable by a unique Worldwide Name. It can act as an originator or a responder.

**node.** A physical device that allows for the transmission of data within a network.

**nonvolatile storage (NVS).** A storage device whose contents are not lost when power is cut off.

**NVS.** See *nonvolatile storage*.

**NVSRAM.** Nonvolatile storage random access memory. See *nonvolatile storage*.

**Object Data Manager (ODM).** An AIX proprietary storage mechanism for ASCII stanza files that are edited as part of configuring a drive into the kernel.

**ODM.** See *Object Data Manager*.

**out-of-band.** Transmission of management protocols outside of the fibre channel network, typically over Ethernet.

**PCI local bus.** See *peripheral component interconnect local bus*.

**PDF.** See *portable document format*.

**peripheral component interconnect local bus (PCI local bus).** A standard that Intel Corporation introduced for connecting peripherals. The PCI local bus allows up to 10 PCI-compliant expansion cards to be installed in a computer at a time. Technically, PCI is not a bus but a bridge or mezzanine. It runs at 20 - 33 MHz and carries 32 bits at a time over a 124-pin connector or 64 bits over a 188-pin connector. A PCI controller card must be installed in one of the PCI-compliant slots. The PCI local bus is processor independent and includes buffers to decouple the CPU from relatively slow peripherals, allowing them to operate asynchronously. It also allows for multiplexing, a technique that permits more than one electrical signal to be present on the PCI local bus at a time.

**performance events.** Events related to thresholds set on SAN performance.

**polling delay.** The time in seconds between successive discovery processes during which Discovery is inactive.

**port.** The hardware entity that connects a device to a fibre channel topology. A device can contain one or more ports.

**portable document format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**private loop.** A freestanding Arbitrated Loop with no fabric attachment.

**program temporary fix (PTF).** A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

**PTF.** See *program temporary fix*.

**RAM.** See *random-access memory*.

**random-access memory (RAM).** A temporary storage location in which the central processing unit (CPU) stores and executes its processes.

**read-only memory (ROM).** Memory in which the user cannot change stored data except under special conditions.

**RDAC.** See *redundant dual active controller*.

**redundant dual active controller (RDAC).** A controller, used with AIX and Solaris hosts, that provides a multipath driver for a storage subsystem. An RDAC is also known as redundant disk array controller.

**red, green, blue (RGB).** (1) Color coding in which the brightness of the additive primary colors of light, red, green, and blue are specified as three distinct values of white light. (2) Pertaining to a color display that accepts signals that represent red, green, and blue.

**RGB.** See *red, green, blue*.

**ROM.** See *read-only memory*.

**router.** A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses.

**SAN.** See *storage area network*.

**SCSI.** See *small computer system interface*.

**segmented loop ports (SL\_Ports).** SL\_Ports allow you to divide a fibre channel Private Loop into multiple segments. Each segment can pass frames around as an independent loop and can connect through the fabric to other segments of the same loop.

**serial storage architecture (SSA).** An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with SCSI devices, allows full-duplex packet multiplexed serial data transfers at rates of 20Mb/sec in each direction.

**server.** A functional hardware and software unit that delivers shared resources to workstation client units on a computer network.

**server/device events.** Events that occur on the server or a designated device that meet criteria that the user sets.

**Simple Network Management Protocol (SNMP).** In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

**SL\_Port.** See *segmented loop ports*.

**small computer system interface (SCSI).** A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

**SNMP.** See *Simple Network Management Protocol*.

**SNMPv1.** The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

**SNMP time-out.** The maximum amount of time the SANavigator tool will wait for a device to respond to a request. The specified time applies to one retry only.

**SNMP trap events.** SNMP is based on a manager/agent model. SNMP includes a limited set of management commands and responses. The management system issues messages that tell an agent to retrieve various object variables. The managed agent sends a Response message to the management system. That message is an event notification, called a trap, that identifies conditions, such as thresholds, that exceed a predetermined value.

**SRAM.** See *static random access memory*.

**SSA.** See *serial storage architecture*.

**static random access memory (SRAM).** Random access memory based on the logic circuit known as flip-flop. It is called *static* because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly refreshed. It is however, still volatile, meaning that it can lose its contents when the power is switched off.

**storage area network (SAN).** A network that links servers or workstations to disk arrays, tape backup subsystems, and other devices, typically over fibre channel.

**storage management station.** A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel I/O path.

**subnet.** An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

**super video graphics array (SVGA).** A video display standard that Video Electronics Standards Association (VESA) created to provide high resolution color display on IBM PC compatible personal computers. The resolution is 800 x 600 4-bit pixels. Each pixel can therefore be one of 16 colors.

**SVGA.** See *super video graphics array*.

**sweep method.** A method of sending SNMP requests for information to all the devices on a subnet by sending the request to every device on the network. Sweeping an entire network can take a half an hour or more. If broadcast is disabled, the recommended method is to enter the individual IP addresses of the SAN devices into the SANavigator tool. This method produces good results without unnecessarily using time to wait for

responses from every IP address in the subnet, especially for IP addresses where no devices are present. There might, however, be times when a full subnet sweep will produce valuable diagnostic information about the network or a device's configuration.

**switch.** A fibre channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

**switch group.** A switch and the collection of devices connected to it that are not in other groups. Switch Groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path Maps.

**system name.** Device name assigned by the vendor's third-party software.

**TCP.** See *Transmission Control Protocol*.

**TCP/IP.** See *Transmission Control Protocol/Internet Protocol*.

**terminate and stay resident program (TSR program).** A program that installs part of itself as an extension of DOS when it is executed.

**TFT.** See *thin-film transistor*.

**thin-film transistor (TFT).** A transistor created by using thin film methodology.

**topology.** The physical or logical arrangement of devices on a network. The three fibre channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

**TL\_Ports.** See *translated loop port*.

**translated loop ports (TL\_Ports).** Each TL\_Port connects to a private loop and allows connectivity between the private loop devices and *off loop* devices (devices not connected to that particular TL\_Port).

**Transmission Control Protocol (TCP).** A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packed-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

**trap.** In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

**trap recipient.** Receiver of a forwarded SNMP trap. Specifically, a trap receiver is defined by an IP address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

**TSR program.** See *terminate and stay resident program*.

**user action events.** Actions that the user takes, such as changes in the SAN, changed settings, and so on. Each such action is considered a User Action Event.

**vendor.** Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered but will always remain editable.

**VGA.** See *video graphics adapter*.

**video graphics adapter (VGA).** A computer adapter that provides high-resolution graphics and a total of 256 colors.

**video random access memory (VRAM).** A special type of dynamic RAM (DRAM) used in high-speed video applications, designed for storing the image to be displayed on a computer's monitor.

**VRAM.** See *video random access memory*.

**WORM.** See *write-once read-many*.

**Worldwide Name (WWN).** A registered, unique 64-bit identifier assigned to nodes and ports.

**write-once read-many (WORM).** Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered. Typically the storage medium is an optical disk whose surface is permanently etched by using a laser in order to record information. WORM media are high-capacity storage devices and have a significantly longer shelf life than magnetic media.

**WWN.** See *worldwide name*.

**XGA.** See *eXtended graphics array*.

**zoning.** A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.



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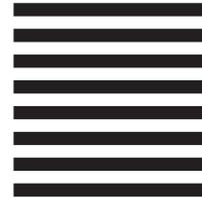
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