

IBM TotalStorageFAStT900  
Fibre Channel Storage Server



# User's Guide

**Read Before Using**

The IBM License Agreement for Machine Code is included in this book. Carefully read the agreement. By using this product you agree to abide by the terms of this agreement and applicable copyright laws.



IBM TotalStorageFAStT900  
Fibre Channel Storage Server



# User's Guide

**Note:**

Before using this information and the product it supports, be sure to read the general information under “Notices” on page 65.

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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.

在安装本产品之前，请仔细阅读 **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 přečtete 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:**



**DANGER**

**Electrical current from power, telephone, and communication cables is hazardous.**

**To avoid a shock hazard:**

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

<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.

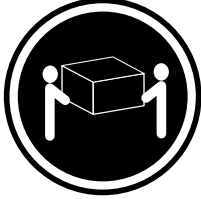
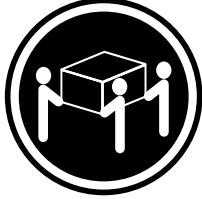
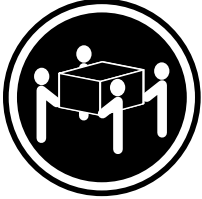
**Class 1 Laser Statement**

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

GS000002

**Statement 4:**



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

**CAUTION:**

Use safe practices when lifting.

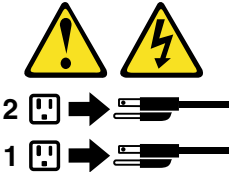


**Statement 5:**



**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.

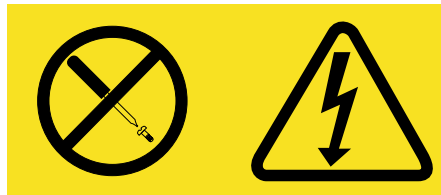


**Statement 8:**



**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.



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## About this document

This document provides an overview of the IBM® TotalStorage™ FASt900 Fibre Channel Storage Server, hereafter referred to as the FASt900 Storage Server, and contains information about routine operations and replacement procedures for all customer replaceable units (CRUs).

Before you use this document, install the hardware and software. For more information, refer to the *IBM TotalStorage FASt900 Fibre Channel Storage Server Installation Guide* and the IBM FASt Storage Manager installation guide appropriate for your operating system. .

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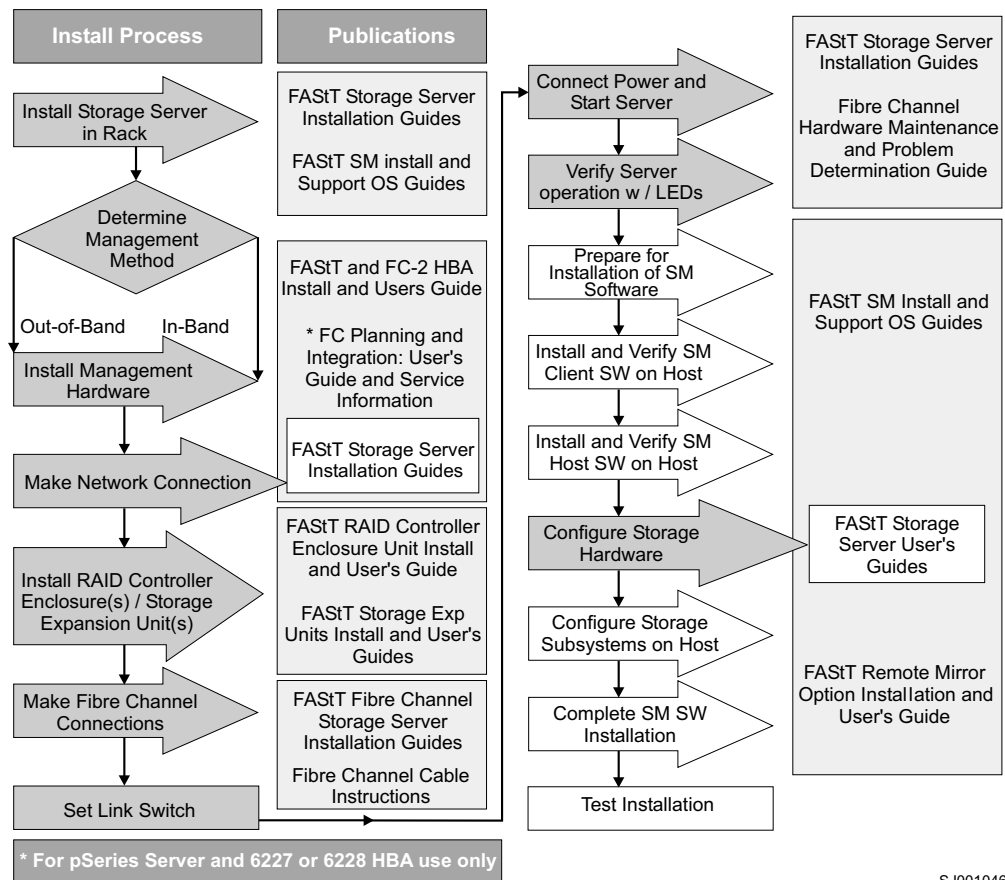
## Who should read this document

This user's guide is intended for system operators and service technicians who have extensive knowledge of Fibre Channel, network technology, computer-system operation, maintenance, and repair. Use this guide to:

- Become familiar with the components of the FASt900 Storage Server
- Learn how to operate the FASt900 Storage Server
- Learn how to replace failed components in the FASt900 Storage Server

## FASTt installation process overview

The following flow chart gives an overview of the installation process for the FASTt hardware and the FASTt 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. Process flow by current publications

## FASTt documentation

The following three tables present an overview of the FASTt900 Fibre Channel Storage Server and the FASTt Storage Manager document libraries, as well as related documents. Each table lists documents that are included in the libraries and where to locate the 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	✓	✓		✓		
FAStT900 Fibre Channel Cabling Instructions, 24P8135	✓	✓				
FAStT900 User's Guide, GC26-7534				✓	✓	✓
FAStT Host Adapter Installation and User's Guide, 59P5712		✓			✓	
FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✓	✓			✓	✓
FAStT Management Suite Java User's Guide, 32P0081					✓	✓
Fibre Channel Hardware Maintenance Manual and Problem Determination Guide, GC26-7528						✓

## 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	✓		✓	✓		
Installation and Support Guide for Linux, GC26-7519	✓		✓	✓		
Installation and Support Guide for Novell NetWare, GC26-7520	✓		✓	✓		
Installation and Support Guide for UNIX and AIX Environments, GC26-7521	✓		✓	✓		
FAST Remote Mirror Option Installation and User's Guide, 48P9821	✓		✓	✓	✓	
IBM FAST Storage Manager Script Commands (see product CD)				✓		
IBM FAST Storage Manager Version 7.10 Concepts Guide, 25P1661	✓	✓	✓	✓	✓	✓

## FASTt related documents

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

Table 3. TotalStorage FASTt related document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
IBM Safety Information, P48P9741					✓	
IBM FASTt500 RAID Controller Enclosure Unit Installation Guide, 59P6244		✓			✓	
IBM FASTt500 RAID Controller Enclosure Unit User's Reference, 48P9847		✓			✓	
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✓				
IBM FASTt200 and FASTt200 HA Storage Servers Installation and User's Guide, 59P6243		✓			✓	
IBM FASTt200 Fibre Channel Cabling Instructions, 21P9094		✓				
IBM TotalStorage FASTt EXP700 Storage Expansion Unit Installation and User's Guide, 32P0178		✓			✓	
IBM FASTt EXP500 Installation and User's Guide, 59P5637		✓			✓	
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

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## How this book is organized

Chapter 1, “Introduction”, on page 1 introduces the FASiT900 Storage Server and its primary components.

Chapter 2, “Operating the FASiT900 Storage Server”, on page 15 describes the tasks required to operate the FASiT900 Storage Server.

Chapter 3, “Replacing the FASiT900 Storage Server components”, on page 37 describes how to service and replace components of the FASiT900 Storage Server.

“Getting information, help, and service”, on page 61 describes how to obtain help, service, and information about IBM products.

“Notices” on page 65 provides product notices.

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## Notices and statements in this document

The caution and danger statements that this document uses also appear in the multilingual *Safety Information* document provided with your FASiT900 Storage Server. Each caution and danger statement is numbered for easy reference to the corresponding statements in the safety document.

This document uses the following types of notices and statements:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice 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 and 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, what to do if you experience a problem with your 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.



- Go to the IBM Support Web site at <http://www.ibm.com/pc/support/> to check for technical information, hints, tips, and new device drivers.
- 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 publications 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 IBM® xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation 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. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support> and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi/>

## Web sites

On the World Wide Web, the IBM Web site has up-to-date information about IBM xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is <http://www.ibm.com/eserver/xseries/> The address for IBM IntelliStation information is <http://www.ibm.com/pc/intellistation>.

You can find service information for your IBM products, including supported options, at <http://www.ibm.com/pc/support/> If you click **Profile** from the support page, you can create a customized support page. The support page has many sources of information and ways for you to solve problems, including how to:

- Diagnose problems, using the IBM Online Assistant
- Download the latest device drivers and updates for your products
- View Frequently Asked Questions (FAQ)
- View hints and tips to help you solve problems
- Participate in IBM discussion forums
- Set up e-mail notification of technical updates about your products

## Software service and support

Through the 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 <http://www.ibm.com/services/sl/products/>

For more information about Support Line and other IBM services, go to <http://www.ibm.com/services/> or go to <http://www.ibm.com/planetwide/> for support telephone numbers.

## 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 <http://www.ibm.com/planetwide/> for support telephone numbers.

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 of 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 that you are commenting on, such as a page number or table number.

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## Chapter 1. Introduction

The IBM TotalStorage FAStT900 Fibre Channel Storage Server (referred to throughout this book as the FAStT900 Storage Server) is a high-performance unit that provides dual, redundant array of independent disks (RAID) controllers and Fibre Channel interfaces to both the host and drive channels.

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### FAStT900 Storage Server overview

The FAStT900 Storage Server (Machine type 1742, models 90U and 90X) supports direct attachment of up to four hosts that contain two host adapters each, and is designed to provide maximum host-side and drive-side redundancy. By 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.

Each FAStT900 Storage Server contains several removable components, called *customer replaceable units (CRUs)*, that you can access from either the front or back of the unit. These CRUs include the battery, RAID controllers, storage server fan, power supplies, fan and communications module, mini hubs, and Small Form-Factor Pluggable (SFP) modules. The FAStT900 Storage Server also has a removable front bezel.

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 an IBM FAStT EXP700 drive. If the Fibre Channel drives are configured in FAStT EXP500 drive expansion units, a maximum of 220 hard drives are supported.

**Attention:** The FAStT900 controller units are not compatible with the FAStT700 or FAStT500 controller units. The FAStT900 controller units are keyed to prevent them from being mistakenly inserted in the non-supported storage server units. Do not force fit the controller units or the backplane might be damaged.

### Front view

Figure 2 on page 2 shows the bezel. The bezel is a removable front cover with holes for viewing the status lights and for boosting air circulation.

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

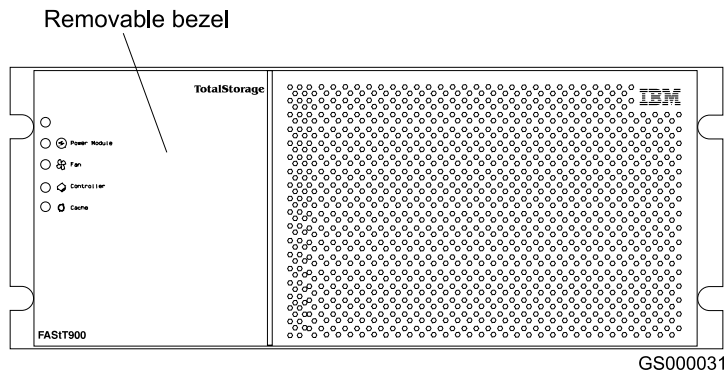


Figure 2. IBM TotalStorage FASt900 Fibre Channel Storage Server front bezel

Figure 3 shows the following components on the FASt900 Storage Server without the front bezel:

- **Storage server fan** - A removable unit that contains two cooling fans and indicator lights
- **Battery** - A removable unit that contains the cache battery for the controllers, battery charger circuitry, and status indicator lights
- **Controllers** - Two removable units that each contain one RAID controller with 1 Gb cache memory and status indicator lights

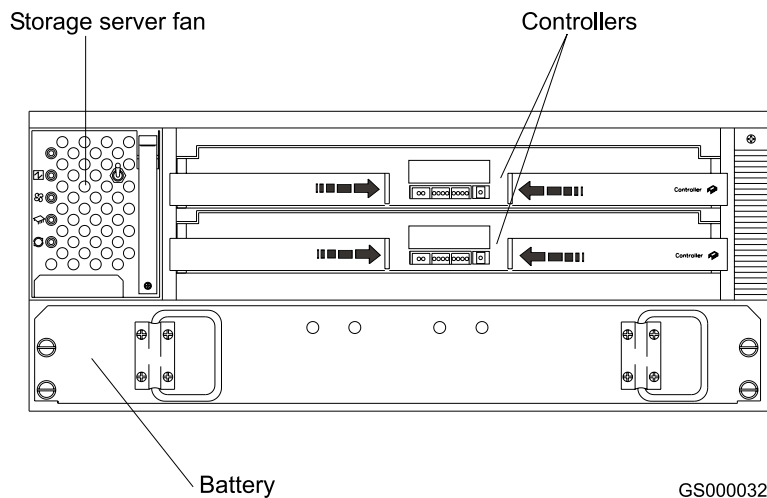


Figure 3. IBM TotalStorage FASt900 Fibre Channel Storage Server front view

## Back view

Figure 4 on page 3 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. You can insert SFP modules into the mini hubs and connect fiber-optic host and drive interface cables to the FASt 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.

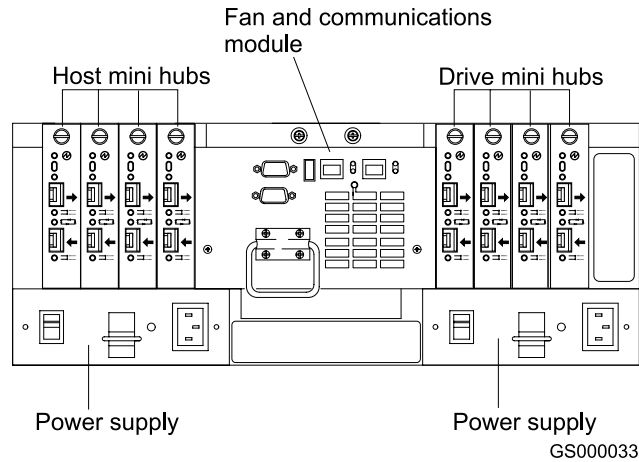


Figure 4. IBM TotalStorage FASi900 Fibre Channel Storage Server - back view

## Fibre Channel connections

When fully configured, the back of the FASi900 Storage Server can accommodate up to four host-side and four drive-side mini hubs. Each mini hub is a single, removable unit that provides the Fibre Channel interface between a FASi900 Storage Server, host computers, and drives. Each mini hub has two SFP module ports. An SFP module is inserted into a mini-hub port. Figure 5 shows the Fibre Channel components.

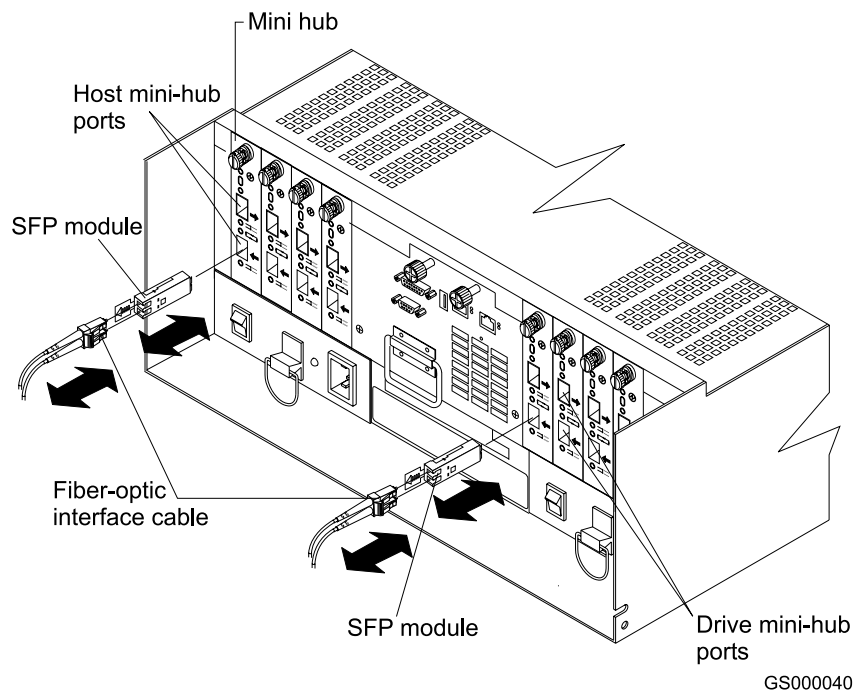


Figure 5. Fibre Channel interface connections

The FAStT900 Storage Server uses fiber-optic cables to connect to other Fibre Channel devices. The fiber-optic cables that you need depend on the type of optical connectors in the device to which you are connecting the FAStT900 Storage Server. If the device uses SFP modules or optical interface connectors, then you must use LC-LC Fibre Channel cables. If the device uses Gigabit Interface Converters (GBICs) as the optical interface connector, you must use LC-LC Fibre Channel cables and LC-SC Fibre Channel cable adapters (Part number 19K1250) to connect to the FAStT900 Storage Server.

---

## Handling fiber-optic cables

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

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

- Do not route the cable along a folding cable-management arm.
- When attaching to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius of less than 38 mm (1.5 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can be damaged by other devices in the rack cabinet.
- Do not use plastic cable ties in place of the provided cable straps.
- 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.

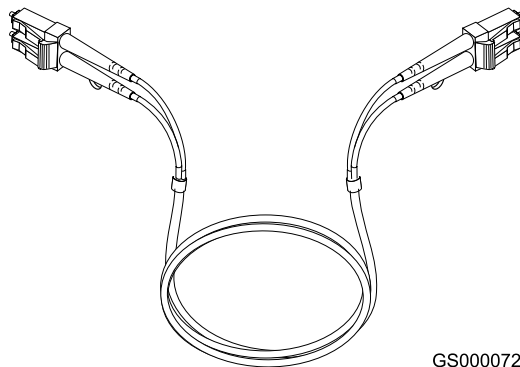
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## Using LC-LC Fibre Channel cables

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 FAStT900 Storage Server mini hub
- SFP module installed in an IBM Fibre Channel switch
- SFP module installed in an IBM FAStT EXP700 drive expansion unit
- Optical interface connector on an IBM FAStT FC-2 Host Bus Adapter (part number 19K1246), IBM FAStT single port FC2-133 Host Bus Adapter (part number 24P0960), or dual port FC2-133 Host Bus Adapter (part number 24P8053)

Figure 6 on page 5 shows an LC-LC Fibre Channel cable.



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Figure 6. 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 FAStT900 Storage Server to a FAStT EXP500 expansion unit or to an IBM FAStT host adapter, you must also use a Fibre Channel cable adapter. For more information about how to use the LC-SC Fibre Channel cable adapter, see “Using LC-SC Fibre Channel cable adapters” on page 8.

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

To connect an LC-LC Fibre Channel cable to an SFP module, complete the following steps.

### Statement 3:



### CAUTION:

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

- 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.

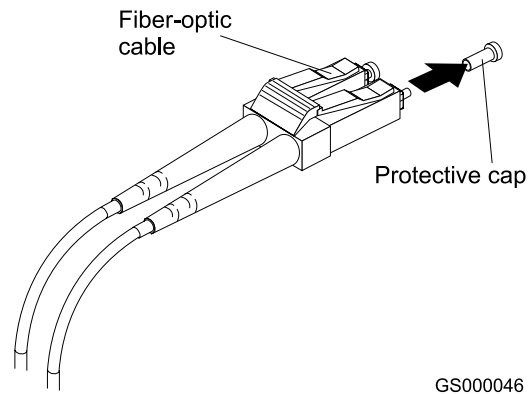


### DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following precautions. Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

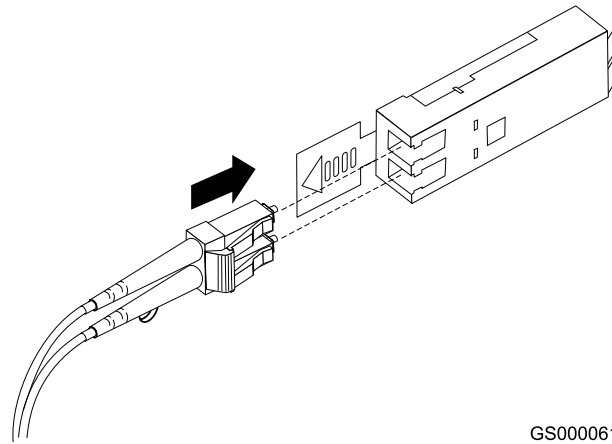
1. Read the information in “Handling fiber-optic cables” on page 4.
2. If necessary, remove the protective cap from the SFP module, as shown in Figure 48 on page 56. Save the protective cap for future use.

3. Remove the two protective caps from one end of the LC-LC cable as shown in Figure 7. Save the protective caps for future use.



*Figure 7. Removing the fiber-optic cable protective caps*

4. Carefully insert that same end of the LC-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. While you hold the connector, push in the connector until it clicks into place.



*Figure 8. Inserting an LC-LC Fibre Channel cable into an SFP module*



Figure 9 shows an LC-LC Fibre Channel cable that connects into an SFP module that is installed in a FAST900 Storage Server mini hub.

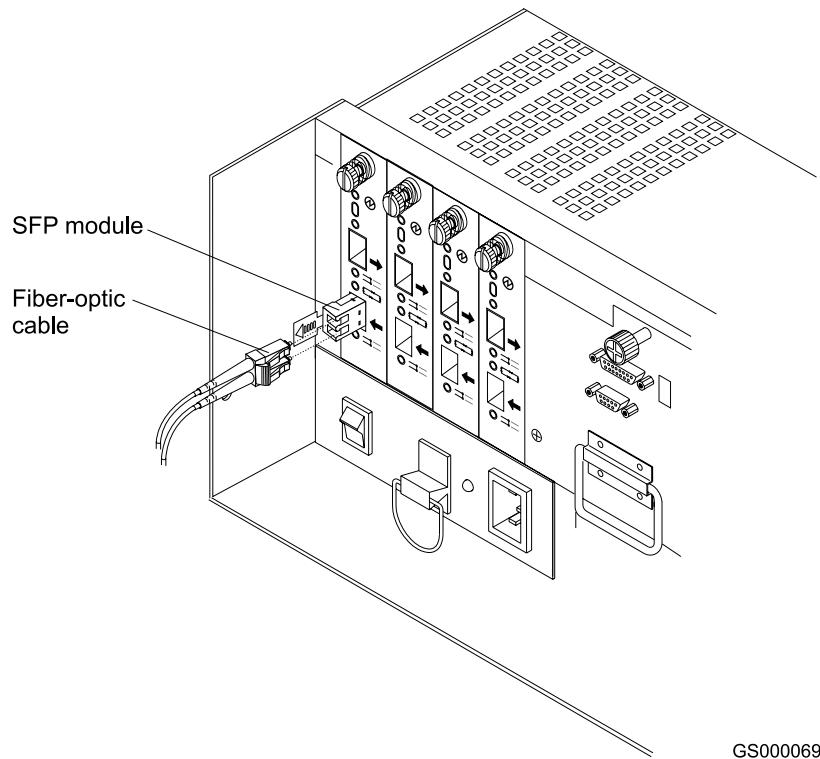


Figure 9. Inserting an LC-LC Fibre Channel cable into an installed SFP module

5. Remove the two protective caps from the other end of the LC-LC cable, as shown in Figure 7 on page 6. Save the protective caps for future use.
6. Connect the end of 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 FC-2 Host Bus Adapter (part number 19K1246)
  - LC-SC Fibre Channel cable adapter (For information about how to use an LC-SC cable adapter, see “Using LC-SC Fibre Channel cable adapters” on page 8.)

## Removing an LC-LC Fibre Channel cable from an SFP module

To remove an LC-LC Fibre Channel cable, perform the following steps:

**Attention:** To avoid damaging the LC-LC cable or SFP module, make sure you press and hold the lever to release the latches as you remove the cable from the SFP module.

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 10 on page 8. Carefully pull on the connector to remove the cable from the SFP module, (ensure that the levers are in the released position when you remove the cable) as shown in Figure 11 on page 8. If you use the SFP module with the pull tab, make sure you do not grasp the plastic tab when you remove the cable.

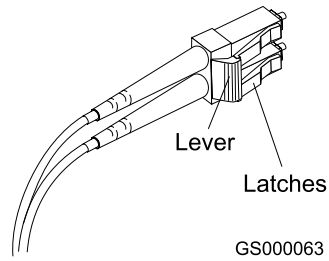


Figure 10. LC-LC Fibre Channel Cable lever and latches

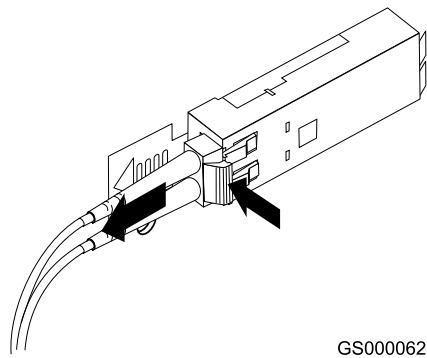


Figure 11. Removing the LC-LC Fibre Channel cable

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 you use to connect the LC connector into one of the following devices that require SC connectors:

- FASTt host adapter (Part number 00N6881)
- FASTt EXP500 expansion unit (Machine type 3560)
- 1 Gb Fibre Channel switch (Machine type 2109)
- 1 Fibre Channel Managed hub (Machine type 3534)

Figure 12 shows an LC-SC Fibre Channel cable adapter.

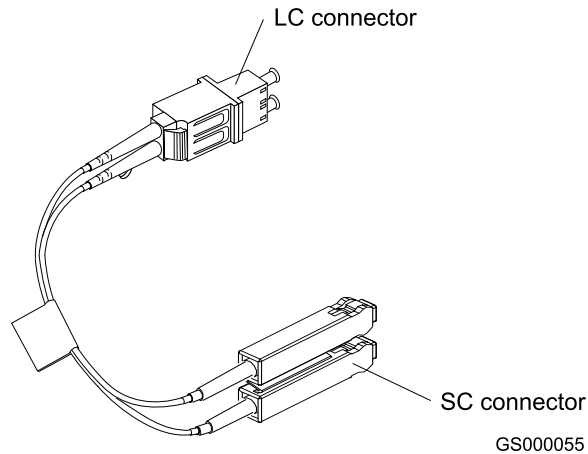


Figure 12. LC-SC Fibre Channel cable

The following sections provide the procedures for properly connecting and removing an LC-SC Fiber Channel cable adapter.

## Connecting an LC-SC cable to a device

To connect an LC-SC cable adapter to a device or LC-LC cable, 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 precautions:

- 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.

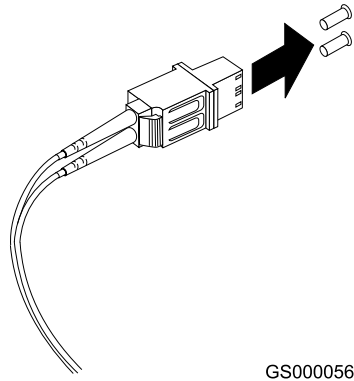


### DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following precautions. 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 4.

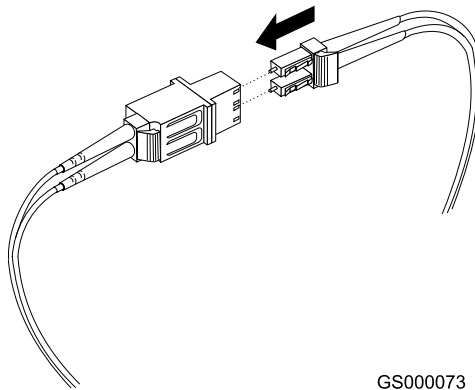
2. Connect an LC-LC cable to an SFP module in the FAStT900 Storage Server mini hub. For instructions, see “Connecting an LC-LC Fibre Channel cable to an SFP module” on page 5.
3. Remove the two protective caps from the LC connector end of the LC-SC cable, as shown in Figure 13. Save the protective caps for future use.



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Figure 13. Removing the LC-SC cable adapter protective caps

4. Carefully insert one end of an LC-LC cable into the LC connector end of the LC-SC cable. Push in the connector until it clicks into place.



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Figure 14. LC-LC cable connected 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 FAStT Host Bus Adapter (Part number 00N6881)
  - GBIC installed in a FAStT EXP500 expansion unit (Machine type 3560)
  - 1 Gb Fibre Channel switch (Machine type 2109)
  - 1 Gb Fibre Channel managed hub (Machine type 3534)

## 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 while you remove the cable from an LC-SC cable adapter. Ensure that both levers on the LC-LC cable are in the released position when you remove the cable.

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 15 shows the location of the lever and latches.

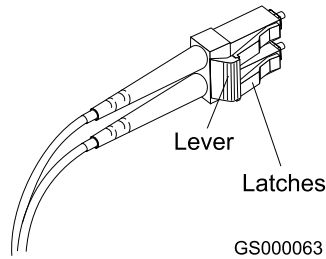


Figure 15. LC-LS Fibre Channel cable lever and latches

2. Carefully pull on the connector to remove it. Make sure you grasp the connector and not the cable when you remove the LC-LC cable from the LC-SC cable adapter, as shown in Figure 16.

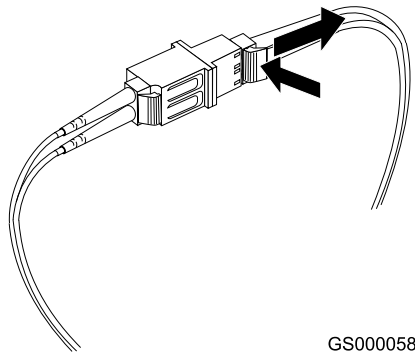


Figure 16. Removing the LC-LC Fibre Channel cable from an LC-SC Fibre Channel cable adapter

3. Replace the protective caps on the cable ends.

---

## Types of interface ports

The FASt900 Storage Server has the following types of interface ports:

- Host mini hub
- Drive mini hub
- Ethernet

The host and drive 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 17.

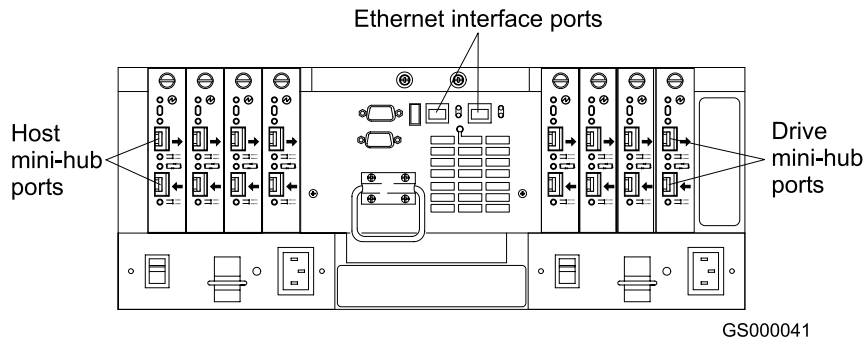


Figure 17. FAST900 Storage Server interface ports

For more information about how to connect the FAST900 Storage Server and drive enclosures (also referred to as expansion units) by using the host and drive interface ports, refer to the *IBM FAST900 Fibre Channel Storage Server Installation Guide*.

## Host interface ports

The FAST900 Storage Server comes with host-side mini hubs 1 and 2 installed. Each mini hub provides host loop connectivity and self-diagnostic features. Host mini hubs connect to the controller in pairs. When fully configured, the FAST900 Storage Server can accommodate four host-side mini hubs, two per controller. 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 18. To ensure redundancy, you must connect each host to both controllers through the appropriate mini hub.

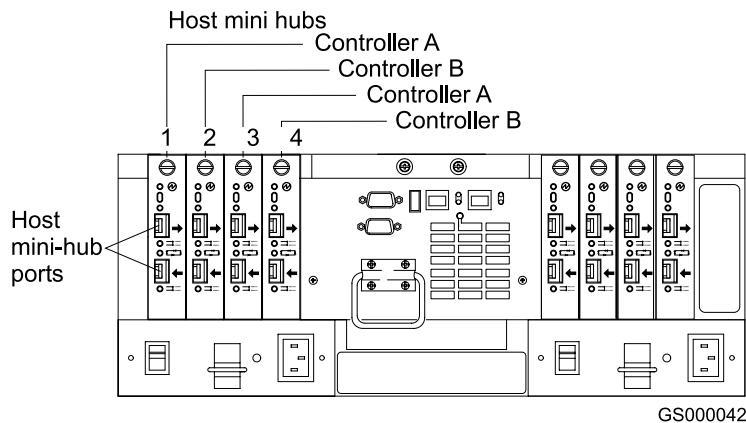


Figure 18. Host-side mini-hub interface ports

## 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 can be connected per pair of redundant drive loops depending on the IBM FAST drive expansion unit models used. The two possible

drive expansion unit types are the IBM FAStT EXP500 and the IBM FAStT EXP700. You can mix the drive expansion unit models in the same storage server or the same pair of drive loops. However, the maximum Fibre Channel transfer speed in the storage server drive mini hubs and the IBM FAStT EXP700 Environmental Card units must be set at 1Gbps because the maximum FC transfer speed of the IBM FAStT EXP500 drive expansion units is 1Gbps. See Table 4 for the possible combinations of EXP500 and EXP700 drive expansion units per drive loop. See Figure 19 on page 14 for a graphical depiction of the drive-side mini-hub interface ports.

A fully configured FAStT900 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 4. Possible combinations of EXP500 and EXP700 drive expansion units per drive loop*

# of EXP500 units	# 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. FAStT900 Storage Servers use only redundant drive-loop configurations.

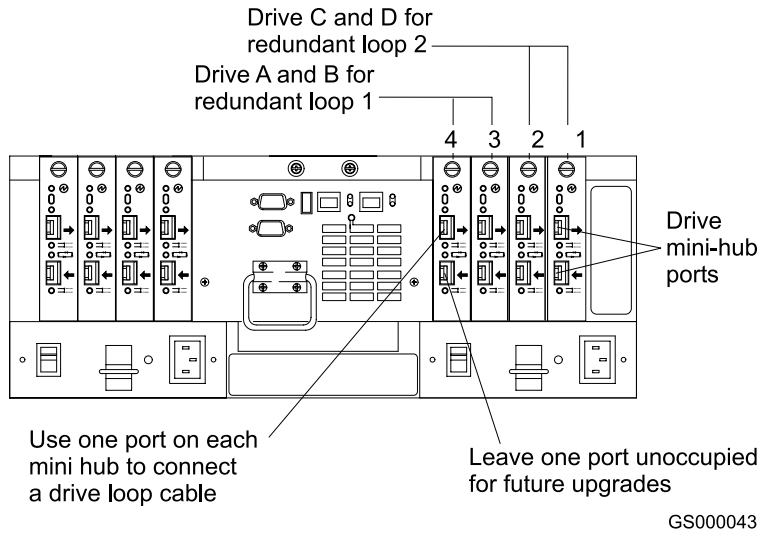


Figure 19. Drive-side mini-hub interface ports

## 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 20 shows the location of the interface ports.

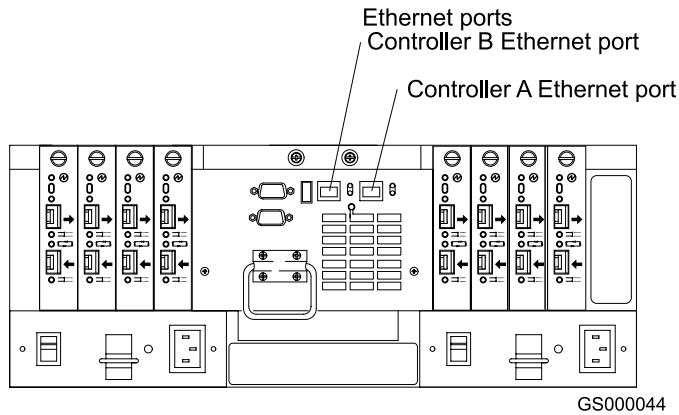


Figure 20. Ethernet interface ports



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## Chapter 2. Operating the FASt900 Storage Server

This chapter describes the tasks required to operate the FASt900 Storage Server.

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### Tasks overview

Perform the tasks shown in Table 5 to maintain the FASt900 Storage Server after you install it.

Table 5. Tasks overview

Task	Description	See
Accessing the FASt900 Storage Server components and indicator lights	To access the controller CRUs, battery, storage server fan, and indicator lights, remove the FASt900 Storage Server bezel.	"Removing and replacing the front bezel to access the FASt Storage Server components" on page 16
Turning on or off the power	The FASt900 Storage Server usually runs continuously. However, you might need to turn off the power to move the FASt900 Storage Server or to perform maintenance procedures.	"Turning on the power" on page 17 and "Turning off the power" on page 18
Monitoring FASt900 Storage Server status through software	Run the storage-management software continuously. This software checks the storage subsystem for failures and displays messages that indicate the types of failures and the recovery procedures.	"Monitoring status through software" on page 20
Checking fault indicator lights for component failures	Component failures are indicated by lights on the front and back of the FASt900 Storage Server and are monitored by the storage-management software. <b>Note:</b> The indicator lights identify problems with the FASt900 Storage Server components, but you might need more information to thoroughly diagnose and repair the unit. Therefore, it is important to use the storage-management software to continuously monitor the status of the FASt900 Storage Server.	"Checking the indicator lights" on page 20
Restoring power after a power supply shutdown	When the FASt900 Storage Server shuts down because of a power supply overtemperature condition, take special care restarting it.	"Overtemperature condition and power supply shutdown" on page 31
Checking the battery service date	Periodically check the battery service date information. Replace the battery whenever it fails to hold a charge or every three years. <b>Note:</b> Using the FASt900 Storage Server in a hot environment (above 35° C or 95° F), lowers the battery life expectancy. Environmental conditions that are not in the specified range are not supported.	"Checking the battery service date" on page 32

Table 5. Tasks overview (continued)

Task	Description	See
Preparing to move the FAST900 Storage Server	You might need to move the FAST900 Storage Server to a new location or remove the chassis from its rack cabinet.	"Preparing to move the FAST900 Storage Server" on page 33

## Removing and replacing the front bezel to access the FAST Storage Server components

To access the controller blades, battery, storage server fan, and indicator lights, you must remove the FAST900 Storage Server bezel, as shown in Figure 21.

**Attention:** Pulling the cover out too far can damage the plastic hooks at the top. To avoid damaging the hooks, place the FAST900 Storage Server on a flat surface. Be sure the front of the FAST900 Storage Server extends beyond the edge approximately 5 cm (2 in.).

1. Carefully pull the bottom of the bezel out to release the pins. Then slide the bezel down as shown in Figure 21.

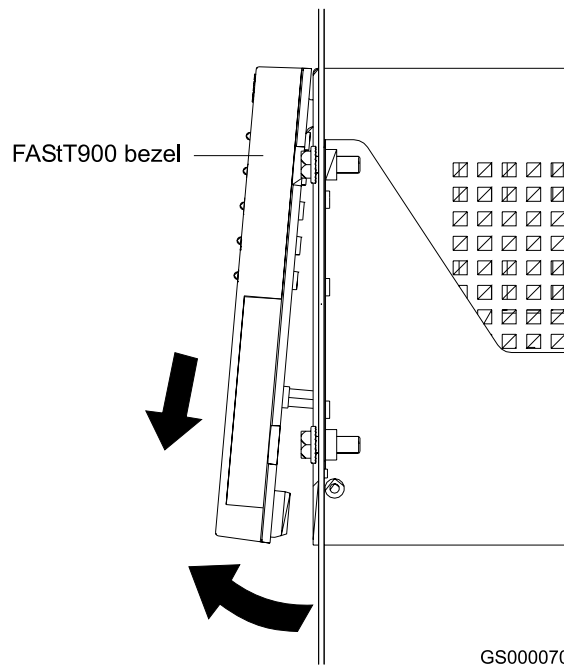


Figure 21. Removing the FAST900 Storage Server bezel

2. To replace the bezel, slip the top edge of the bezel under the lip on the chassis, then push the bottom of the bezel until the pins snap into the mounting holes, as shown in Figure 22 on page 17.

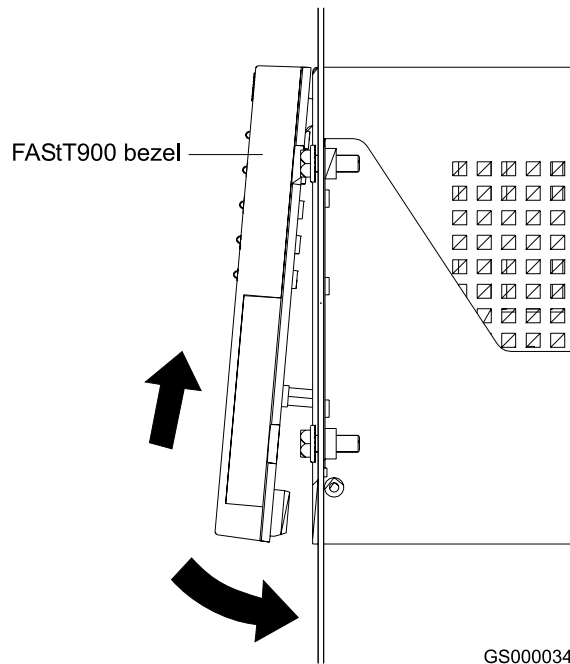


Figure 22. Replacing the FAST900 Storage Server bezel

## 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 you turn on the hard disk drives after the FAST900 Storage Server.

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

Turn on the power to each device in the following order:

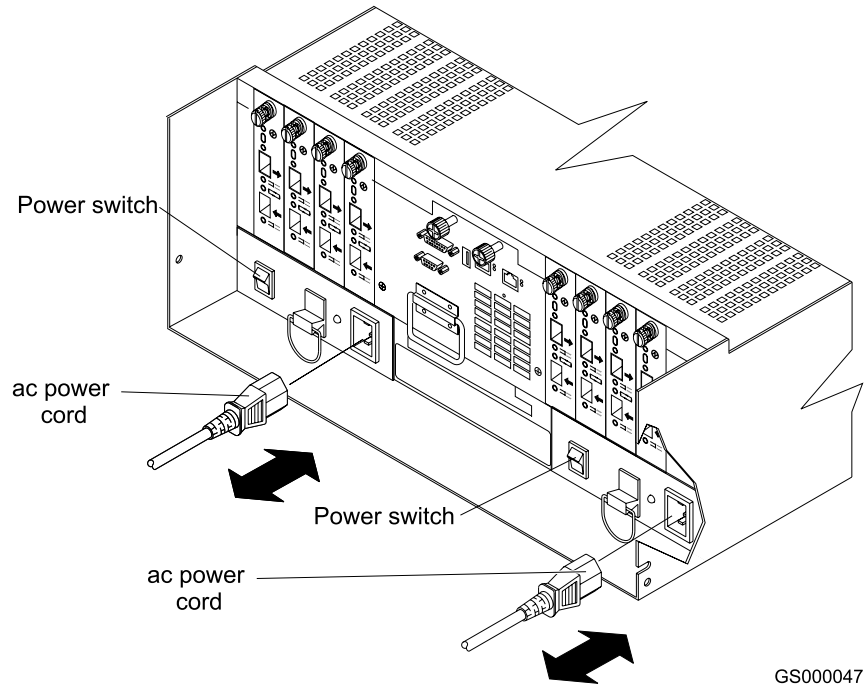
- Supporting devices
- Drive enclosures
- FAST900 Storage Server
- Host

If you are restoring power to the FAST900 Storage Server after an emergency shutdown or power outage, go to “Overtemperature condition and power supply shutdown” on page 31.

Use the following procedure to turn on the connected devices and the FAST900 Storage Server:

1. Turn on the power to the supporting devices (for example, Ethernet switches, Fibre Channel switches, and management stations).
2. Turn on the drive enclosure. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on turning on the drive enclosures, refer to the drive enclosure documentation.
3. Turn on the power to the FAST900 Storage Server, as follows:

- a. Verify that all communication and power cables are plugged into the back of the FASt900 Storage Server and to a properly grounded ac electrical outlet.
- b. Turn on the power supply switches on the back of the FASt900 Storage Server (see Figure 23). You must turn on both power-supply switches to take advantage of the redundant power supplies.



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Figure 23. Connecting the power cords and power switch locations

- c. Use the storage-management software and the Fault indicator lights to check the overall status of the FASt900 Storage Server and its components. See "Checking the indicator lights" on page 20.
4. Depending on the type of operating system on the host server, perform either a server power cycle, a server restart, or a rescan for hardware on the host server.

---

## Turning off the power

**Attention:** The FASt900 Storage Server is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power even if any FASt900 Storage Server fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before you turn off the power. This measure ensures that the FASt900 Storage Server powers up correctly later. Also do not power off the storage server to reset it. Use the Reset Controller menu function in the Storage Manager Client program instead.

**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 you turn off the power. For more information, see “Monitoring status through software” on page 20 and “Checking the indicator lights” on page 20.
2. Perform any required procedures that are indicated by the operating system software.
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 you power off the storage server.
- 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).

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

4. Turn off the power to the FAStT900 Storage Server or turn off the power to each device using the following shutdown sequence.
  - a. Turn off power to the host before you turn off the power to 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. See Figure 23 on page 18.

- c. Instead of turning off the power to other supporting devices ( for example, management stations, Fibre Channel switches, or Ethernet switches), disconnect the communications cables to the supporting devices.

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## Monitoring status through software

To monitor FAStT900 Storage Server status, always run the storage-management software and check it frequently. Be sure to enable the management alerts that you need. The storage-management software provides the best way to diagnose and repair FAStT900 Storage Server failures. This software can help you:

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

Although the FAStT900 Storage Server has fault indicators, these lights are summary indicators and might not identify the specific component that has failed or needs replacing, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in FAStT900 Storage Server drive loops), the fault light does not come on. Only the storage-management software can detect the failure.

Recovering from a FAStT900 Storage Server failure might require you to perform procedures other than replacing the component. The storage-management software gives these procedures when you are using the Recovery Guru menu.

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

For more information about the storage-management software, refer to the Online help or publications that are appropriate for your operating system (see “About this document” on page xvii for a list of publications).

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## Checking the indicator lights

The FAStT900 Storage Server indicator lights display the status of the FAStT900 Storage Server and its components. Green indicator lights mean normal operating status; amber indicator lights mean a possible failure.

It is important that you check all the indicator lights on the front and back of the FAStT900 Storage Server a few minutes *after* you turn on the power. After you turn on the power, the indicator lights might blink intermittently. Wait until the FAStT900 Storage Server completes its power up before checking for faults. It can take up to 15 minutes for the battery to complete its self-test and up to 24 hours to fully charge, particularly after an unexpected power loss of more than a few minutes.

The indicator lights for the components of the FAStT900 Storage Server are described in the following sections.

### Storage server indicator lights

The storage server has five indicator lights, as shown in Figure 24 on page 21. To view the storage server indicator lights, you do not have to remove the FAStT900 Storage Server bezel.

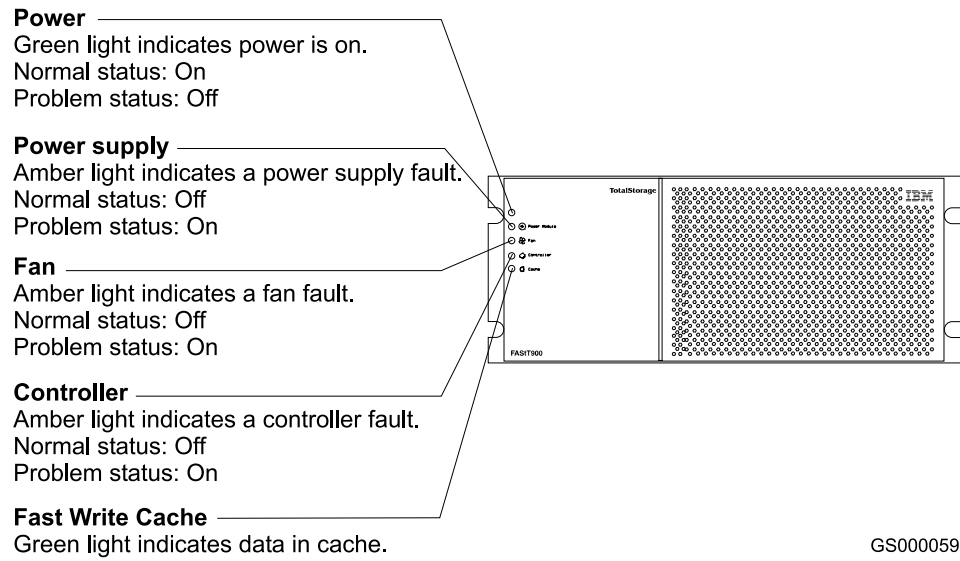


Figure 24. Storage server indicator lights

Table 6 on page 22 describes the storage server indicator lights.

Table 6. Storage server indicator lights

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator <sup>1</sup>
Power	Green	On	Off	<ul style="list-style-type: none"> <li>The FASt900 Storage Server has no power.</li> <li>The power supply cables are loose or the switches are off.</li> <li>Both power supplies have failed, are missing, or are not fully seated in FASt900 Storage Server.</li> <li>The temperature of the FASt900 Storage Server is too high.</li> </ul>
Power supply fault	Amber	Off	On	<ul style="list-style-type: none"> <li>One of the redundant power supplies has failed or the power supply is turned off, disconnected, or is not fully seated in the FASt900 Storage Server.</li> <li>The temperature of the FASt900 Storage Server is too high.</li> <li>If both power supplies have failed, are turned off, or are disconnected, all of the indicator lights will not be off.</li> </ul>
Storage server fan fault	Amber	Off	On	<ul style="list-style-type: none"> <li>The storage server fan has failed.</li> <li>The fan and communications module is missing, unplugged, or has failed.</li> <li>The storage server fan circuitry has failed.</li> <li>The temperature of the FASt900 Storage Server is too high.</li> </ul>
Controller fault	Amber	Off	On	<ul style="list-style-type: none"> <li>The RAID controller is restarting.</li> <li>The RAID controller has failed.</li> <li>One or more controller memory modules have failed.</li> </ul>
Fast write cache	Green	Steady or blinking <sup>2</sup>	Software dependent <sup>1</sup>	<p>During normal operation, the indicator light is not lit in the following conditions:</p> <ul style="list-style-type: none"> <li>The RAID controller cache is not enabled.</li> <li>The battery is not ready.</li> </ul>

<sup>1</sup> Always use the storage-management software to identify the failure. <sup>2</sup> The fast write cache indicator light is on when there is data in the cache and blinks during a fast write operation.

## RAID controller indicator lights

Each RAID controller has ten indicator lights: one power, one fault, and eight status lights, as shown in Figure 25 on page 23.



**Note:** To view the RAID controller indicator lights, remove the FASt900 Storage Server bezel, as shown in Figure 21 on page 16.

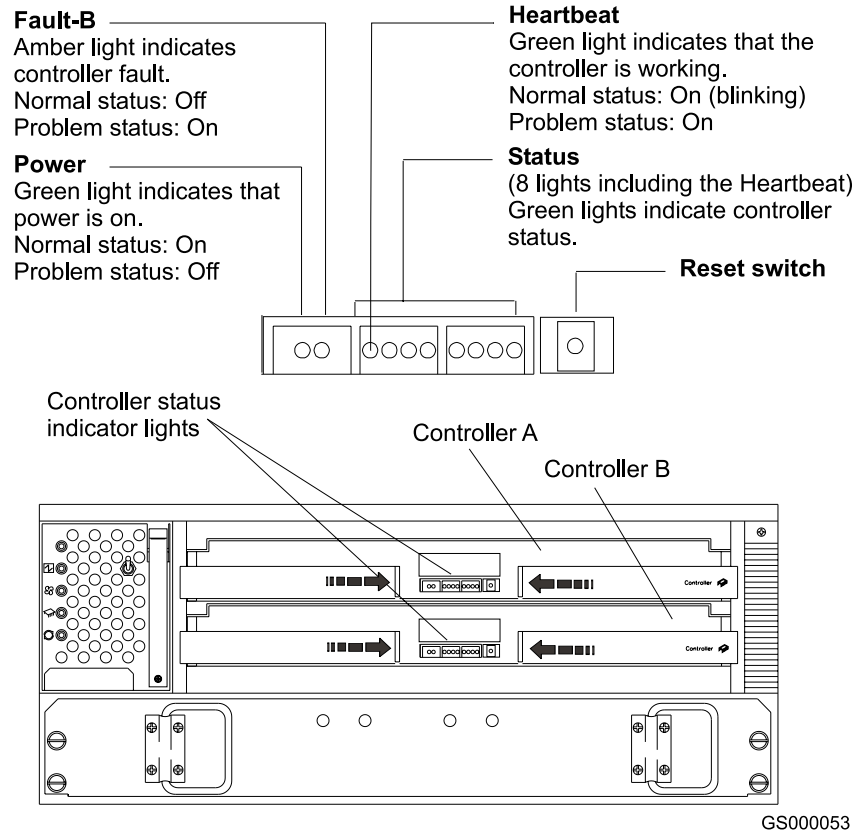


Figure 25. RAID controller indicator lights

Table 7 on page 24 describes the FASt900 RAID controller indicator lights.

Table 7. RAID controller indicator lights

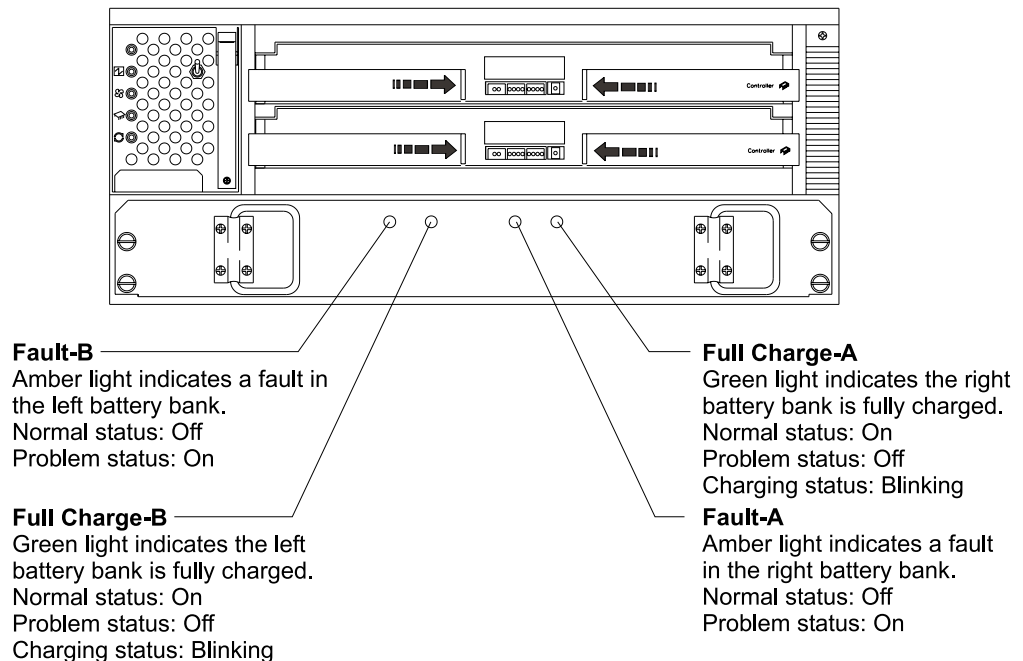
Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator <sup>1</sup>
Power	Green	On	Off	<ul style="list-style-type: none"> <li>There is no power to the storage subsystem.</li> <li>The cables are loose or the switches are off.</li> <li>The power supply has failed, is missing, or is not fully seated.</li> <li>The temperature of the FASTt900 Storage Server is too high.</li> </ul>
Fault <sup>3</sup>	Amber	Off	On	Controller failure
Heartbeat	Green	Blinking	Not blinking	No controller activity
Status (seven <sup>3</sup> lights not including Heartbeat)	Green	All indicator lights are off except the heartbeat <sup>2</sup>	Various patterns depending on the condition <sup>2</sup>	If any status indicator lights are lit and the controller is not offline, there is a memory fault indicating that the controller CRU has failed.

<sup>1</sup> Always use the storage-management software to identify the failure. <sup>2</sup> There are eight indicator lights (the Heartbeat and seven others) the seven others are lit in various patterns, depending on the controller status. <sup>3</sup>If the controller is offline, all of the indicator lights will be lit. This does not indicate failure.

## Battery indicator lights

The battery has four indicator lights, as shown in Figure 26.

**Note:** To view the battery indicator lights, remove the FASTt900 Storage Server bezel, as shown in Figure 21 on page 16.



GS000050

Figure 26. Battery indicator lights

Table 8 on page 25 describes the battery indicator lights.

Table 8. Battery indicator lights

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator <sup>1</sup>
Fault-A or Fault-B	Amber	Off	On	<ul style="list-style-type: none"> <li>The left or right battery bank has failed.</li> <li>The battery is either discharged or defective.</li> </ul>
Full Charge-A or Full Charge-B	Green	On <sup>2</sup>	Off	The left or right battery bank has failed.

<sup>1</sup> Always use the storage-management software to identify the failure. <sup>2</sup> If the Full Charge-A or Full Charge-B indicator light is blinking, the battery is in the process of charging.

## Fan and communications module indicator light

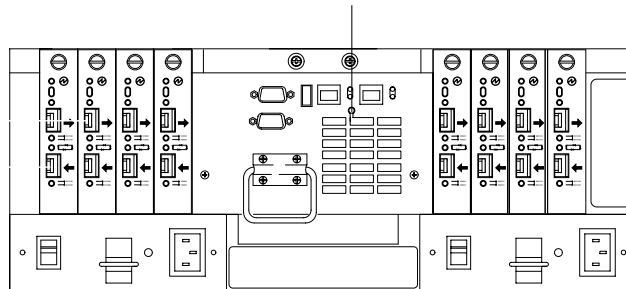
The fan and communications module has one indicator light, as shown in Figure 27.

### Fault

Amber light indicates a fault in the fan and communications module.

Normal status: Off

Problem status: On



GS000064

Figure 27. Fan and communications module indicator light

Table 9 describes the fan and communications module indicator light.

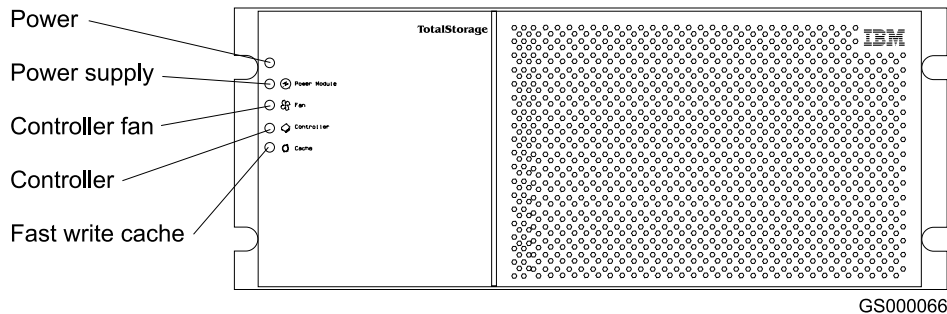
Table 9. Fan and communications module indicator light

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator <sup>1</sup>
Fan and communications fault	Amber	Off	On	<ul style="list-style-type: none"> <li>The fan and communications module has failed or is installed incorrectly.</li> <li>The temperature of the FASi900 Storage Server is too high.</li> </ul>

<sup>1</sup> Always use the storage-management software to identify the failure.

## Power supply indicator light

The power supply has one indicator light, as shown in Figure 28.



GS000066

Figure 28. Power supply indicator light

Table 10 describes the power supply indicator light.

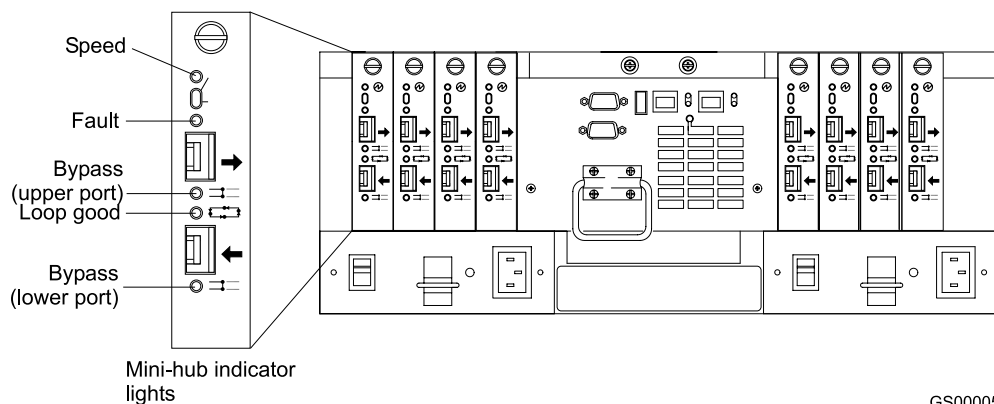
Table 10. Power supply indicator light

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator <sup>1</sup>
Power supply	Green	On	Off	<ul style="list-style-type: none"> <li>The power supply has failed or is turned off</li> <li>The temperature of the FAST900 Storage Server is too high.</li> </ul>

<sup>1</sup> Always use the storage-management software to identify the failure.

## Mini-hub indicator lights

There are five indicator lights on each mini hub. Figure 29 shows the host-side indicator lights. The drive side indicator lights are the same; however, the possible conditions indicated by the problem indicators (described in Table 11 on page 27) might be different.



GS000052

Figure 29. Mini-hub indicator lights

Table 11 on page 27 describes the indicator light status when there are Fibre Channel connections to devices between host-side and drive-side mini hubs.

Table 11. Host-side and drive-side mini-hub indicator lights

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
None	Speed	Green	On for 2 Gb Off for 1 Gb	Not applicable	Light on indicates data transfer rate of 2Gb/s. Light off indicates data transfer rate of 1Gb/s.
!	Fault	Amber	Off	On	Mini hub has failed. <b>Note:</b> If a host-side mini hub is not connected to a controller, this fault light is always lit.

Table 11. Host-side and drive-side mini-hub indicator lights (continued)


Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> <li>• Upper mini-hub port is bypassed.</li> <li>• Mini hub port or SFP module has failed or is loose.</li> <li>• Fiber-optic cables are damaged.</li> </ul> <p><b>Note:</b> When two functioning SFP modules are installed into the mini-hub ports and no Fibre Channel cables are connected to them, the bypass indicator light is lit.</p> <p>If only one functioning SFP module is installed in a host-side mini hub port and no Fibre Channel cables are connected to it, the indicator light will not be lit.</p> <p>However, the drive-side mini hub bypass indicator light will be lit when one SFP module is installed in the mini hub and the mini hub has no Fibre Channel cable connection.</p>

Table 11. Host-side and drive-side mini-hub indicator lights (continued)



Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Loop good	Green	On	Off	<ul style="list-style-type: none"> <li>• The loop is not operational, so no devices are connected.</li> <li>• Mini hub has failed or a faulty device is connected to the mini hub.</li> <li>• If no SFP module is installed, the indicator will be lit.</li> <li>• If one functioning SFP module is installed in the host-side mini hub port and no Fibre Channel cable is connected to it, the loop good indicator light will not be lit.</li> </ul> <p>If one functioning SFP module is installed in the drive-side mini hub port and no Fibre Channel cable is connected to it, the loop good indicator light will be lit.</p> <ul style="list-style-type: none"> <li>• Drive enclosure has failed (drive-side mini hub only).</li> </ul>

Table 11. Host-side and drive-side mini-hub indicator lights (continued)

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> <li>• Lower mini-hub port is bypassed; no devices are connected.</li> <li>• Mini-hub port or SFP module has failed or is loose.</li> <li>• Fiber-optic cables are damaged.</li> </ul> <p><b>Note:</b> When two functioning SFP modules are installed into the mini hub port and no Fibre Channel cables are connected to them, the bypass indicator light is lit.</p> <p>If only one functioning SFP module is installed in a host-side mini hub port and no Fibre Channel cables are connected to it, the indicator light is not lit.</p> <p>However, the drive-side mini hub bypass indicator light will be lit when one functioning SFP module is installed in the mini hub port and the mini-hub has no Fibre Channel cables connected to it.</p>



## Overtemperature condition and power supply shutdown

If the fan and communications module fails or is unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the FASiT900 Storage Server might shut down (see Figure 30). If both power supplies shut down, the FASiT900 Storage Server is not operational.

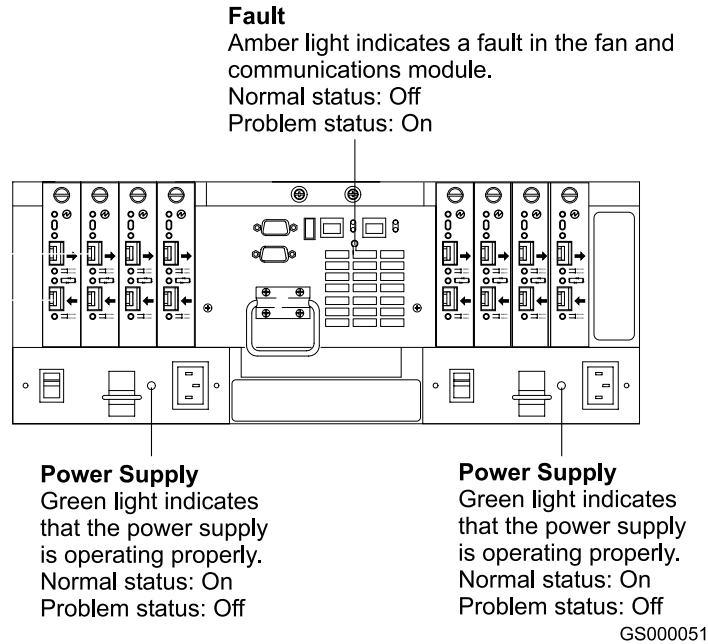


Figure 30. Fan and communications and power supply fault indicators

The storage-management software causes the fan and communications module fault indicator and storage server fan indicator to light before the temperature has risen sufficiently to shut down the power supplies. The storage server fan indicator light, shown in Figure 31, is lit when the FASiT900 Storage Server temperature exceeds 45° C (113° F). The FASiT900 Storage Server shuts down if the temperature rises to 70° C (158° F). If both power supplies shut down, the fault indicator cannot light.

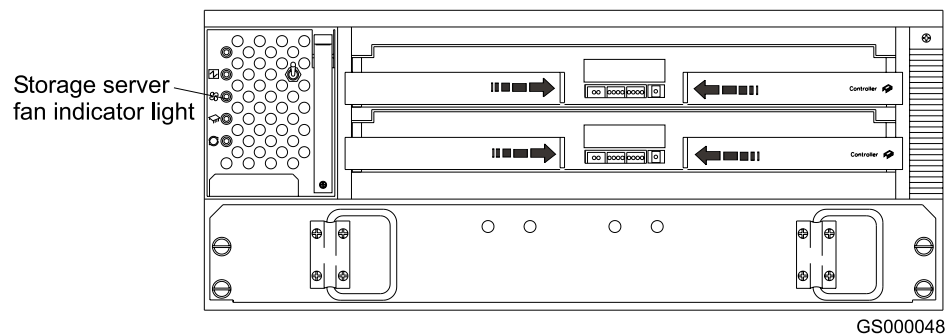


Figure 31. Storage server fan indicator

## Turning on the power after an overtemperature shutdown

If your FASt900 Storage Server shuts down unexpectedly and you received a "Maximum temperature exceeded " alert from the storage server before it shutdown, take the following precautions to cool it before you power on the unit:

1. Turn off the power switches to allow the FASt900 Storage Server to cool.
2. When the room temperature is below the upper operating temperature of 35° C (95° F), turn on the power switches.
3. Check the FASt900 Storage Server for faults or damage. Use the storage-management software to check the overall status of the FASt900 Storage Server and its components. Correct any problems indicated.

## Turning on the power after an emergency shutdown

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

1. Check all components and cables for damage. If there is no visible damage, continue with Step 2; otherwise, service the system.
2. Make sure the power cords are plugged in.
3. Make sure that the circuit breaker, drive enclosures, and storage server power switches are in the off position.
4. Turn on the circuit breakers in the rack cabinet, and turn on the power switches on all drive enclosures attached to the FASt900 Storage Server.

**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 attached 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.

5. Turn on both power switches on the back of the FASt900 Storage Server. For the location of the power switches, see Figure 23 on page 18.
6. Check the status of the FASt900 Storage Server and other devices. Make sure all fault indicator lights are off on the front and back of the FASt900 Storage Server. For more information, see "Checking the indicator lights" on page 20.
7. When all the devices are powered up, check the overall system status by using the storage-management software.

---

## Checking the battery service date

**Note:** Replace the battery whenever it fails to hold a charge or every three years. Operating the FASt900 Storage Server in a hot environment (above 35° C or 95° F) lowers the battery life expectancy.

To check the battery service date, perform the following steps:

1. Remove the FASt900 Storage Server bezel, as shown in Figure 21 on page 16.

2. Check the Battery Support Information label, as shown in Figure 32.

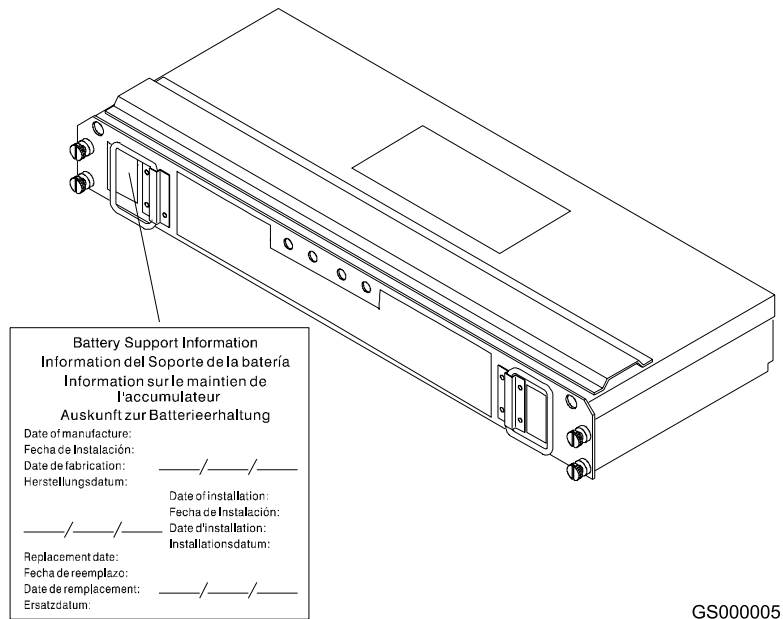


Figure 32. Checking the battery service date

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

- **Date of Manufacture** - Date the battery was built at the factory
  - **Date of Installation** - Date the battery was installed in the FAStT900 Storage Server
  - **Replacement Date** - Battery replacement date (see the note at the beginning of this section)
3. Perform one of the following tasks:
    - If it is time to replace the battery, install a new battery using the procedure described in “Replacing a failed battery” on page 41.
    - If it is not time to replace the battery, replace the FAStT900 Storage Server bezel, as shown in Figure 22 on page 17.

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## Preparing to move the FAStT900 Storage Server

Remove each component CRU before you move the FAStT900 Storage Server to a new location or before you remove the chassis from its rack cabinet. This precaution helps safeguard the equipment and ensures a smoother transition to the new environment.

If you are moving the FAStT900 Storage Server a short distance, and you have sufficient assistance or equipment, you might be able to move the FAStT900 Storage Server without removing each component CRU. If you do not have sufficient assistance or equipment, use the procedure in “Moving or relocating the FAStT900 Storage Server” on page 34 to safely move the equipment to its new location.

If you are moving the FAStT900 Storage Server a significant distance, be sure to pack it in its original shipping container.

## Moving or relocating the FASt900 Storage Server

Use the following procedure to remove all component CRUs before you move or relocate the FASt900 Storage Server.

1. Prepare the FASt900 Storage Server for shutdown. Refer to “Turning off the power” on page 18.
2. Label the host Fibre Channel and interface cables and disconnect them.

**Attention:** Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not bend the cables to a radius of less than 38 mm (1.5 in.).

3. Disconnect all remaining cables from the FASt900 Storage Server and label them so that you can correctly reconnect them later.

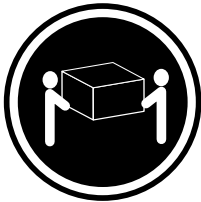
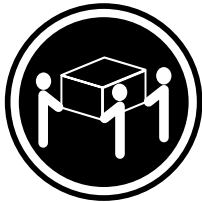
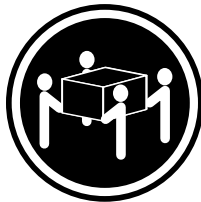
**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 37.

4. Remove all CRUs from the FASt900 Storage Server. For information about removing and replacing CRUs, see Chapter 3, “Replacing the FASt900 Storage Server components”, on page 37.
5. Remove the two screws from the inside rear of the FASt900 Storage Server; then, remove the two screws from the inside front of the FASt900 Storage Server. Save the screws for later. For detailed information, see the *Rack Mounting Instructions* that come with the storage server.

**Attention:** Do not remove the black hex head screws. These secure the rails that support your FASt900 Storage Server.

### Statement 4:



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

### CAUTION:

**Use safe practices when lifting.**

6. Slide the FASt900 Storage Server out of the rack cabinet and set it on a level, dry surface.
7. Perform one of the following tasks:
  - If you are shipping the FASt900 Storage Server to another location, replace all CRUs in the FASt900 Storage Server. Carefully pack the unit in its original shipping container. You are finished with this procedure.
  - If you are moving the FASt900 Storage Server to another rack cabinet, remove the support rails and power cords from the old rack cabinet and install them in the new one.

8. To install the FAStT900 Storage Server into a rack cabinet in the new location, perform the following steps:
  - a. Slide the FAStT900 Storage Server into the rack cabinet.
  - b. Insert and tighten two of the screws that you removed in Step 5 on the inside front of the FAStT900 Storage Server.
  - c. Insert and tighten the remaining two screws that you removed in Step 5 on the inside rear of the FAStT900 Storage Server.
9. Replace all CRUs in the FAStT900 Storage Server.
10. Connect the interface cables and host Fibre Channel cables that you labeled in Step 3 on page 34.
11. Connect the remaining cables to the FAStT900 Storage Server.
12. Turn on power to the FAStT900 Storage Server. Use the procedure in “Turning on the power” on page 17.
13. Replace the FAStT900 Storage Server bezel.



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## Chapter 3. Replacing the FASSt900 Storage Server components

The FASSt900 Storage Server contains two RAID controllers, a cooling system that contain four fans, mini hubs, SFP modules, and a power system. This chapter includes detailed instructions on how to replace these components.

---

### Handling static-sensitive devices

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

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

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

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### FASSt900 Storage Server controller

The FASSt900 Storage Server supports RAID technology. The FASSt900 Storage Server contains two RAID controllers.

Each controller comes in a removable, portable unit, called a controller CRU, as shown in Figure 34 on page 39. Each controller CRU slides into one of two controller slots on the front of the FASSt900 Storage Server and attaches to hosts through Fibre Channel connections. Two handles lock the controller in place. Each controller slot has a controller slot designation that identifies the physical location of the controller in the chassis: controller slot A (top) or controller slot B (bottom). Each controller CRU has ten indicator lights: one power, one fault, and eight status indicator lights, as shown in Figure 33 on page 38.

**Attention:** If you are removing both controllers (controller A and controller B) from the FAST900 Storage Server, label controllers A and B with the white tape dots that are included in the rack mounting, label assembly kit. To prevent data loss, the controllers must be installed into their original location.

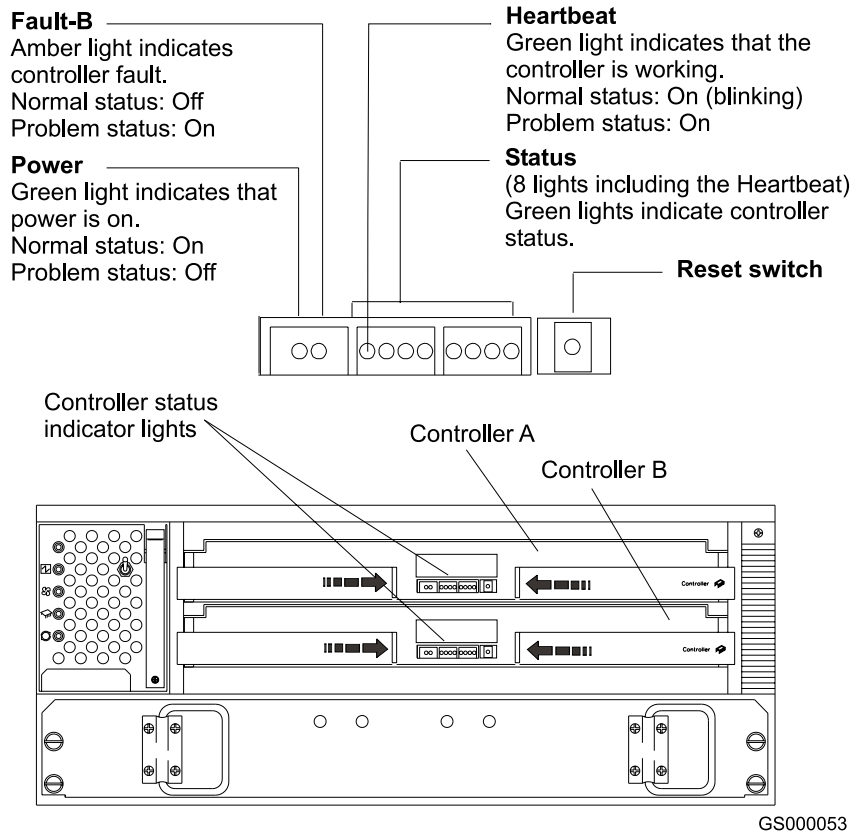


Figure 33. Controller status indicator lights

## Servicing notes

Consider the following factors when servicing the controllers in the FAST900 Storage Server:

- The FAST900 Storage Server supports two controller CRUs, which attach to hosts through Fibre Channel connections.
- You can hot swap or replace a failed controller while the FAST900 Storage Server is in operation as long as the host has a Fibre Channel connection to the functioning controller and is in a “passive” or “offline” status in the storage-management software.
- If cache mirroring is enabled in redundant controllers and one controller fails, the second controller assumes processing functions without data loss. However, some or all data might be lost if cache mirroring is disabled and a failure occurs before data is written from cache memory to disk.
- If you replace the controller CRU and still experience problems, the FAST900 Storage Server might have other defective components or connections. Check the storage-management software for indications of other component failures.
- When a controller CRU fails, the fault light on the affected controller is lit. For more information about indicator lights, see “RAID controller indicator lights” on page 22.



- The two controllers are automatically synchronized when you replace a failed controller. The storage-management software automatically synchronizes the firmware between the existing controller and the new controller.

## Replacing a failed controller

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

**Attention:** After replacing a controller, always use the storage-management software to verify the firmware levels.

1. Remove the FASiT900 Storage Server bezel, as shown in Figure 21 on page 16.

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

- Has a fault indicator light that is lit
  - Is marked as “Failed” (offline) through the storage-management software
2. Using Figure 34 as a guide, remove the controller that has failed.
    - a. Using your thumbs, squeeze the two center tabs and pull both controller handles outward with your fingers.
    - b. Using both handles, pull out on the controller to remove it.

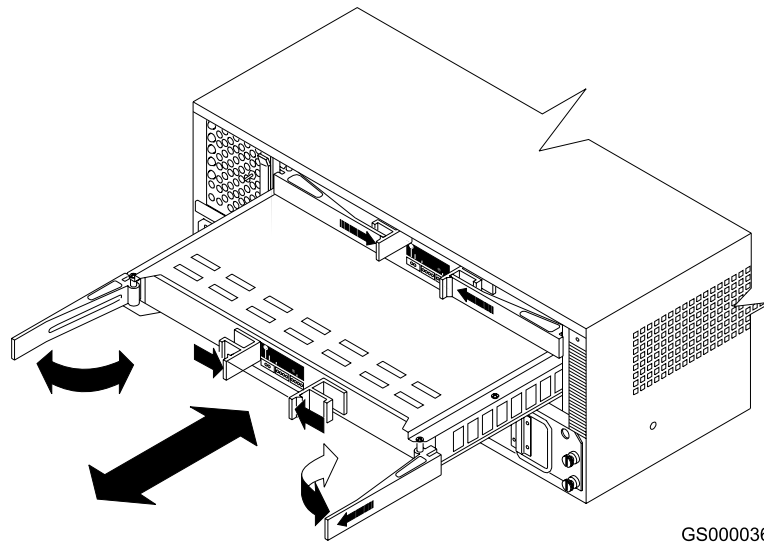


Figure 34. Removing and replacing a failed controller CRU

**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 37.

3. Unpack the new controller. Using the proper handling precautions, remove the new controller from the packing material.

Check the shipping invoice and the controller to make sure that it has the same memory size as the controller that you just removed.

4. Using Figure 34 as a guide, install the new controller as follows:
  - a. Using your thumbs, squeeze the two center tabs and pull both controller handles outward with your fingers.

- b. Using the handles, slide the controller into the slot until the back edge of both handles hooks onto the frame.
  - c. Close both handles and snap into place.
5. Using Figure 35 as a guide, check the controller indicator lights.

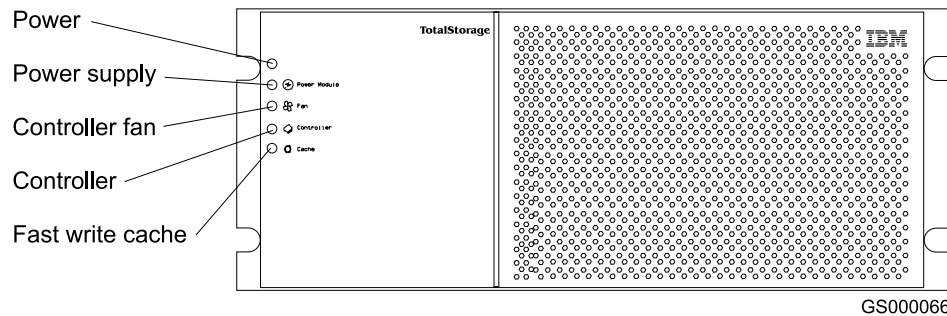


Figure 35. Indicator lights on the FAST900 Storage Server bezel

- If the green power indicator light is on and the amber fault indicator light is off, go to Step 8.
  - If the green power indicator light remains off or the fault indicator light is on after a few seconds, make sure that the controller CRU is locked into place. If the fault indicator light remains on, go to Step 6.
6. Use the storage-management software to check the status of both controllers. If applicable, perform the recovery procedures required by the software. If this corrects the fault and the FAST900 Storage Server is operating without error, go to Step 8. If not, go to Step 7.
  7. Reinsert the controller CRU. Then, if there are no error messages or controller faults, go to Step 8. If there is still a problem, call for service.
  8. Replace the FAST900 Storage Server bezel, as shown in Figure 22 on page 17.

## Battery

The battery CRU contains rechargeable batteries and a battery-charger board. The battery CRU plugs into the front of the FAST900 Storage Server (see Figure 36 on page 42) where it provides backup power to the cache memory in both controllers. During a power outage, a properly charged battery CRU maintains electrical current to the controllers for up to five days with 1 Gb cache memory installed. All data stored in memory is preserved as long as the batteries can sustain power to the cache memory. However, the battery does not provide power to the rest of the system during a power outage. Therefore, the system is not able to write data to hard disk drives without a backup power source.

## Servicing notes

Consider the following factors when you service the battery in the FAST900 Storage Server:

- The battery has a three-year life expectancy. Replace the battery every three years or whenever it fails to hold a charge. Operating the FAST900 Storage Server in an unsupported environment (above 35° C or 95° F) lowers the life expectancy of the battery.
- The service label on the battery provides a blank line for recording the date on which the battery was last serviced (see Figure 37 on page 43). Check this label

to determine when to replace the battery. For information about using the software to track battery age, refer to the IBM FASTT Storage Manager online help.

- When a battery fails, the fault light on the battery is lit. For more information about indicator lights, see “Battery indicator lights” on page 24.
- If you replace the battery and still experience battery problems (for example, loss of battery power to the controllers or batteries not charging properly), the FASTT900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

## Replacing a failed battery

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

**Attention:** Because the battery CRU is a sealed unit, you must replace the entire CRU (not just the batteries) in order to keep the battery backup system in working order. Opening the battery CRU voids your warranty.

1. Use the storage-management software to disable caching. Caching is disabled when the Fast write cache indicator light is off. Data in cache is unprotected if a power outage occurs while the battery CRU is out of operation.

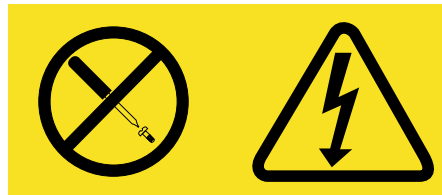
**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 37.

**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.**

2. Remove the FASTT900 Storage Server bezel, as shown in Figure 21 on page 16.

**Attention:** Be careful when you remove the battery. The battery weighs approximately 6.4 kg (14 lb).

3. Using Figure 36 on page 42 as a guide, remove the battery.
  - a. Loosen the four captive screws on the battery. If necessary, use a flat blade screwdriver to loosen the screws.
  - b. Using both pull handles, slide out the battery about 5 cm (2 in.).
  - c. Using both hands, grasp the sides of the battery and pull out.

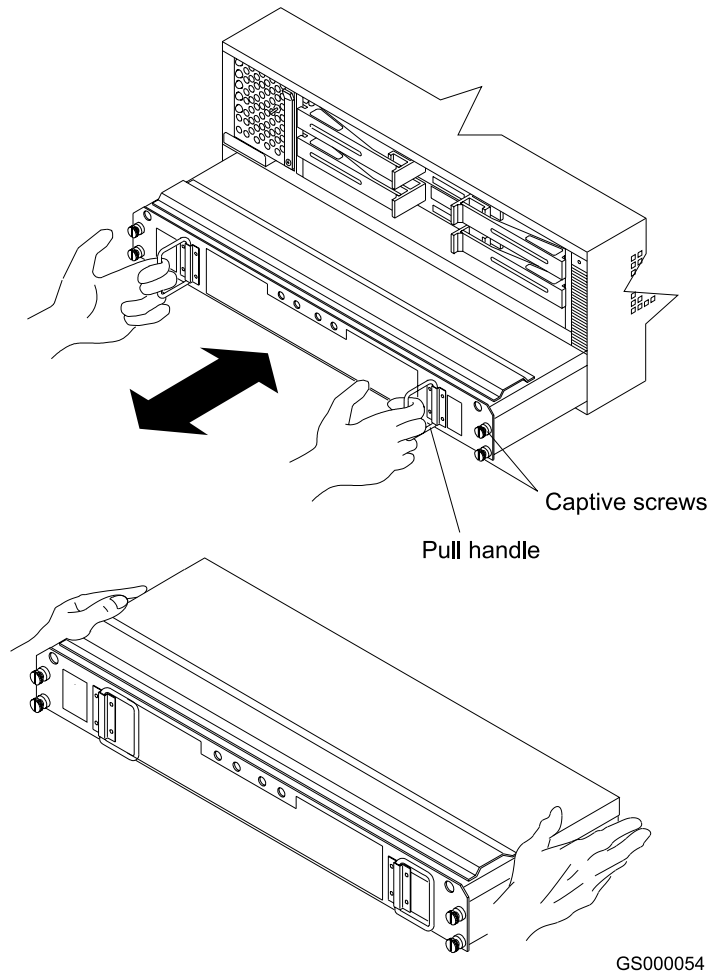
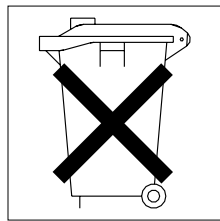


Figure 36. Removing and installing a battery

4. This product contains a sealed lead acid battery. The battery must be recycled or disposed of properly.



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Recycling facilities might not be available in all areas.

In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used IBM sealed lead acid batteries. For information on proper disposal of these batteries, please contact your IBM representative.

For information on disposal of sealed lead acid batteries outside the United States, contact your local waste disposal facility.

5. Prepare the new battery. Unpack the battery CRU. Save the packing material for shipping the used battery CRU to a disposal facility.
6. Find the “Battery Support Information” label on the front of the new battery CRU, as shown in Figure 37.

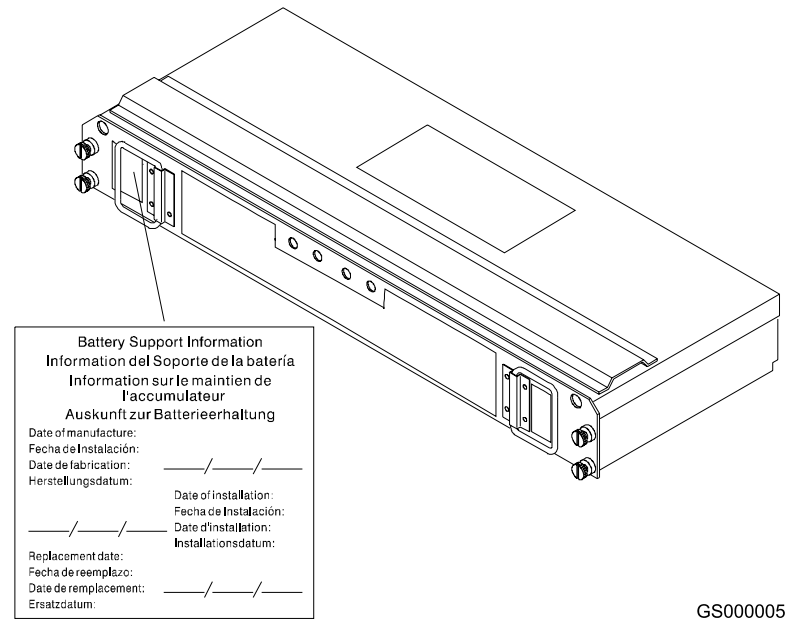


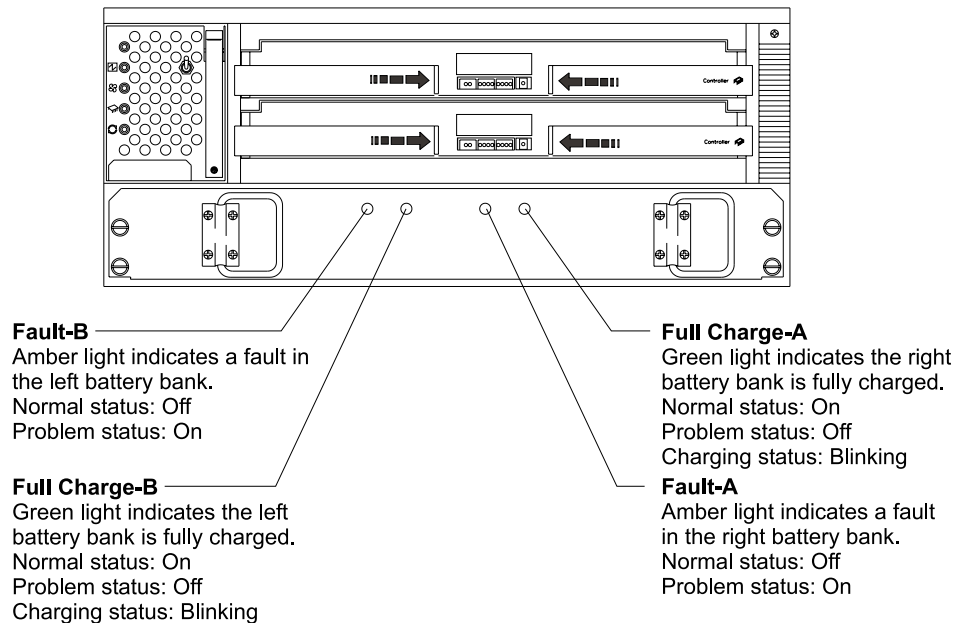
Figure 37. Recording the battery support information

Fill in the following information:

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

7. Install the new battery.
  - a. Using both hands, slide the battery about 5 cm (2 in.) into the slot.
  - b. Using the pull handles, slowly push the battery completely into the slot.
  - c. Tighten the four captive screws.
8. Replace the FASt900 Storage Server bezel, as shown in Figure 22 on page 17.
9. Run the system for at least 24 hours to properly charge the batteries. The battery might take up to 15 minutes to complete its self-test and up to 24 hours to fully charge, especially after a power loss of more than a few minutes. When properly charged, both full-charge indicator lights on the front of the battery are lit.

10. Check the battery indicator lights, as shown in Figure 38.



GS000050

Figure 38. Battery CRU indicator lights

**Note:** If the Full Charge-A and the Full Charge-B indicator lights are blinking, the battery is in the process of charging.

11. After your battery has completed the self test, reset the battery installation date using the storage-management software. The software continues to issue battery-related errors if the installation date is not reset.

## Storage server fan

The storage server fan is a single, removable unit that contains two cooling fans and temperature monitoring circuitry. The storage server fan plugs directly into a slot on the front of the FASt900 Storage Server, to the left of the controllers (see Figure 40 on page 46). Five indicator lights provide overall system status information (see Figure 41 on page 47). The dual fans in the storage server fan unit provide a redundant cooling system to both controller CRUs. If one fan fails, the other continues to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire storage server fan.

To prevent cooling problems, the FASt900 Storage Server must have proper air circulation throughout the chassis. Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the FASt900 Storage Server to overheat. Make sure that the ambient air temperature around the FASt900 Storage Server is within the environmental requirements. To boost air circulation, the FASt900 Storage Server chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions (Refer to the *IBM FASt900 Fibre Channel Storage Server Installation Guide* for operating specifications).

Figure 39 on page 45 shows the FASt900 Storage Server air flow. Make sure your installation site allows adequate ventilation to the FASt900 Storage Server during operation.

**Note:** Allow at least 60 cm (2 ft) of clearance in front of and behind the FAStT900 Storage Server for proper ventilation.

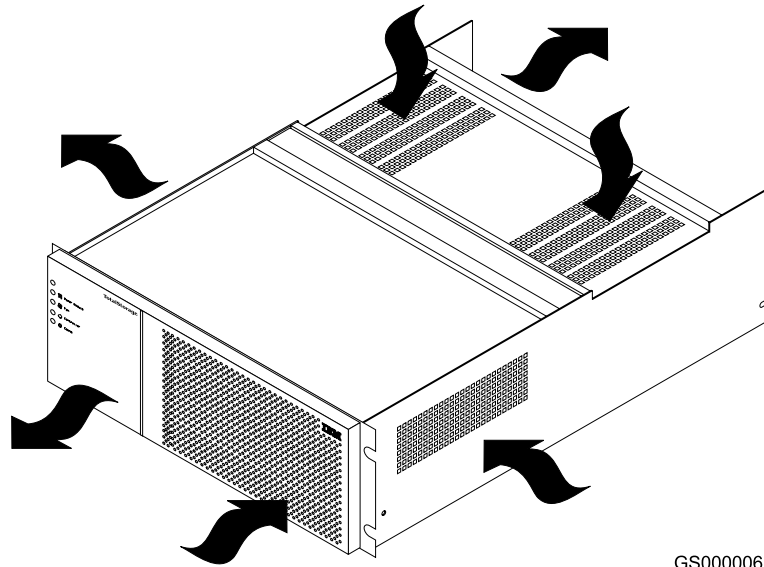


Figure 39. FAStT900 Storage Server airflow

## Servicing notes

Consider the following factors when you service the storage server fan:

- The storage server fan and the fan and communications module cooling system failing simultaneously in the storage server is unlikely. Such a failure will cause either one or both controllers to overheat. Under these circumstances, the amber controller light on the front panel might be lit. If this occurs, shut down the FAStT900 Storage Server immediately and let the unit cool to room temperature and then replace the storage server fan.
- You can hot swap, or replace, the storage server fan, as long as you complete the exchange within 15 minutes. The time limit applies to the total time that the fan is out of the chassis. The time begins when you remove the failed storage server fan and ends when you install the new one. This does not include the time it takes to perform the entire procedure (for example, checking the indicator lights).
- When a storage server fan fails, the fault light on the storage server fan is lit. For more information about indicator lights, see “Storage server indicator lights” on page 20.
- If you replace the storage server fan and still experience problems, the FAStT900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.
- The storage server fan indicator light is also used to indicate a fan and communications module failure. Be sure to check the storage server fan and fan and communications module before you call for service.

## Replacing a failed storage server fan

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

1. Remove the FAStT900 Storage Server bezel, as shown in Figure 21 on page 16.

**Attention:** To prevent damage to the FASt900 Storage Server components, do not operate the FASt900 Storage Server without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the storage server fan, you must shut down the FASt900 Storage Server to prevent it from overheating. The time limit applies to the total time that the fan is out of the chassis. For more information, see “Turning off the power” on page 18.

2. Remove the failed storage server fan, as shown in Figure 40.
  - a. Lift up the lever on the storage server fan.
  - b. Pull firmly on the bottom lip to remove the fan.

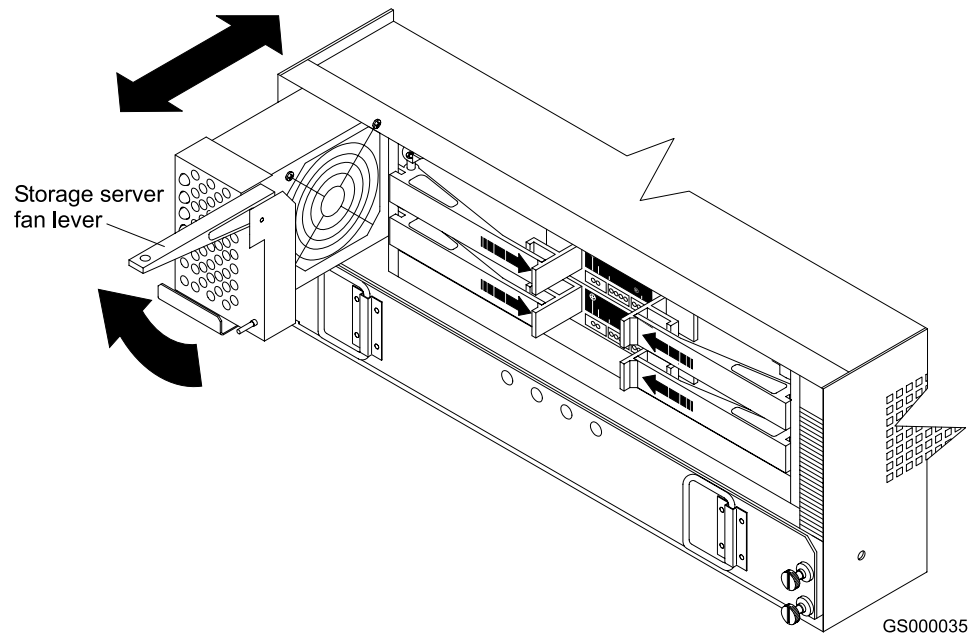


Figure 40. Removing and installing the storage server fan

**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 37.

3. Unpack the new storage server fan.
4. Install the new storage server fan.
  - a. Slide the new storage server fan all the way into the slot.
  - b. Press down on the lever and snap the lever into place.



- Using Figure 41 as a guide, check the storage server indicator lights on the fan.

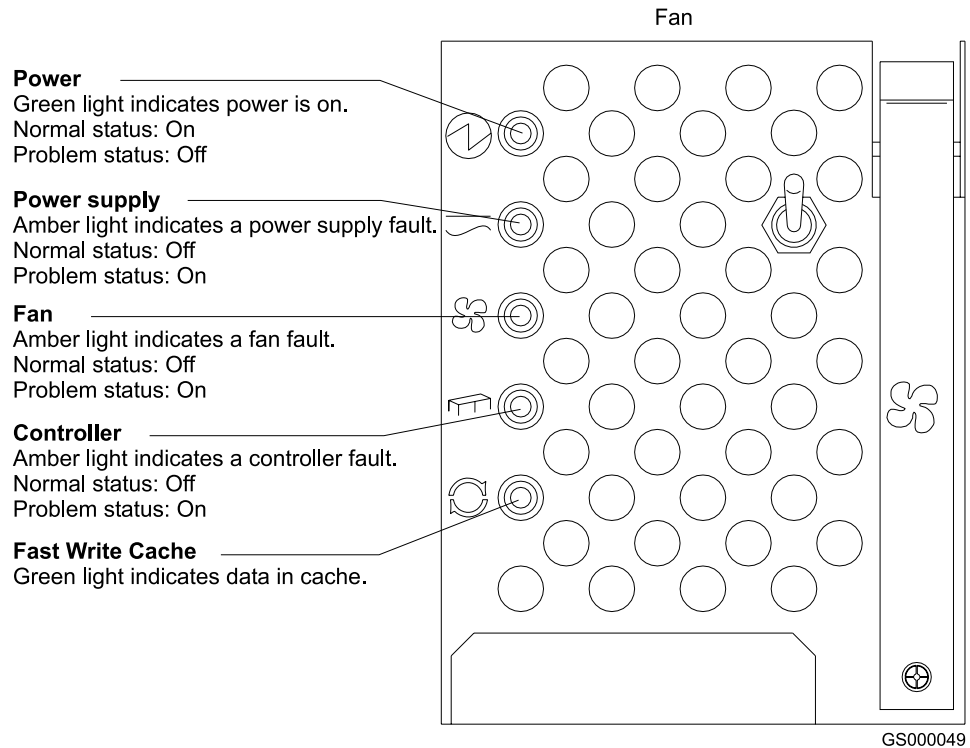


Figure 41. Storage server indicator lights

- When the storage server fan is operating properly, the green power indicator is lit and the amber fan indicator is off.
  - If the amber fan indicator is lit or the green power indicator remains off, make sure that the storage server fan is seated securely in the slot and that the lever is snapped into place. Check the storage server fan or the fan and communications module status.
  - If the storage server fan indicator remains on, it might indicate a problem with the new storage server fan or the fan and communications module (both components share the same indicator light). Replace the storage server fan with a spare, if available. Otherwise, turn off the FAStT900 Storage Server to prevent it from overheating until you can replace the fan.
- Replace the FAStT900 Storage Server bezel, as shown in Figure 22 on page 17.

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## Fan and communications module

The fan and communications module is a single, removable unit that contains two cooling fans and two Ethernet ports. This module plugs into a slot at the center back of the FAStT900 Storage Server, just above the power supplies (see Figure 43 on page 49). It has two captive screws and a rectangular handle for securing and removing the fan and communications module. The module contains dual fans that provide a redundant cooling system to both power supplies. If one fan within the module fails, the other continues to operate. A single fan provides sufficient air circulation to prevent the power supplies from overheating until you can replace the entire fan and communications module.

## Servicing notes

Consider the following factors when you service the fan and communications module:

- The fan and communications module contains two Ethernet connections used for direct network-management.
- You can hot swap the fan and communications module as long as you complete the exchange within 15 minutes from when you remove the failed unit until you install the new one.
- It is unlikely that the storage server fan and the fan and communications module cooling system will fail simultaneously. Such a failure will cause one or both power supplies to overheat. In these circumstances, the amber power supply indicator light on the bezel is lit and the overheated power supply automatically shuts down (the green power indicator light on the power supply turns off). Once the ambient air temperature cools below 70° C (158° F), the power supply automatically turns on. Replace the failed fan and communications module. Then check the power supply indicator lights (fault indicator light on the front and power indicator light on the back). If the power supply fault indicator light remains on, replace the power supply. For more information about indicator lights, see “Fan and communications module indicator light” on page 25 and Figure 28 on page 26.
- If you replace the fan and communications module and still experience problems, the FASt900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

## Replacing a failed fan and communications module

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

**Attention:** To prevent damage to the FASt900 Storage Server circuitry, do not operate the FASt900 Storage Server without adequate ventilation to the power supplies and mini hubs. If it will take longer than 15 minutes to replace the fan and communications module, you must shut down the FASt900 Storage Server to prevent it from overheating. The time limit applies only to the total time that the fan and communications module is out of the chassis. The time begins when you remove the failed module and ends when you install the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the indicator lights).

1. Disconnect all Ethernet interface cables from the failed fan and communications module. The locations of the ports are shown in the following figure.

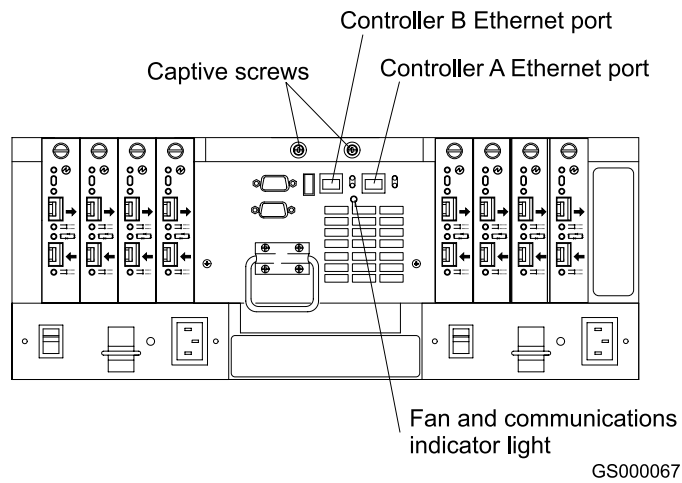


Figure 42. Fan and communications module ports and indicator light

2. Use Figure 43 as a guide and perform the following steps to remove the failed fan and communications module from the FAStT900 Storage Server.

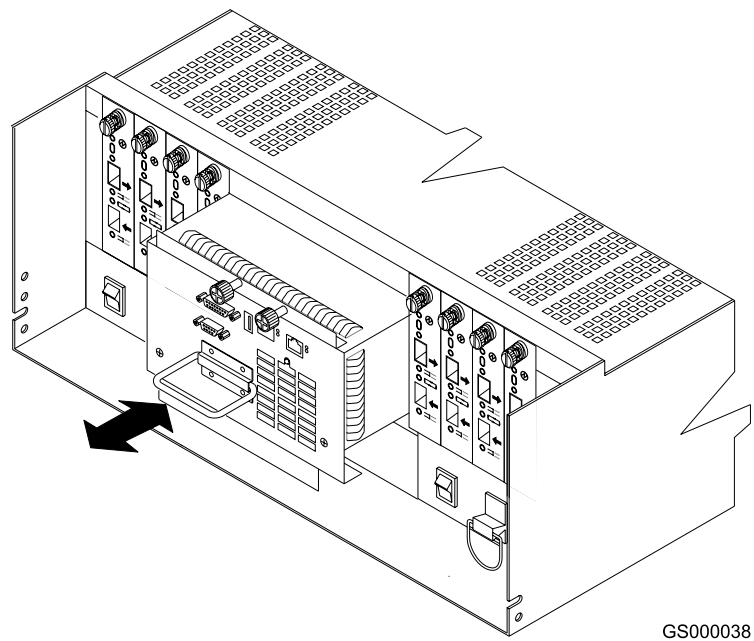


Figure 43. Removing and installing a fan and communications module

- a. Using a flat-blade screwdriver, loosen the two captive screws on the fan and communications module.
- b. Use the pull handle to slide the module out of the slot a few inches.
- c. Grasp the sides of the module with both hands and remove it from the FAStT900 Storage Server.

**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 37.

3. Unpack the new fan and communications module.
4. Install the new fan and communications module.
  - a. Push the new fan and communications module all the way into its chassis slot.
  - b. Use a flat-blade screwdriver to tighten the two captive screws on the new module, securing it into place.
5. Check the fan and communications indicator light. See Figure 42 on page 49 for the location of the fan and communications indicator light.
  - If the amber fault indicator light is on, make sure that the fan and communications module is inserted all the way into the chassis and secured in place.
  - If the fault indicator light remains on, one or both fans inside the fan and communications module might be malfunctioning. Replace the failed fan and communications module with a spare, if available. Otherwise, shut down the FASiT900 Storage Server until you can replace the failed fan and communications module with a new one.
6. Reconnect the interface cables that you disconnected in Step 1 on page 49 to the new fan and communications module.

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## Power supply

The FASiT900 Storage Server power system consists of two power supplies. The power supplies slide into either of the two slots on the back of the FASiT900 Storage Server. The power supplies provide power to the internal components by converting incoming ac voltage to dc voltage. The power supplies are interchangeable and redundant. Each power supply uses one power cord. You can plug both power cords into a common power source or plug each cord into a separate circuit for power redundancy. One power supply can maintain electrical power to the FASiT900 Storage Server if the other power supply is turned off or malfunctions.

## Servicing notes

Consider the following factors when you service the power supplies:

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

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

- You cycle the power switches (turn off the power switches, wait at least 30 seconds, then turn on the power switches). For more information, see “Overtemperature condition and power supply shutdown” on page 31.
  - The power supplies automatically resume operation when the ambient air temperature cools to below 70° C (158° F). When the power supplies automatically resume operation, the FASiT900 Storage Server also resumes operation.
- You can hot swap (replace) a power supply because the two power supplies provide redundancy.

- Both power supplies have built-in temperature sensors designed to prevent the power supplies from overheating. If a temperature sensor detects an ambient air temperature greater than 70° C (158° F), the “overheated” power supply automatically shuts down. The second power supply remains on as long as its temperature remains below 70° C (158° F). If the second power supply overheats, it turns off all power to the FAStT900 Storage Server.

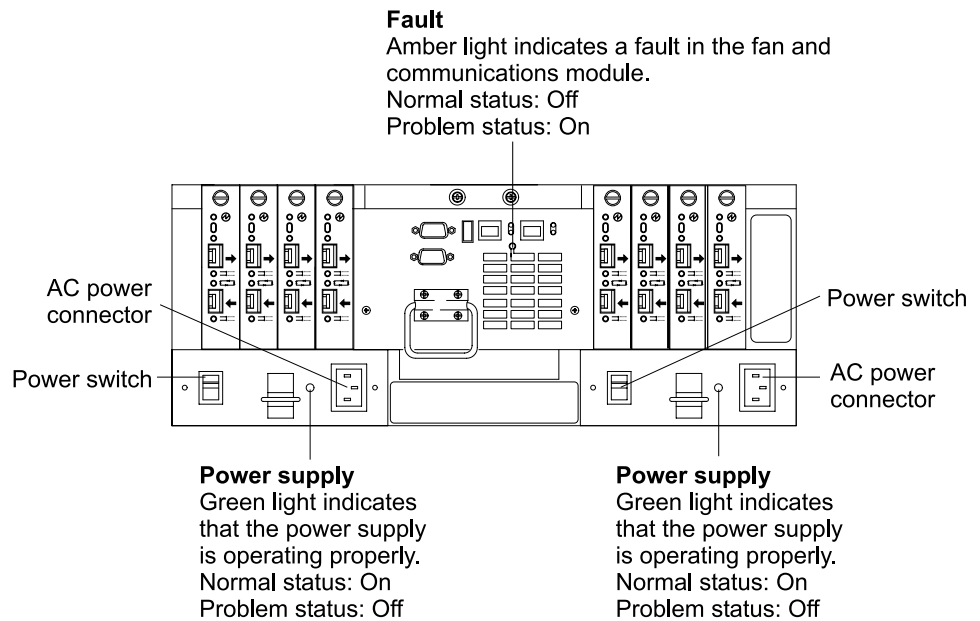
**Note:** There is a serious problem if the air temperature inside the rack cabinet is hot enough to cause the power supplies to shut down.

- The FAStT900 Storage Server is capable of power-up recovery without operator intervention. Once the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to restart the hard disk drives, which has no effect on the hard disk drives if they are already running, and returns the FAStT900 Storage Server to normal operation.
- When a power supply fails, the green power indicator light on the power supply goes off and the amber power supply fault light is lit on the front of the FAStT900 Storage Server. For more information, see “Power supply indicator light” on page 26 and “Storage server indicator lights” on page 20.
- If you replace the power supply CRU and still experience problems, the FAStT900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

## Replacing a failed power supply

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

1. Check the power supply indicator light on the back of the FAStT900 Storage Server, as shown in Figure 44. Be sure that the green power indicator light on the failed power supply is off.



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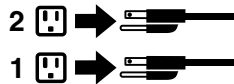
Figure 44. Power supply switch, ac power connectors, and indicator lights

**Statement 5:**



**CAUTION:**

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



2. Turn off the power switch and unplug the power cord from the failed power supply (see Figure 44 on page 51).

**Statement 8:**



**CAUTION:**

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



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

3. Using Figure 45 on page 53 as a guide, remove the failed power supply. Lift up and pull out on the pull handle to release the power supply. Then slide the unit out.

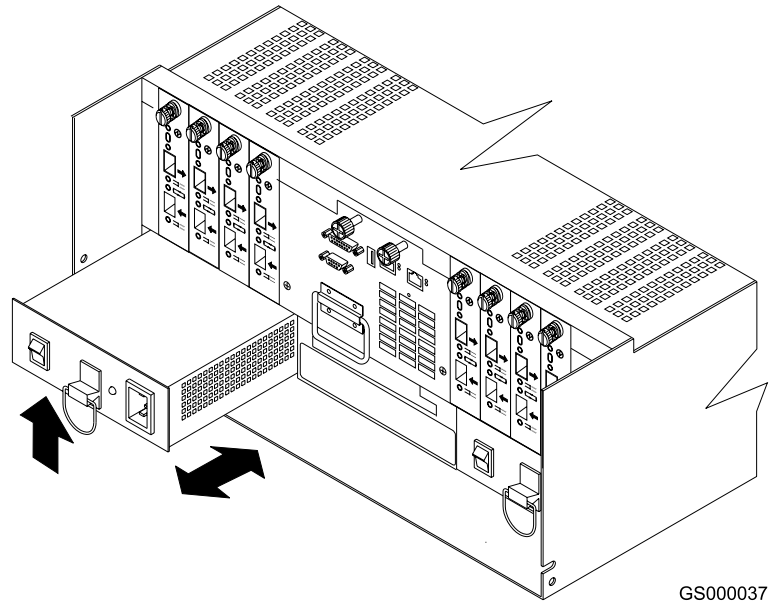


Figure 45. Removing and installing a power supply CRU

**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 37.

4. Unpack the new power supply.
5. Install the new power supply, as shown in Figure 45. Using the pull handle, push the power supply into the slot until it locks into place.
6. Plug in the power cord and turn on the power supply switch.
7. Check the new power supply and other FAST900 Storage Server indicator lights for faults. For more information, see “Checking the indicator lights” on page 20.

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## Small Form-Factor Pluggable (SFP) modules

Small Form-Factor Pluggable (SFP) modules are used to connect mini-hub ports to attached nodes. An SFP module slides into a mini-hub port on the back of the FAST900 Storage Server and then a host or drive-interface cable connects into the SFP module. For more information, see “Fibre Channel connections” on page 3 and “Mini hubs” on page 57.

## Servicing notes

Consider the following factors when you service SFP modules:

- The SFP module housing has an integral guide key designed to prevent you from inserting the SFP module improperly.
- Use minimal pressure when you insert 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 storage server is powered on.
- The operational loop performance is not affected when you install or remove an SFP module.

- You must insert the SFP module into a mini-hub port *before* you connect the fiber-optic cable.
- You must remove the fiber-optic cable from the SFP module before you remove the SFP module from the mini hub.
- Four indicator lights on a mini hub provide status information. If an SFP module fails, the corresponding SFP port bypass indicator will be lit on the mini hub. For more information, see “Mini-hub indicator lights” on page 26.
- If you replace the SFP module and still experience problems, the FAST900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

## Replacing a failed SFP module

When instructed by the storage-management software, complete the following steps to replace an SFP module from the mini hub.

### Statement 3:



### CAUTION:

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

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

**Attention:** To 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 that has failed. For more information, see “Handling fiber-optic cables” on page 4 and “Removing an LC-LC Fibre Channel cable from an SFP module” on page 7.



2. Replace the protective caps on the LC-LC Fibre Channel cables.

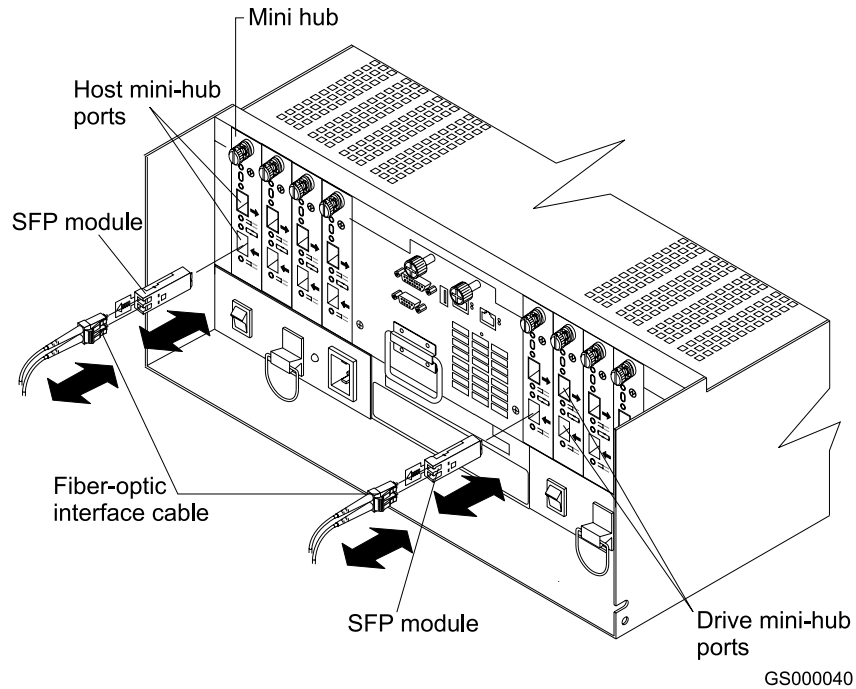


Figure 46. Replacing a failed SFP module

3. To remove the SFP module from the mini hub, perform the following steps:
  - a. Unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 47. Pull the failed SFP module from the mini hub.
  - b. With the SFP latch in the unlocked position, slide the SFP module out of the mini-hub port.

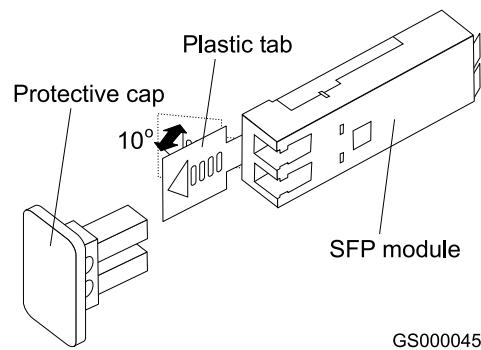
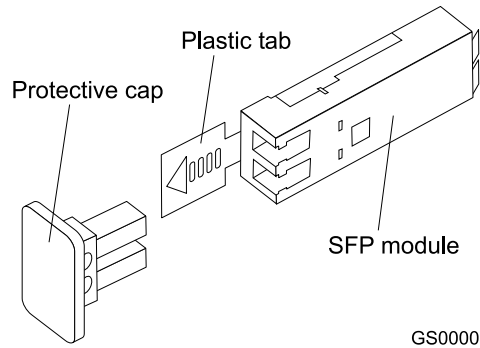


Figure 47. Unlocking the SFP module latch

- c. Replace the protective cap on the SFP module.

**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 37.

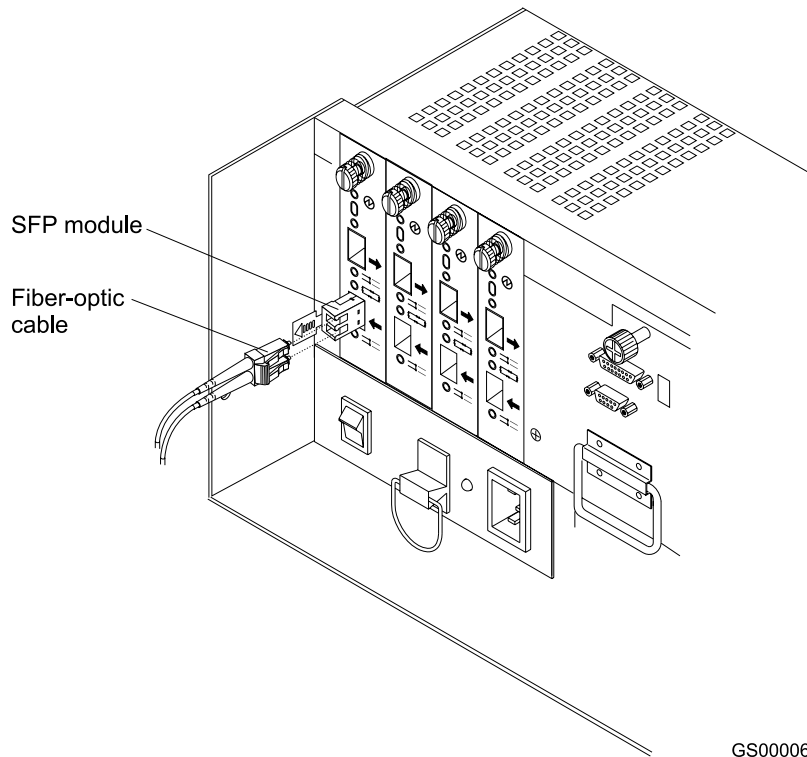
4. Unpack the new SFP module.
5. Remove the protective cap from the SFP module, as shown in Figure 48 on page 56.



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Figure 48. Small Form-Factor Pluggable (SFP) Module

6. Insert the SFP module into the mini-hub port until it clicks into place.



GS000069

Figure 49. Installing an SFP module in a mini hub

7. Reconnect the fiber-optic cables that you removed in Step 1 on page 54.
8. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is lit and the fault light is not lit. If the mini-hub port is in normal operation, the amber port bypass light is not lit. If a problem is indicated, use the storage-management software to check the FAST900 Storage Server status. For more information, see "Mini-hub indicator lights" on page 26.

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## Mini hubs

The mini hubs are located on the back of the FASt900 Storage Server (see Figure 51 on page 59). A mini hub is a single, removable unit that provides the Fibre Channel interface between a FASt900 Storage Server and hosts or drives. The back of the FASt900 Storage Server can accommodate eight mini hubs: up to four host-side and up to four drive-side mini hubs. Each mini hub has two ports. An SFP module is installed in a mini-hub port; then, a fiber-optic interface cable is connected into the SFP module. For more information, see “Fibre Channel connections” on page 3 and “Small Form-Factor Pluggable (SFP) modules” on page 53.

## Servicing notes

Consider the following factors when you service mini hubs:

- You can hot swap (replace) a failed mini hub while the FASt900 Storage Server is in operation.
- Four indicator lights provide status information. If a mini hub fails, the interface fault and the bypass indicator lights on the mini hub are lit and the loop good indicator light is off. For more information about indicator lights, see “Mini-hub indicator lights” on page 26.
- If you replace the mini hub and the SFP modules in them and still experience problems, the FASt900 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

For more information, see “Fibre Channel connections” on page 3 and “Types of interface ports” on page 11.

## Replacing a failed mini hub

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

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

**Note:** You *must* remove the fiber-optic cable from the SFP module before you can remove the SFP module from the mini-hub port.

1. On the mini hub that has failed, remove the fiber-optic cables from the SFP modules, as shown in Figure 50 on page 58.

For proper handling of fiber-optic cables, see “Handling fiber-optic cables” on page 4.

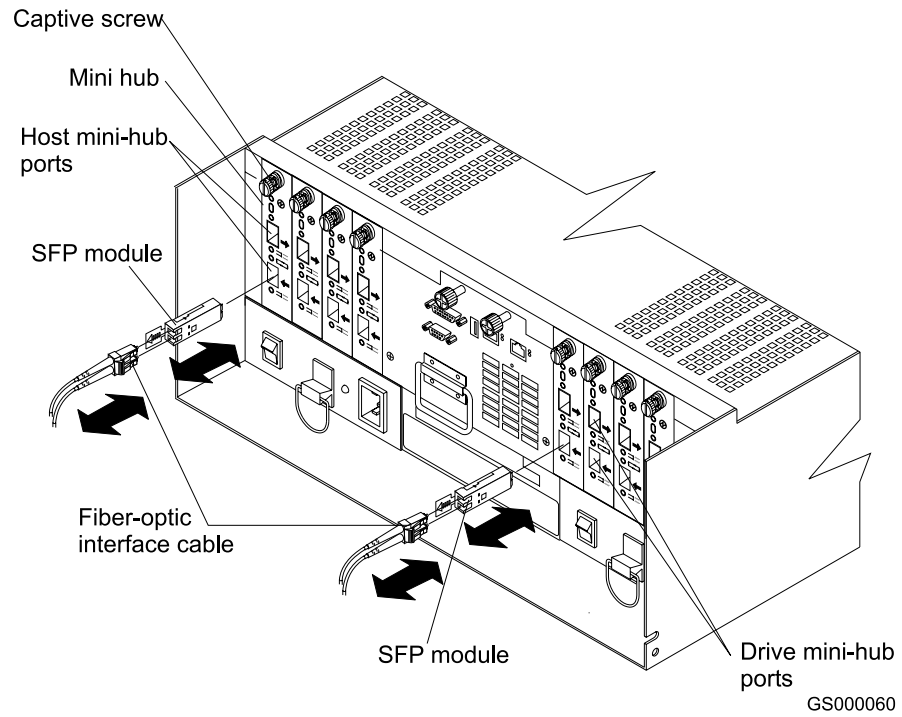
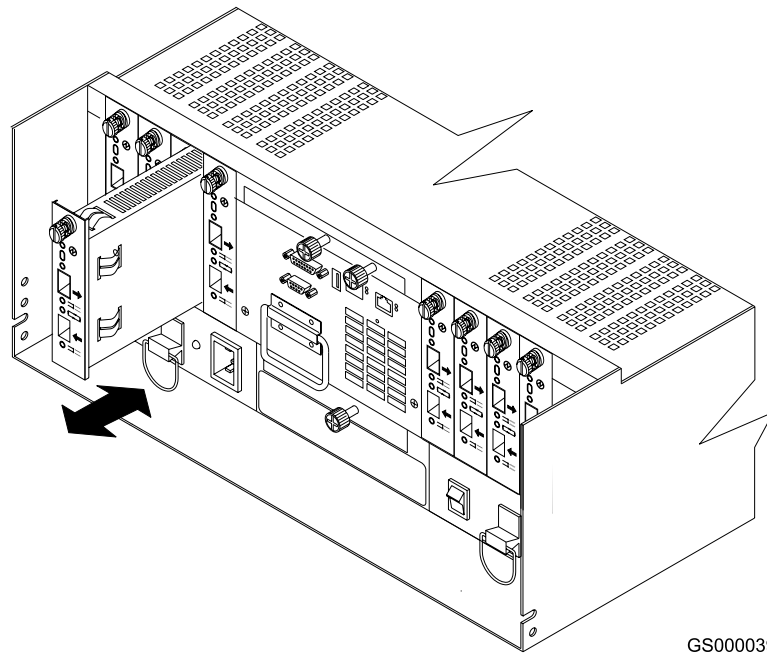


Figure 50. Removing the fiber-optic cable from the SFP module

2. Replace the protective caps on the cables.
3. Remove the SFP modules from the mini hub as follows:
  - a. Unlock the SFP module latch by pulling the plastic tab outward 10° and slide the SFP module out of the mini-hub port.
  - b. Replace the protective cap on the SFP module.
  - c. Place the SFP modules into their static-protective packages.

4. Loosen the captive screw on the mini hub. Then grasp the screw and remove the mini hub from the chassis, as shown in Figure 51.



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Figure 51. Removing and installing a mini hub

**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 37.

5. Unpack the new mini hub and slide it into the appropriate slot. Then tighten the captive screw.
6. Install the SFP modules that you removed in Step 3a on page 55 as follows:
  - a. Remove the SFP modules from their static-protective packages.
  - b. Remove the protective caps from the SFP modules.
  - c. Slide the SFP modules into the mini-hub ports.
7. Replace the fiber-optic cables that you removed in Step 1 on page 57.
8. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is lit and the fault light is off. If the mini-hub port is active, the amber port bypass light is not lit. For more information see “Mini-hub indicator lights” on page 26. If a problem is indicated, use the storage-management software to check the FASt900 Storage Server status.



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## Appendix. 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 computer, and whom to call for service should it be necessary.

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### Getting information

Information about your IBM server product and preinstalled software, if any, is available in the documentation that comes with your server. That documentation includes printed books, online books, README files, and help files. In addition, information about IBM products is available on the World Wide Web and through the IBM Automated Fax System.

### Using the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM products and support. The address for the IBM Personal Computing home page is <http://www.ibm.com/pc/>.

You can find support information for your IBM products at <http://www.ibm.com/pc/support/>.

If you click **Profile** from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products.

You also can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi>.

### Getting information by fax

If you have a touch-tone telephone and access to a fax machine, in the U.S. and Canada, you can receive, by fax, marketing and technical information on many topics, including hardware, operating systems, and local area networks (LANs).

You can call the IBM Automated Fax System 24 hours a day, 7 days a week. Follow the recorded instructions, and the requested information will be sent to your fax machine. In the U.S. and Canada, to access the IBM Automated Fax System, call 1-800-426-3395.

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### Getting help and service

If you have a problem with your server product, you will find a wide variety of sources available to help you.

### Using the documentation and diagnostic programs

Many problems can be solved without outside assistance. If you experience a problem with your server product, the first place to start is the troubleshooting

information in your IBM documentation. If you suspect a software problem, see the documentation, including README files and online help, that comes with the operating system or application program.

Most IBM server products come with a set of diagnostic programs that you can use to help you identify hardware problems. See the troubleshooting information in your IBM documentation for instructions on 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. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support/> and follow the instructions.

## Calling for service

If you have tried to correct the problem yourself and still need help, during the warranty period, you can get help and information by telephone through the IBM HelpCenter<sup>®</sup>. The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make selected Engineering Changes (ECs) available that apply to your hardware.

The following items are not covered:

- Replacement or use of non-IBM parts or nonwarranted IBM parts. All warranted parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Configuration of BIOS as part of an installation or upgrade.
- Changes, modifications, or upgrades to device drivers.
- Installation and maintenance of network operating systems (NOS).
- Installation and maintenance of application programs.

Refer to your IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

In the U.S. and Canada, these services are available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9:00 a.m. to 6:00 p.m.

**Note:** Response times vary and may exclude some holidays.

In addition, you are eligible for IBM Start Up Support for 90 days after installation. This service provides assistance for:

- Setting up your network operating system
- Installing and configuring interface adapters
- Installing and configuring network adapters

Please have the following information ready when you call:

- Machine type and model



- Serial numbers of your IBM hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

## Telephone numbers

Phone numbers are subject to change without notice. For the most up-to-date phone numbers, go to <http://www.ibm.com/pc/support/> and click **Support Phone List**.

Country		Telephone number
Austria	Österreich	01-24 592 5901
Belgium - Dutch	Belgie	02-210 9820
Belgium - French	Belgique	02-210 9800
Canada	Toronto only	416-383-3344
Canada	Canada - all other	1-800-565-3344
Denmark	Danmark	45 20 82 00
Finland	Suomi	09-22 931 840
France	France	02 38 55 74 50
Germany	Deutschland	07032-1549 201
Ireland	Ireland	01-815 9202
Italy	Italia	02-7031 6101
Luxembourg	Luxembourg	298-977 5063
Netherlands	Nederland	020-514 5770
Norway	Norge	23 05 32 40
Portugal	Portugal	21-791 51 47
Spain	España	91-662 49 16
Sweden	Sverige	08-477 4420
Switzerland	Schweiz/Suisse/Svizzera	058-333 0900
United Kingdom	United Kingdom	01475-555 055
U.S.A. and Puerto Rico	U.S.A. and Puerto Rico	1-800-772-2227

In all other countries or regions, contact your IBM reseller or IBM marketing representative.

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## International warranty Service

If you travel with your server product or relocate it to a country where your server machine type is sold and serviced by IBM or by IBM resellers who are authorized to perform warranty service, International Warranty Service is available for your server product.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your server product is eligible for International Warranty Service and to view a list of the countries where service is available, go to <http://www.ibm.com/pc/support/>, and click **Warranty Lookup**. Eligible IBM server products are identified by their four-digit machine types. For more information about International Warranty Service, see Service Announcement 601-034 at <http://www.ibm.com/>. Click **Support & downloads**, click **Announcement letters**, and click **Announcements search**. In the **Search by letter number only** field, type 601-034, and click **Search**.

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## Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

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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.

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

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

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### Federal Communications Commission (FCC) statement

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

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

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

### Industry Canada Class A emission compliance statement

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

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

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

### Australia and New Zealand Class A statement

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

## United Kingdom telecommunications safety requirement

### Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

## European Union EMC Directive conformance statement

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

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The Limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

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GS000016

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GS000008

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## Power cords

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

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

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

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

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

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

<b>IBM power cord part number</b>	<b>Used in these countries and regions</b>
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, China (Macau S.A.R.), Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dubai, Fiji, Ghana, 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 FAStT. This glossary also provides definitions for the terminology used for the IBM TotalStorage FAStT 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.

This glossary includes terms for the IBM FAStT Storage Manager Version 8.30 for Microsoft Windows NT and Windows 2000 environments. A glossary also exists in the Help section of the Storage Manager Enterprise Management window and the Storage Subsystem Management window.

This glossary also includes terms and definitions from: *IBM Glossary of Computing Terms*, available online at the following Web site:

[www.ibm.com/ibm/terminology/](http://www.ibm.com/ibm/terminology/)

The following cross-reference convention is used in this glossary:

**See** Refers you to (a) a term that is the expanded form of an abbreviation or an 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 kps 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*.

**MAC..** See *medium access control*.

**medium access control (MAC)..** In LANs, the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

**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 0 (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.

**RDAC.** See *redundant disk array controller*.

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

**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.

**redundant disk array controller (RDAC).** (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

**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*.

**scope.** Defines a group of controllers by their IP addresses. You must create and configure a scope so that dynamic IP addresses can be assigned to controllers on your 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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Fibre Channel Storage Server  
User's Guide

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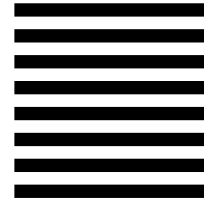
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