

IBM TotalStorage SAN Switch



2005 Model H08 and Model H16 Installation, Service, and User's Guide

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IBM TotalStorage SAN Switch



2005 Model H08 and Model H16 Installation, Service, and User's Guide

Note:

Before using this information and the product it supports, read the information in “Notices” on page 45.

First Edition (May 2004)

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Safety and environmental notices

This section contains information about:

- “Safety notices and labels”
- “Safety inspections” on page xiv
- “Laser safety” on page xviii
- “Rack Safety” on page xix
- “Environmental notices and statements” on page xxi

Safety notices and labels

When using this product, observe the danger, caution, and attention notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition. The danger and caution notices are listed in numerical order based on their IDs, which are displayed in parentheses, for example (D004), at the end of each notice. Use this ID to locate the translation of these danger and caution notices in the *IBM® eServer™ Safety Notices* (G229–9054) publication, which is on the CD-ROM that accompanies this product. See the following examples of danger and caution notices for the location of the ID number.

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

Danger notices

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



DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

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



DANGER

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

To avoid a shock hazard:

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

To Disconnect:

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

To Connect:

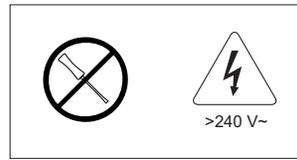
1. Turn everything OFF (unless instructed otherwise).
2. Attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlet.
5. Turn device ON.

(D005)

Labels

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

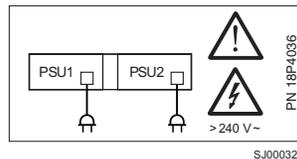
The actual product safety labels may differ from these sample safety labels:



DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. (L001)

Do not service, there are no serviceable parts.



DANGER

Multiple power cords (L003)

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

Caution notices

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

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

Sample caution notices:



CAUTION:

This product is equipped with a 3-wire (two conductors and ground) power cable and plug. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C018)



CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

Attention notices

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



Attention: Do not use screws longer than 3/16 in.; you can damage the switch.

Safety inspections

Perform the following safety checks to identify unsafe conditions. Be cautious of potential safety hazards that are not covered in the safety checks. If unsafe conditions are present, determine how serious the hazards are and whether you should continue before you correct the problem.

Removing ac power

Perform the following steps to remove the alternating current (ac) power:

1. Perform a controlled system shutdown.
2. Set the power switch on the Model H08 or the Model H16 to the off position.
3. Disconnect the power cable from the power source.



DANGER

Multiple power cords. (L003)

External machine checks

Perform the following external machine checks:

1. Verify that all external covers are present and are not damaged.
2. Ensure that all latches and hinges are in correct operating condition.
3. If the Model H08 or the Model H16 is not installed in a rack cabinet, check for loose or broken feet.
4. Check the power cable for damage.
5. Check the external signal cable for damage.
6. Check the cover for sharp edges, damage, or alterations that expose the internal parts of the device.
7. Correct any problems that you find.

Internal machine checks

Perform the following internal machine checks:

1. Check for any non-IBM changes that might have been made to the machine. If any are present, obtain the “Non-IBM Alteration Attachment Survey” form, number R009, from the IBM branch office. Complete the form and return it to the branch office.
2. Check the condition of the inside of the machine for any metal or other contaminants, or any indications of water, other fluid, fire, or smoke damage.
3. Check for any obvious mechanical problems, such as loose components.
4. Check any exposed cables and connectors for wear, cracks, or pinching.

Safety label checks

Perform the following safety label checks:

Note: The illustrations in this section show the Model H16 labels; the Model H08 labels will be very similar. The H16 has sixteen ports and dual power supplies, while the H08 has eight ports and a single power supply. With the exception of dual power sources for the H16, all other safety considerations apply to both models.

1. Verify that the safety certification label shown in Figure 1 is installed on the Model H08 or Model H16. The place of manufacture or assembly may vary from the example shown, and the label will indicate the model number of the switch.

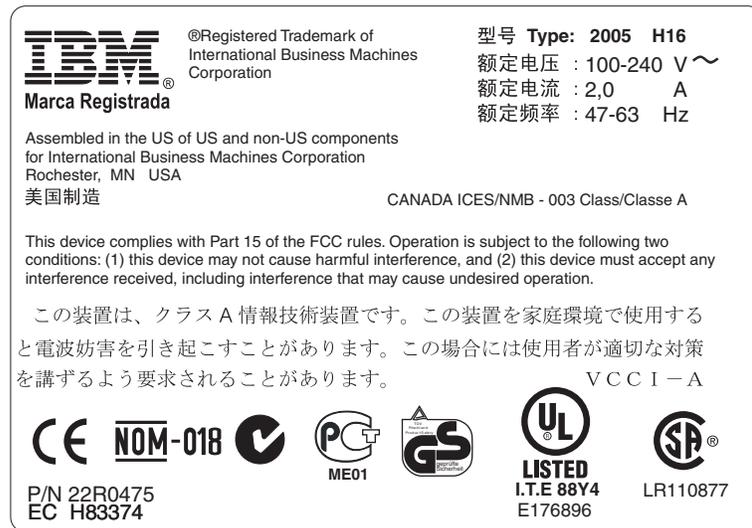
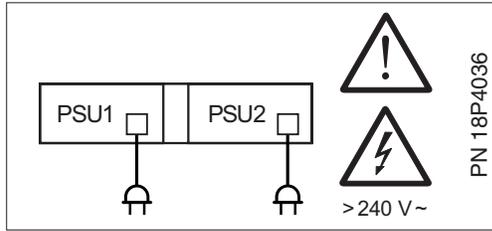


Figure 1. Safety certification label on the Model H16

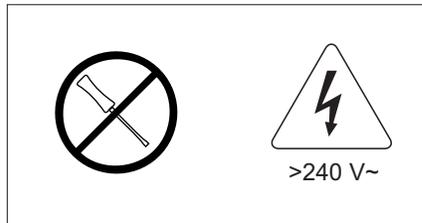
2. Verify that the linecord safety label shown in Figure 2 on page xvi is installed on the power supply of the Model H08 or the Model H16.



SJ000325

Figure 2. Dual linecord caution label

3. Verify that the power supply cover caution label shown in Figure 3 is installed on the power supply of the switch.



SJ000323

Figure 3. Power supply cover caution label

4. Verify that the SFP labels shown in Figure 4 and Figure 5 on page xvii are installed on the SFP transceiver of the Model H08 and the Model H16.

Note: The following SFP illustrations may differ from the SFPs included or installed with your particular switch, depending upon the SFP manufacturer. The labels shown below may vary by manufacturer.



SJ000317

Figure 4. SFP label (front view)

Laser safety

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



Class I

CAUTION:

This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

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

Usage restrictions

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

Rack Safety

Rack Installation



DANGER

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

CAUTION:

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

(R001)

Rack Relocation (19" Rack)

CAUTION:

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

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

(R002)

Environmental notices and statements

This section describes the environmental notices and statements.

Battery notice



CAUTION:

Only trained service personnel may replace this battery. The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not:

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

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

Fire suppression systems

A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, or a local building inspector, or both, should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire suppression systems.

Product recycling

This unit contains recyclable materials. These materials should be recycled where processing sites are available and according to local regulations. In some areas, IBM provides a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

Product disposal

This unit might contain batteries. Remove and discard these batteries, or recycle them, according to local regulations.

About this document

This document describes how to install, service, and use the IBM TotalStorage[®]™ SAN Switch 2005 Model H08 and Model H16. Throughout this document, the products are referred to as the Model H08 and the Model H16, or simply the H08 and H16. The term *switch* is also used for both the H08 and H16, when appropriate.

The sections that follow provide information about:

- “Who should read this document”
- “Model H08 and Model H16 library”
- “Related documents”
- “Web sites” on page xxiv
- “Getting help” on page xxiv
- “How to send your comments” on page xxv

Who should read this document

This document is intended for clients who are responsible for installing, servicing, and using the Model H08 and the Model H16 switches.

Model H08 and Model H16 library

The following documents contain information related to this product:

- *IBM TotalStorage SAN Switch 2005 Model H08 and Model H16 Installation, Service, and User's Guide*, GC26-7629 (this document)
- *IBM eServer Safety Notices*, G229–9054
- *IBM TotalStorage SAN Switch Statement of Limited Warranty*, GC26–7638

You can find additional information related to the software for the Model H08 and the Model H16 at the following Web site:

<http://www.ibm.com/servers/storage/support/san>

Related documents

You can find information related to the software that supports the H08 and H16 in the following documents:

- *Brocade Advanced Performance Monitoring User's Guide*
- *Brocade Advanced Web Tools User's Guide*
- *Brocade Advanced Zoning User's Guide*
- *Brocade Diagnostic and System Error Message Reference*
- *Brocade Design, Deployment, and Management Guide*
- *Brocade Fabric Manager User's Guide*
- *Brocade Fabric OS Procedures Guide*
- *Brocade Fabric OS Reference*
- *Brocade Fabric Watch User's Guide*
- *Brocade ISL Trunking User's Guide*
- *Brocade MIB Reference*

- *Brocade Secure Fabric OS User's Guide*
- *Building and Scaling Brocade SAN Fabrics: Design and Best Practices Guide*

When you use any of the Brocade documents, you will notice that the model numbers reflect the original Brocade switches. Table 1 provides a product matrix for you to use to correlate the Brocade model numbers to the IBM product and model numbers.

Table 1. Brocade and IBM product and model number matrix

Brocade model number	IBM product and model number
Silkworm 3250	2005 Model H08
Silkworm 3800	2109 Model F16
Silkworm 3850	2005 Model H16
Silkworm 3900	2109 Model F32
Silkworm 12000	2109 Model M12
Silkworm 24000	2109 Model M14

Web sites

To get specific details about models and firmware that the switch supports, see the following Web site:

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

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at:

www.fibrechannel.org/

For a directory of worldwide contact information, including technical support, see the following Web site:

www.ibm.com/contact/

Getting help

Contact IBM for technical support. This includes hardware support, all product repairs, and ordering of spare components.

Be prepared to provide the following information to support personnel:

- The switch serial number
- The switch worldwide name (**licenseidshow** command)
- The configuration (**topologyshow** command)
- Any output from the **supportShow** Telnet command
- A detailed description of the problem
- Any troubleshooting steps that you have already performed

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Chapter 1. Introducing the Model H08 and Model H16

The IBM TotalStorage SAN Switch 2005 Models H08 and H16 deliver next generation performance and functionality for Fibre Channel Storage Area Networks (SAN), including 1 and 2 Gbit/sec auto-sensing capability, full forward- and backward-compatibility with all IBM TotalStorage SAN Switch models, as well as improved affordability and ease of management. The base functionality for both H08 and H16 switch models includes webtools, advanced zoning, and hot code activation standard in Fabric OS 4.2.

The IBM SAN Switch 2005 Model H08 is designed for entry level SAN applications, and provides 8 Fiber Channel ports, a single power supply, and fans in 1U rack height. The base H08 switch functionality supports one E-Port connection to one other IBM SAN switch.

The IBM SAN Switch 2005 Model H16 is designed for mid-range SAN applications, and provides 16 Fiber Channel ports, dual power supplies, and fans in 1U rack height. The base H16 switch functionality supports connections with up to three other IBM SAN switches.

For both H08 and H16 switch models, the optional Full Fabric Activation feature enables the maximum supported E-Port Inter-Switch Link (ISL) capability, while the Extended Fabric activation feature increases buffer credits to support disaster tolerance solutions. Additional optional functions include Fabric Manager v4 Maximum Supported Domains, Remote Switch Activation, Performance Bundle Activation, and Advanced Security.

This chapter provides the following information:

- “Features and functions of the Model H08 and the Model H16”
- “Model H08 and H16 switch comparison” on page 2
- “Supported connectivity” on page 2
- “Switch characteristics” on page 3
- “ISL trunking groups” on page 4
- “Supported (optional) features” on page 4

Features and functions of the Model H08 and the Model H16

The Model H08 and Model H16 provide the following features and functions:

- Base switch with single (Model H08) or dual (Model H16) power supply and fixed fans, 1U, 2 Gb auto negotiate, H08: 2 domain limit, H16: 4 domain limit, Webtools & Advanced Zoning (standard)
- Fabric OS 4.2 – Hot code activation
- Full fabric activation feature adds unlimited E_ports
- Air-cooled 1U chassis. You can install the chassis as a stand-alone unit or mount it in a standard Electronic Industries Association (EIA) 19 in. (48.26 cm) rack.
- Distance capability feature increases buffer credits
- One RS–232 serial port, designed to connect to a DTE port
- One 10/100 Mb/sec Ethernet port with an RJ–45 connector
- The following light-emitting diodes (LEDs):
 - Power status
 - System status

- Ethernet status
- Port status and Port speed for each port
- Eight (Model H08) or sixteen (Model H16) Fibre Channel ports, with the following characteristics:
 - Automatic negotiation to the highest common speed of all devices connected to port
 - Port interfaces compatible with small form factor pluggable (SFP) transceivers, both short wavelength (SWL) and long wavelength (LWL)
 - Universal and self-configuring: capable of becoming an F_Port (fabric enabled), FL_Port (fabric loop enabled), or E_Port (expansion port)
- Additional functions through feature code include Full Fabric (no E-port limit and Fabric Watch), ISL Trunking, Performance Monitoring, Extended Fabric, Remote Switch, Advanced Security and Fabric Manager
- Performance is non-blocking performance, hot code activation, and distance support

Model H08 and H16 switch comparison

The basic difference between the Model H08 and the Model H16 is the number of ports: the Model H08 contains 8 ports, while the Model H16 contains 16 ports. The Model H08 contains only one power supply while Model H16 has built-in redundancy and contains two power supplies. The Model H16 also weighs more, due to the additional ports and power supply.

The Model H16 can operate indefinitely using either one of its redundant power supplies.

Supported connectivity

The IBM TotalStorage SAN Switch Models H08 and H16 support Fibre Channel connectivity for the following:

Servers

- IBM eServer pSeries® and selected RS/6000® servers
- IBM eServer iSeries™ and selected AS/400® servers
- IBM eServer xSeries® and selected Netfinity® servers
- Other Intel-based servers with Windows® 2000 and 2003, Netware and Linux
- Selected Sun and HP servers

Storage Systems

- IBM TotalStorage Enterprise Storage Server® (ESS)
- IBM TotalStorage FAStT Family of Storage Servers
- IBM TotalStorage Enterprise Tape System 3590 and 3592
- IBM TotalStorage Enterprise Tape Library 3494
- IBM 3582 and 3583 Ultrium Tape Libraries and IBM 3584 UltraScalable Tape Library

Switch characteristics

The following sections describe the physical characteristics of the Model H08 and the Model H16 and some important requirements for proper operation.

Port side of the Model H08 and the Model H16

You can see the physical differences between the Model H08 and the Model H16 in the following figures. The most noticeable difference is the number of ports. Figure 6 shows the port side of the Model H08, and Figure 7 shows the port side of the Model H16.

All LEDs are on the port side of the switch: the nonport side is used for serial number labeling and to allow the free flow of air. A complete description of the locations and interpretations of these LEDs can be found at “Interpreting LED activity” on page 21. The Model H16 enclosure has forced-air cooling, with the fans pushing the air from the nonport side of the chassis through the enclosure, and exhausting to the port side.

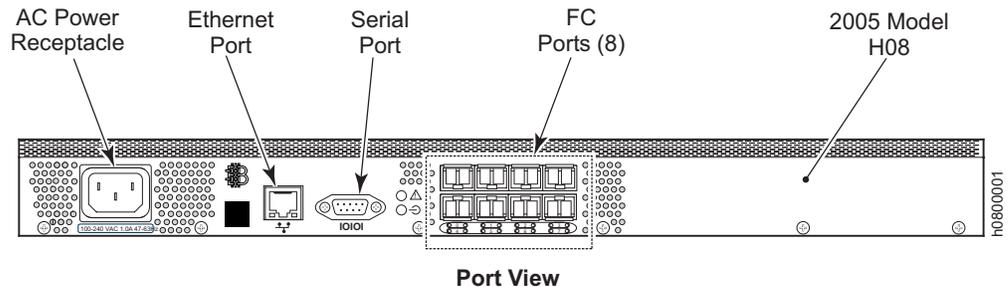


Figure 6. Port side of the Model H08

As Figure 7 shows, Model H16 has twice the number of ports and a second AC power receptacle.

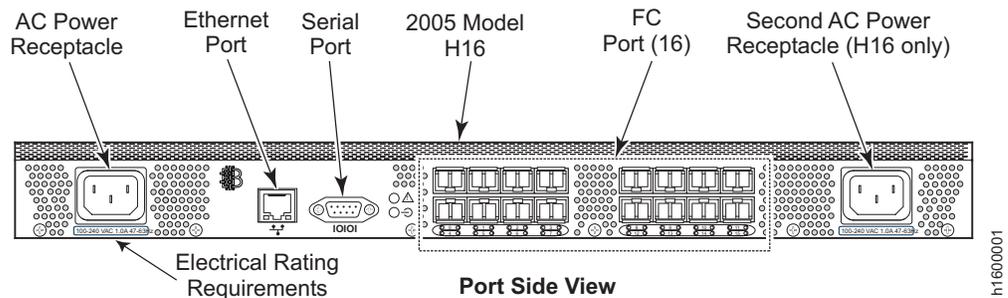


Figure 7. Port side of the Model H16

Nonport side of the Model H08 and the Model H16

The nonport side of the Model H08 and the Model H16 is used solely for air flow and for serial number labels. Two labels are on the rear of the chassis. The label on the left side contains the Model H08 or Model H16 media access control (MAC) addresses and worldwide names (WWN).

ISL trunking groups

If your Model H08 and your Model H16 are licensed for ISL trunking, use the trunking groups available on the switch.

The Fibre Channel ports are numbered from left to right, color-coded into groups of four to indicate the groups of ports that can be used in the same interswitch link (ISL) trunking group. The trunking groups are the two (H08) or four (H16) sets of four ports at the top or at the bottom of the group, as Figure 8 shows.

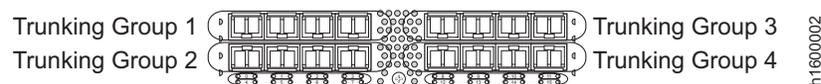


Figure 8. Trunking groups on a Model H16

Note: ISL Trunking is optional software that allows you to create trunking groups of ISLs between adjacent switches. For more information about trunking, refer to the *Brocade Fabric OS Features Guide*.

Supported (optional) features

The Model H08 and the Model H16 support the following optional software, which can be activated with the purchase of the corresponding license key:

- Extended Fabrics
- Remote Switch
- Performance Bundle (Performance Monitoring and ISL Trunking)
- Full Fabric Upgrade (no E-port limit and Fabric Watch)

For information on any of these features, refer to the *Brocade Fabric OS Features Guide*.

Chapter 2. Installing and configuring the Model H08 and the Model H16

You can install the Model H08 or the Model H16 in either of two ways:

- As a stand-alone unit on a flat surface
- In an Electronic Industries Association (EIA) cabinet using a slide-rail rack mount kit, which is provided with the switch. When you mount the switch into a slide-rail rack, you can mount the chassis to slide from either the port side or the non-port side.

This chapter provides the following information:

- “Items included with the Model H08 and the Model H16”
- “Installation and safety considerations” on page 6
- “Installing a stand-alone Model H08 or Model H16” on page 8
- “Installing a Model H08 or a Model H16 into an EIA cabinet” on page 9
- “Cabling and configuring the Model H08 or the Model H16” on page 15

Items included with the Model H08 and the Model H16

The following items are included with the standard shipment of the Model H08 and the Model H16. When you open the packaging, verify that these items are included in the package and that no damage occurred during shipping.

- One Model H08 or one Model H16 switch, composed of:
 - One cabinet-mountable 1U chassis designed to be mounted in a 19-inch cabinet space, with forced-air cooling that flows from the non-port side of the switch to the port side
 - 8 or 16 Fibre Channel ports, compatible with small form factor pluggable (SFP) transceivers, short wavelength (SWL) and long wavelength (LWL)
 - One RS-232 serial port (DB-9 connector)
 - One IEEE-compliant RJ-45 connector for use with 10/100 Mbps Ethernet for switch management
 - LEDs as described in “LED location” on page 21
 - One (Model H08) or two (Model H16) fixed power supplies and built-in fans
 - A real-time clock (RTC) with a 10-year battery
- An accessory kit that contains the following items:
 - One or two grounded 6 ft. (1.8 m.) country-specific power cables, depending on the number of power supplies installed in the switch
 - One RS-232 serial cable.
 - Four rubber mounting feet, required for setting up the switch as a stand-alone unit
 - One slide-rail rack mount kit, with instructions
 - Four (for Model H08) or eight (for Model H16) SFP transceivers
 - The Model H08 and Model H16 Installation, Service, and User’s Guide (this document).
 - One LC wrap plug-D

Installation and safety considerations

Use this section to prepare your site for a safe and successful installation.

Attention: Although the H08 and H16 switches have been designed for customer installation and replacement procedures, you must first ensure that the rack into which the switch is to be installed is also customer accessible. If it is not, then only trained personnel can install and service these switches in such a rack.



Attention: Read the “Safety and environmental notices” on page xi before attempting any installation or maintenance procedures.

General safety considerations

Successful and safe switch operation requires that the following minimum conditions be met:

- The supply circuit, line fusing, and wire size must conform to the electrical rating on the switch nameplate (see Figure 1 on page xv).
- The ambient air temperature near the switch must not exceed 40 degrees Celsius (104°F) . This is particularly important if the switch is installed in a closed or multi-rack assembly.
- At a minimum, adequate cooling requires that you install the switch with its port side facing the exhaust aisle (usually the service aisle). This prevents the fans from pulling in heated air.
- The volume of air flow available to the switch must be at least 24 cubic feet per minute, and the port side and non-port side air vents must not be blocked.
- If the switch is to be installed as a stand-alone unit, the surface on which the switch rests should be flat and even.
- If the switch is to be installed in a cabinet:
 - The cabinet must be a standard EIA cabinet.
 - The rack space must be one rack EIA unit high (1.75 in; 4.45 cm), 19 in (48.26 cm) wide, and 24 in (60.96 cm) deep.
 - All equipment installed in the cabinet should have a reliable branch circuit ground connection. Do not rely on a connection to a branch circuit, such as a power strip.
 - The additional weight of the switch should not unbalance the cabinet or exceed the cabinet’s weight limits.
 - The cabinet should be mechanically secured to ensure stability.
- The accessory kit contains SFP transceivers that are Class 1 laser devices. They are to be used specifically for this product. Take the necessary precautions.

Facility requirements

To ensure correct operation of the switch, the facility where the switch is in use must meet the requirements listed in Table 2 on page 7.

Table 2. Facility requirements

Type	Requirements
Thermal	<ul style="list-style-type: none"> • A minimum air flow of 24 cubic ft/minute available in the immediate vicinity of the switch • Ambient air temperature not exceeding 40°C (104°F) while the switch is operating
Cabinet (when rack-mounted)	<ul style="list-style-type: none"> • A minimum of one EIA unit in a 19-in. (48.3 cm.) cabinet • All equipment in the cabinet must be grounded through a reliable branch circuit connection • Additional weight of switch must not exceed the cabinet's weight limits • Cabinet must be secured to insure stability in case of unexpected movement, such as an earthquake

Electrical requirements

For successful installation and operation of the switch, ensure that the following electrical requirements are met. For power supply information, refer to “System specifications” on page 37.

- Primary ac input 100-240 V ac, 1.5A, 47-63 Hz (Model H08) and 100-240 V ac, 2.0A, 47-63 Hz (Model H16); switch autosenses input voltage
- Correctly wired primary outlet, with circuit protected by a circuit breaker and grounded in accordance with local electrical codes
- Adequate supply circuit, line fusing, and wire size, as specified by the electrical rating on the switch nameplate

See “Power supply specifications” on page 36 for details.

Environmental requirements and considerations

To ensure proper operation, the switch must not be subjected to environmental conditions beyond those for which it was tested. The ranges specified in Table 3 list the acceptable environment for both operating and non-operating conditions.

Table 3. Environmental requirements

Condition	Acceptable range during operation	Acceptable range during non-operation
Temperature	-10° to + 40°C (14°to 104°F)	-50° to 100°C (-58° to 212°F)
Humidity	20% to 85% RH non-condensing, at 40°C (104°F), with maximum gradient of 10% per hour	10% to 85% RH non-condensing, at 70°C (158°F)
Altitude	0 to 3 km (10,000 ft) above sea level	0 to 12 km (39,370 ft) above sea level
Shock	20 G, 6 ms duration, half sine wave	15 G, 12-18 ms duration, trapezoid
Vibration	0.5 G, 5-500 Hz	2.0 G, 5-500 Hz

Table 3. Environmental requirements (continued)

Condition	Acceptable range during operation	Acceptable range during non-operation
Air flow	Normal: 24 cubic ft/minute 1 fan failed remaining running at high speed): 30 cfm All fans running at high speed: 44 cfm	None required

Check that the environmental conditions meet the following requirements:

- At a minimum, adequate cooling requires that you install the switch with the non-port side, which contains the air intake vents, facing the cool-air aisle.
- Verify that a minimum of 24 cubic ft/minute of air flow is available to the air intake vents on the non-port side of the switch.
- Verify that the ambient air temperature does not exceed 40°C (104°F) while the switch is operating.
- If installing the switch in a cabinet:
 - The cabinet must be a standard EIA cabinet.
 - Plan a cabinet space that is at least 1 rack unit (1.75 inches; 4.45 cm) high, 19 inches (48.3 cm) wide, and at least 30 inches (76.2 cm) deep.
 - Ground all equipment in the cabinet through a reliable branch circuit connection and maintain ground at all times. Do not rely on a secondary connection to a branch circuit, such as a power strip.
 - Ensure that airflow and temperature requirements are met on an ongoing basis, particularly if the switch is installed in a closed or multicabinet assembly.
 - Verify that the additional weight of the switch does not exceed the cabinet's weight limits or unbalance the cabinet in any way.
 - Secure the cabinet to ensure stability in case of unexpected movement, such as an earthquake.

Installing a stand-alone Model H08 or Model H16

To install the Model H08 or the Model H16 as a stand-alone unit, use the following procedure:

1. Unpack the Model H08 or the Model H16 and verify that all items listed in “Items included with the Model H08 and the Model H16” on page 5 are present and undamaged.
2. Apply the adhesive rubber feet. Applying the rubber feet onto the switch helps prevent the switch from sliding off the supporting surface.
 - a. Clean the indentations at each corner of the bottom surface of the switch to ensure that they are free of dust or other debris that might lessen the adhesion of the feet.
 - b. Place one rubber foot in each indentation with the adhesive side against the chassis, and firmly press into place.
3. Place the switch on a flat, sturdy surface.
4. Provide power to the switch as described in “Powering up the switch and logging in” on page 16.

Attention: Do not connect the switch to the network until the IP address is correctly set. For instructions on how to set the IP address, see “Cabling and configuring the Model H08 or the Model H16” on page 15.

Installing a Model H08 or a Model H16 into an EIA cabinet

Attention: Refer to “Rack Safety” on page xix for danger and caution notices related to rack and cabinet installations.

You can install the rack mount kit in either of two ways:

- To allow the port side of the switch to slide out of the exhaust-air side of the cabinet. In this installation, the port side of the switch is flush with the edge of the cabinet.
- To allow the non-port side of the switch to slide out the cool-air side of the cabinet. In this installation, the port side of the switch is set 3 in. (7.62 cm.) back from the edge of the cabinet, allowing a more gradual bend in the fiber optic cables.

Time required

Approximately 30 minutes

Items required

You need the following items to install the Model H08 or the Model H16 in a slide-rail rack:

- Straight slot screwdriver
- Rack space: 1.5 EIA units of rack space, 48.26 cm (19 in.) wide, and 60.96 cm (24 in.) deep
- One (H08) or two (H16) power cables that are provided with the switch
- One (H08) or two (H16) power outlets
- Rack mount kit

Attention: Use the exact screws specified in the procedure for use with the switch chassis. Using screws longer than 3/16 in. can damage the switch. The different types of screws are listed in Table 4 on page 10.

Note: Make sure that you tighten all screws used in this procedure.

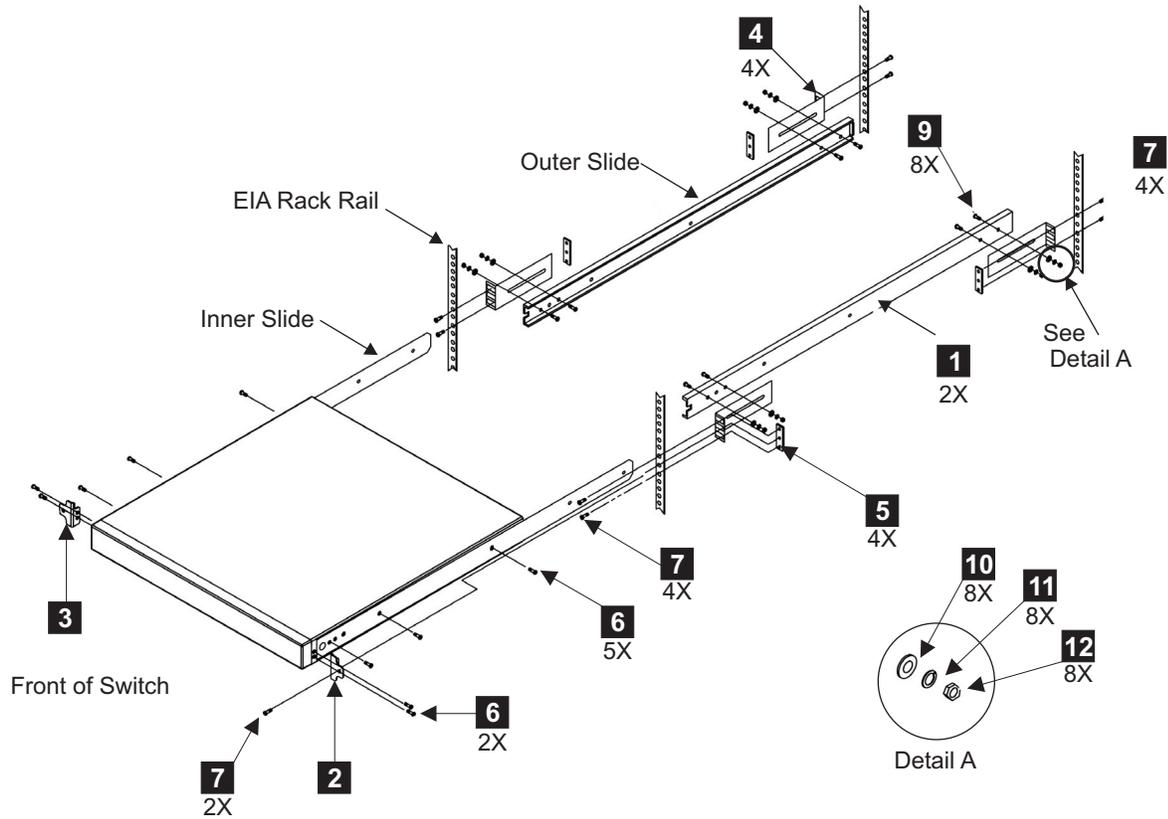
Installation instructions

To install the Model H08 or the Model H16 in a slide-rail rack that meets EIA standards, use the following procedure.

Note: These procedures use parts that are included in the Model H08 or the Model H16 rack-mount kit. These parts are listed in Table 4 on page 10. The installation procedure cross-references the items in this table. Be sure to use the referenced parts when you perform each step.

Before you start the rack-mount installation process, locate the rack-mount slides and the mounting bracket that are provided in the shipping container.

Figure 9 on page 10 shows the rack assembly.



SJ000153

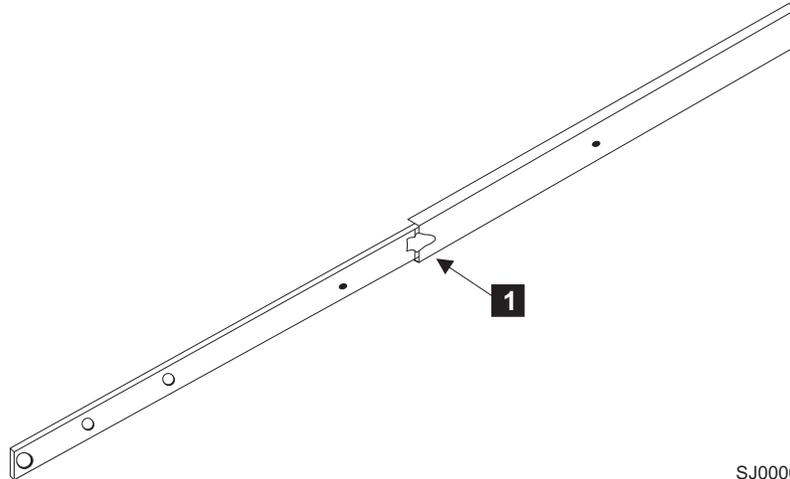
Figure 9. Rack assembly

1. Unpack the Model H08 or the Model H16 and verify that all ordered items and parts are present. See Table 4 for a list of parts and the quantities supplied.

Table 4. Parts supplied with the Model H08 or the Model H16 rack-mount kit

Item	Description	Quantity
1	Rack mount slide (inner and outer slide)	2
2	Right rack mount bracket (optional bracket for front of switch)	1
3	Left rack mount bracket (optional bracket for front of switch)	1
4	Rack mounting bracket (3-hole)	4
5	Nut clip, M5	11
6	Screw, 8-32 x 3/16 in., zinc	11
7	Screw, M5 x 12	11
8	Bracket to slide rack kit (contains items 9 - 12)	1
9	Screw, 8-32 x 3/8 in., zinc	5
10	Washer, flat, No. 8	5
11	Washer, lock, No. 8	5
12	Nut, hex, 8-32	5

2. Separate the inner and outer slides.
 - a. Open one of the slides until the lock engages.
 - b. Press the lock release lever (**1** in Figure 10 and remove the inner rail from the outer rail.



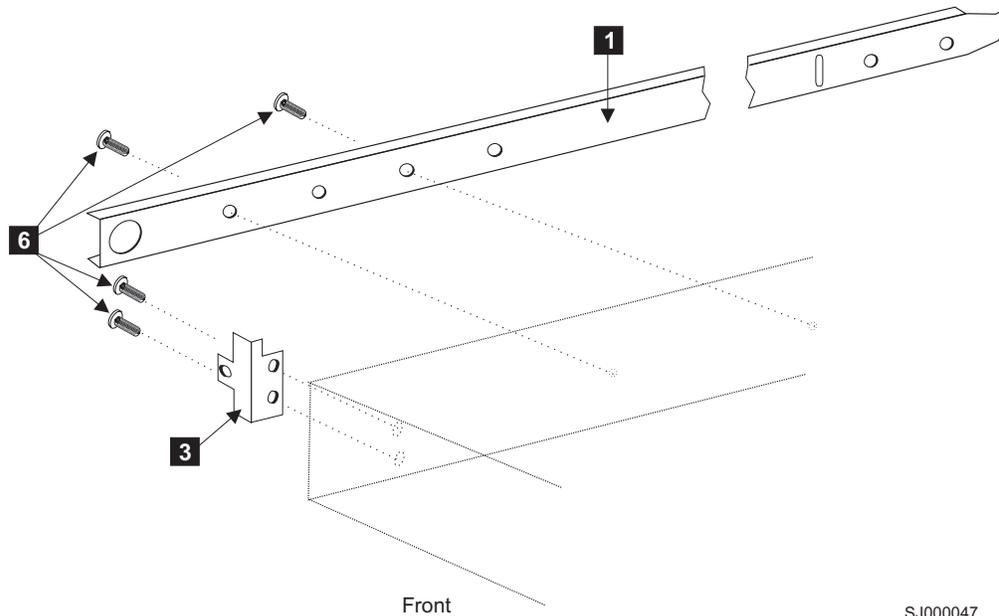
SJ000046

Figure 10. Moving slide

- c. Repeat step 2a and step 2b for the other rail.
- Note:** For racks with flush-mount doors, such as the 9306 Netfinity® racks, do not install the ears. Instead, use the rack-mount slides by attaching the Model H08 or the Model H16 to the set of mounting holes, which are offset 3 inches into the rack.
3. Install the inner (smaller) slide on the Model H08 or the Model H16 chassis, as Figure 9 on page 10 shows.

Attention: If you use screws longer than 3/16 in., you can damage the switch.

 - a. Position the flat side of the inner rail along one side of the switch. Align the holes in the rail with the threaded holes in the side of the switch chassis. The chamfered end of the inner rail should face toward the rear of the switch (away from the ports) as Figure 11 on page 12 shows.
 - b. Attach the inner rail by using three of the 8-32 x 3/16 in. zinc screws (**6** in Table 4 on page 10).



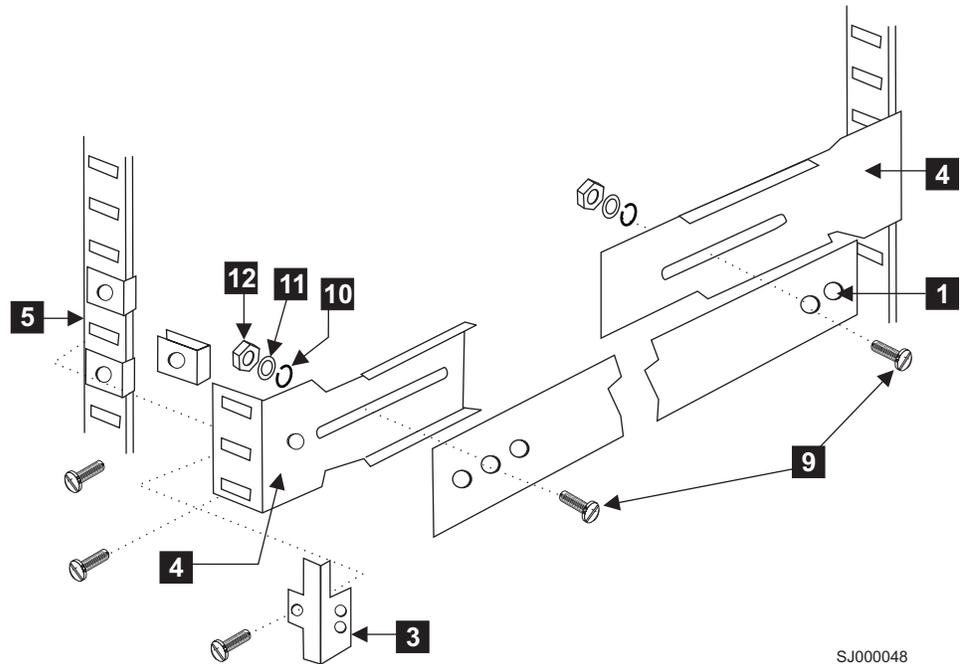
SJ000047

Figure 11. Mounting the moving portion of the slide and mounting brackets to the switch

- c. Repeat step 3a on page 11 and step 3b on page 11 for the second inner rail on the other side of the switch chassis.
4. Optional step: If desired, install the right rack mount bracket **2** (see Figure 9 on page 10) and the left rack mount bracket **3** on the switch chassis. Use these brackets to secure the switch to the rack as Figure 11 shows.

Attention: Do not use screws longer than 3/16 in.; they can damage the switch.

 - a. Position the left rack mount bracket at the left front corner of the switch chassis. You want the two holes in the bracket to align with the two threaded holes in the switch chassis.
 - b. Attach the bracket by using two of the 8-32 x 3/16 in. zinc screws (see **6** in Figure 9 on page 10)
 - c. Repeat step 4a and step 4b for the right rack mount bracket on the right front corner of the switch chassis.
5. Attach all four of the 3-hole rack mounting brackets **4** in Figure 12 on page 13.
 - a. Position a 3-hole rack mounting bracket **4** at the end of one of the outer slides.
 - b. Attach the bracket by using the 8-32 x 3/8 in. zinc screws **9**. Ensure that the screw heads are inside the slides.
 - c. Place one each of the following items on the outer end of the screw in the order listed:
 - 1) Washer, flat No. 8 **10**
 - 2) Washer, lock No. 8 **11**
 - 3) Nut, hex, 8-32 **12**
 - d. Repeat steps 5a through 5c for the three remaining rail ends.

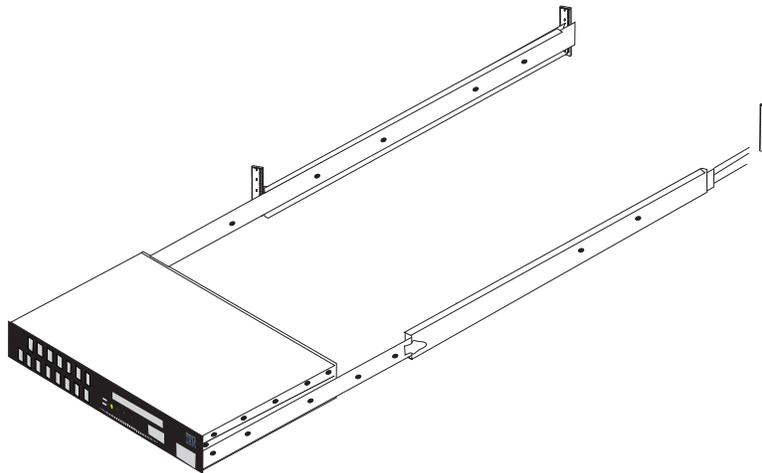


SJ000048

Figure 12. Mounting the fixed portion of the rail and the locking ears to the rack

6. Install the outer (larger) slides in the rack, as shown in Figure 12.
 - a. At the desired height, install the five M5 nut clips **5**. Put three M5 nut clips in the front of the rack and two in the back. The middle clip in the front of the rack is for the locking ears.

Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.
 - b. Attach the slides by using four M5 x 12 screws **7** (see Figure 9 on page 10).
 - c. Repeat step 6a and step 6b for the other rail.
7. Install the switch in the rack.
 - a. Position the switch in front of the rack. Insert the switch into the rack by sliding the inner slides that are mounted on the switch into the outer slides that are mounted on the rack. See Figure 13 on page 14.



SJ000049

Figure 13. Inserting slides into the rack rails

- b. Check the alignment of the slides by sliding the switch in and out of the rack. Any difficulty moving the switch indicates lateral stress or misalignment. If this situation occurs, adjust the slide positions until the movement is smooth.
8. Optional step: If the right and left rack mount brackets are installed on the front corners of the switch, attach both brackets to the cabinet rack by using M5 x 12 screws **7**. See step 4 on page 12 and Figure 9 on page 10. The screws should pass through the front of each bracket and the slide rail.

Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.

9. Provide power to the switch.

DANGER



An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

Attention: Ensure that the power cables are routed so that they are not pinched or exposed to stress when the switch is moved on the slide-rails.

- a. Connect the power cables to the Model H08 or the Model H16 power supplies and to the power outlets.

Note: Do not connect the switch to the network until you perform one of the following steps:

- Set the internet protocol (IP) address.
- Verify that the default IP address does not conflict with the existing IP addresses in the same network.

For more information, see “Cabling and configuring the Model H08 or the Model H16” on page 15.

- b. Turn on the power supply (flip the ac switch to “I”) when you are ready to supply power to the switch. The switch automatically runs a power-on self-test (POST) each time you turn it on.
- c. Repeat step 9a on page 14 and step 9b for the remaining power supply (Model H16 only).

Cabling and configuring the Model H08 or the Model H16

You must configure the Model H08 and the Model H16 to ensure correct operation within a network and fabric. For instructions about how to configure the switch to operate in a fabric that contains switches from other vendors, refer to the *Brocade Fabric OS Procedures Guide*.

For more information about the commands used in this procedure, refer to the *Brocade Fabric OS Reference Manual*.

Recommendations for cable management

Attention: The minimum bend radius for a 50 micron cable is 51 mm (2 in.) under full tensile load and 30.5 mm (1.2 in.) with no tensile load. Because they are easily overtightened, tie wraps are not recommended for optical cables.

Cables can be organized and managed in a variety of ways: for example, using cable channels on the sides of the cabinet or patch panels to minimize cable management. A list of recommendations follows:

- Plan for rack space required for cable management before installing the switch.
- Leave at least 1 meter (3.28 ft) of slack for each port cable. This provides room to remove and replace the switch, allows for inadvertent movement of the rack, and helps prevent the cables from being bent to less than the minimum bend radius.
- If you are using Brocade ISL Trunking, consider grouping cables by trunking groups. The cables used in trunking groups must meet specific requirements, as described in the Brocade Fabric OS Features Guide.
- For easier maintenance, label the fiber optic cables and record the devices to which they are connected.
- Keep LEDs visible by routing port cables and other cables away from the LEDs.
- Do not use tie wraps on fiber optic cables, because wraps are easily overtightened and can damage the optic fibers.

Items required for installation

The following items are required for configuring and connecting the Model H08 or the Model H16 for use in a network and fabric:

- Model H08 or the Model H16 installed and connected to a power source
- Workstation with an installed terminal emulator, such as HyperTerminal
- Available IP address and corresponding subnet mask and gateway address
- Serial cable (provided)
- Ethernet cable
- SFP transceivers and compatible cables, as required
- Access to an FTP server for backing up the switch configuration (optional)

Configuring the Model H08 or the Model H16

Follow the steps described in the next sections to configure your Model H08 or the Model H16 for use:

1. “Creating a serial connection”
2. “Powering up the switch and logging in”
3. “Setting the IP address” on page 17
4. “Creating an Ethernet connection and logging in” on page 17
5. “Modifying the domain ID (optional)” on page 17
6. “Installing the SFP transceivers” on page 18
7. “Connecting the cables” on page 18

Creating a serial connection

Before you can begin configuring the Model H08 or the Model H16, you must create a connection by way of the serial port. To create a serial connection to the Model H08 or the Model H16, perform the following steps:

1. Insert the provided serial cable into the serial port on the switch.
2. Disable any serial communication programs running on the workstation.
3. Open a terminal emulator application (such as HyperTerminal on a PC or TERM in a UNIX[®] environment) and configure the application as follows:

- In a Windows 95, 98, 2000, or NT environment:

Bits per second	9600
Databits	8
Parity	None
Stop bits	1
Flow control	None

- In a UNIX environment, type the following string at the prompt:

```
tip /dev/ttyb -9600
```

Powering up the switch and logging in

After you create the serial connection following the steps in “Creating a serial connection,” provide power to the switch by following the steps below. Power is supplied to the switch as soon as the first power supply is connected and powered on, you should then see POST messages.

1. Connect the power cords to both power supplies and power sources.
To protect against ac failure, connect the power cords to outlets on separate circuits. Ensure that the cords have a minimum service loop of six inches available at the connection to the switch and are routed to avoid stress.
The power supply LED lights up green, and the switch begins running POST. The POST should complete and the switch will complete the boot process in about three minutes.
2. After POST is complete, verify that the System Status and Power Status LEDs are green.
3. Using a serial connection, when the terminal emulator application stops reporting information, press **Enter** to display the login prompt.
4. Log in using the administrative account. The logon is admin and the default password is password. You can create up to two simultaneous admin sessions and four user sessions. For details, refer to the *Brocade Fabric OS Procedures Guide* and the *Brocade Fabric OS Reference Manual*.

Setting the IP address

Replace the default IP address and related information with the information provided by your network administrator. By default, the IP address is set to 10.77.77.77.

1. Type `ipaddrset` at the terminal emulator application prompt, as shown in the following example:
2. Type the requested information as prompted. In this example, the items in **bold** are the new values that were entered.

Table 5. Example of changing an IP address

```
switch:admin> ipaddrset
Ethernet IP Address [192.168.1.1]:10.32.53.47
Ethernet Subnetmask [255.255.255.0]:255.255.240.0
Fibre Channel IP Address [0.0.0.0]:
Fibre Channel Subnetmask [0.0.0.0]:
Gateway IP Address [0.0.0.0]:10.32.48.1
Set IP address now? [y = set now, n = next reboot]:y
IP address being changed...
Committing configuration...Done.
switch:admin>
```

3. Optionally, verify that the address was correctly set by entering the `ipaddrshow` command at the prompt.
4. Record the IP address on the label clearly displayed on the port side of the chassis.
5. If the serial port is no longer required, log out of the serial console, remove the serial cable, and replace the safety plug in the serial port.

Note: Any time the port is not in use, the safety plug should be installed to protect it from foreign material.

Creating an Ethernet connection and logging in

Create an Ethernet connection to the Model H08 or the Model H16 by performing the following steps:

1. Connect an Ethernet cable to the Ethernet port and to the workstation or to an Ethernet network that contains the workstation. After this connection is made, the switch can be accessed remotely, by command line or by using Advanced Web Tools. Ensure that the switch is not being modified from any other connections during the remaining steps.
2. Log in to the switch with Telnet using the admin account.

Modifying the domain ID (optional)

If desired, you can modify the domain ID. The default domain ID is domain 1. If the switch is not powered on until after it is connected to the fabric and the default domain ID is already in use, the domain ID for the new switch is automatically reset to a unique value. If the switch is connected to the fabric after it has been powered on and the default domain ID is already in use, the fabric will segment.

The domain IDs that are currently in use can be determined by using the **fabricshow** command. The number of domains is determined by your domain fabric licensing.

To modify the domain ID, perform the following steps:

1. Disable the switch by typing `switchdisable`.

2. Type `configure`. This prompts sequential displays; type a new value or press **Enter** to accept each default value.
3. At the Fabric Parameters prompt, type `Y` and press **Enter**, as the following example shows:
Fabric parameters (yes, y, no, n): [no] **y**
4. Enter a unique domain ID, such as the domain ID that the previous switch used, if still available, as the following example shows:
Domain: (1..239) [1] **3**
5. Complete the remaining prompts or press `Ctrl+D` to accept the remaining default settings.
6. Re-enable the switch by entering the `switchenable` command.
7. Optionally, specify any custom status policies:
 - Enter the `switchstatuspolicyset` command at the prompt. This command sets the policy parameters that determine the overall switch status.
 - Customize the status policies as desired.

Installing the SFP transceivers

If your Model H08 or Model H16 came without SFP transceivers installed, or if the transceivers have been removed, use the following procedure to install them into the Fibre Channel ports.

The ports selected for use in trunking groups must meet specific requirements. For a list of these requirements, refer to the *Brocade Fabric OS Features Guide*.

To install SFP transceivers, perform the following steps:

1. Position a transceiver so that it is oriented correctly and insert it into a port until the latching mechanism clicks. The transceivers are keyed to ensure correct orientation.
If a transceiver does not install easily, ensure that it is correctly oriented. For instructions specific to the type of transceiver, refer to the transceiver manufacturer's documentation.
2. Repeat for the remaining ports, as required.

Connecting the cables

Attention: The minimum bend radius for a 50-micron cable is 2 inches under full tensile load, and 1.2 inches with no tensile load.

Because they are easily overtightened, tie wraps are not recommended for optical cables.

Connect the cables to the transceivers:

1. The cable connectors are keyed to ensure correct orientation. Orient a cable connector so that the key (ridge on one side of connector) aligns with the slot in the transceiver and insert cable into transceiver until latching mechanism clicks. If a cable does not install easily, ensure it is correctly oriented. For instructions specific to cable type, refer to the cable manufacturer's documentation.
2. Repeat for the remaining transceivers, as required.

The cables used in trunking groups must meet specific requirements. For a list of these requirements, refer to the *Brocade Fabric OS Features Guide*.

Verifying the configuration

After you complete the configuration, use the LEDs and commands to verify that the configuration has been accepted:

1. Check the LEDs to verify that all components are functional. For information about LED patterns, refer to “Interpreting LED activity” on page 21.
2. Verify the correct operation of the Model H08 or the Model H16 by entering the **switchshow** command from the workstation. This command provides information about the switch and port status.
3. Verify the correct operation of the Model H08 or the Model H16 in the fabric by entering the **fabricshow** command from the workstation. This command provides general information about the fabric.

Backing up the configuration

Backup regularly to ensure that a recent configuration is available for downloading to a replacement switch, if required. For specific instructions about how to back up the configuration, refer to the *Brocade Fabric OS Procedures Guide*.

Back up the switch configuration to an FTP server by entering the **configupload** command and following the prompts. This command uploads the switch configuration to the server, making it available for downloading to a replacement switch, if necessary.

Chapter 3. Operating the Model H08 and the Model H16

This chapter provides the following information:

- “Powering the Model H08 and the Model H16 on and off”
- “Interpreting LED activity”
- “POST and boot specifications” on page 26
- “Interpreting POST results” on page 27

Powering the Model H08 and the Model H16 on and off

To apply power to the Model H08 and the Model H16, connect at least one power cable to an AC receptacle on the switch and to a power source. The switch runs POST (power-on self-test) by default each time you power on, reset, or reboot. POST requires as long as 3 minutes.

To end the flow of power to the Model H08 and the Model H16, remove the power cord from the power source.

Note: Removing all power from the switch triggers a system reset. All devices are returned to their initial state the next time the switch is powered on.

Interpreting LED activity

System activity and status can be determined through the activity of the LEDs on the switch.

There are three possible LED states: no light, a steady light, and a flashing light. The steady lights and flashing lights can be green or amber.

The LEDs flash any of these colors during boot, POST, or other diagnostic tests. This is normal and does not indicate a problem unless the LEDs do not indicate a healthy state after all boot processes and diagnostic tests are complete.

LED location

All Model H08 and Model H16 LEDs are located on the port side. They include:

- Switch Status
- Power
- Port Status
- Port Speed
- Ethernet

Figure 14 on page 22 shows the port side of the Model H08, paying special attention to the LEDs. Figure 15 on page 22 shows the port side of the Model H16.

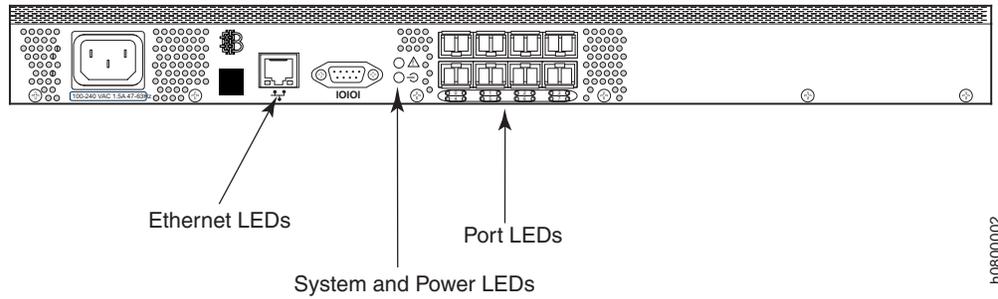


Figure 14. Model H08 LED locations

The Model H08 and the Model H16 switches are physically similar except for the number of ports and related port LEDs and the second AC power receptacle. For a closer look at the location of the Model H08 and the Model H16 LEDs, see Figure 16 on page 23 (Model H08 shown for illustration purposes).

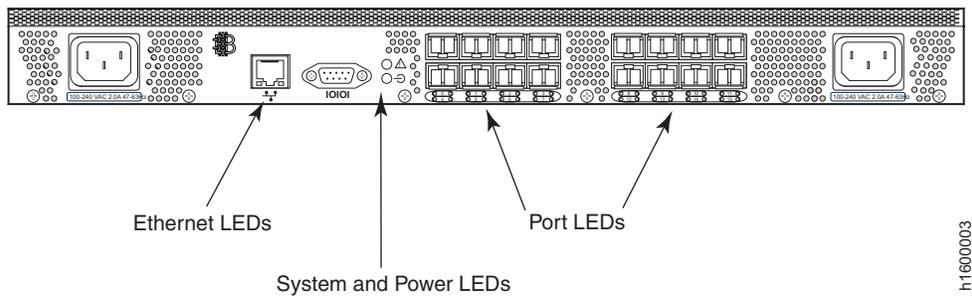


Figure 15. Model H16 LED locations

All LEDs are on the port side of the switch. Figure 16 on page 23 shows the location of these LEDs. See “LED patterns” on page 23 for details about how to interpret LEDs.

Figure 16 on page 23 shows the LEDs on the Model H08, but the LEDs are the same for the Model H16; there are equivalent LEDs on the second set of ports.

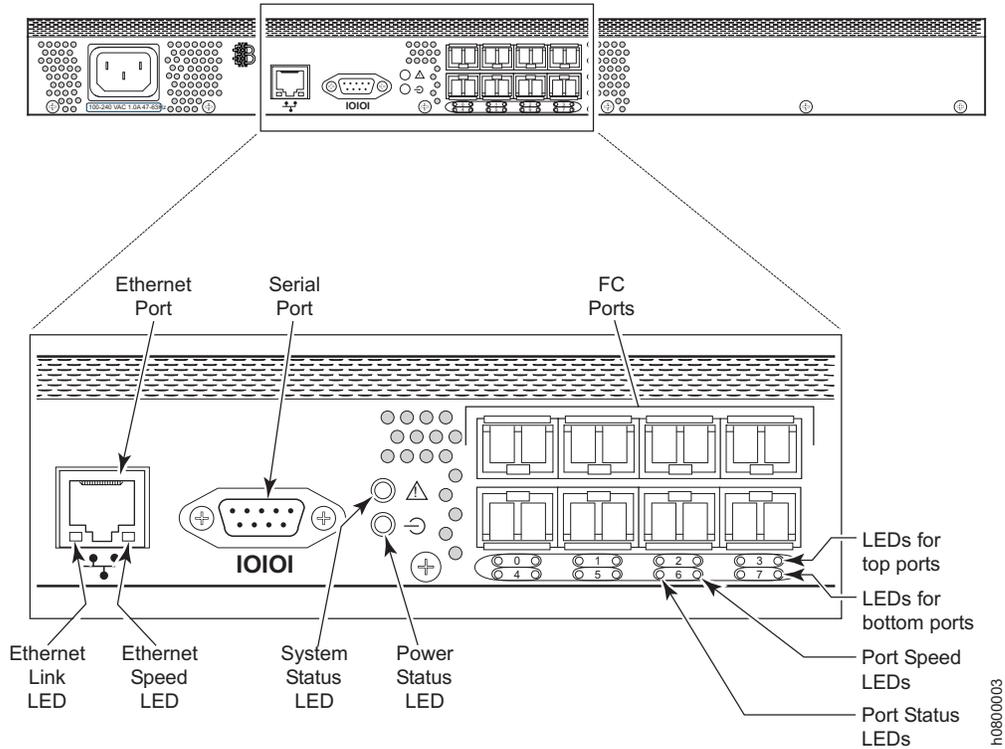


Figure 16. Detailed view of the Model H08 LEDs

LED patterns

Table 6 on page 24 and Table 7 on page 25 summarize LED location, color, and meaning of the Model H08 and the Model H16 LEDs, as well as any recommended user response.

System and power LED patterns

The system and power LED patterns are shown in Table 6 on page 24.

Table 6. System LED patterns during normal operation

LED name, location	LED color	Status of Hardware	Recommended action
System Status and Power Status (to the right of the serial port)	No light	Switch is off, boot is not complete, or boot failed.	Verify that the switch is on and has completed booting.
	Steady green	Switch is on and power supplies are functioning properly.	No action required.
	Slow-flashing green (on one second, off one second)	One or both of the following are true: <ul style="list-style-type: none"> • One or more environmental ranges are exceeded. • Error log contains one or more port diagnostic error messages. 	Complete the following steps (See the <i>Brocade Fabric OS Reference</i> for the telnet commands): <ol style="list-style-type: none"> 1. Check environmental conditions, error log, Port Status LEDs, transceivers, cables, and loopback plugs. 2. Correct error condition. 3. Clear error log. 4. Rerun diagnostics to verify fix.
	Amber	One failed power supply in Model H16	No action required, but failure of the remaining power supply will cause the switch to fail.

In addition to the switch system LEDs, each port has two LEDs: a port speed and a port status indicator. These LEDs are located below both rows of ports, and each set is labeled with the port number. Table 7 on page 25 shows the LED location, color, and meaning for these port LEDs.

Table 7. Port LED patterns during normal operation

LED name, location	LED color	Status of hardware	Recommended action
Port Status (below the ports on the left)	No light	No light or signal carrier (transceiver or cable) detected.	Check transceiver and cable.
	Steady green	Port is online (connected to external device) but has no traffic.	No action required.
	Slow-flashing green (on one second, off one second)	Port is online but segmented, indicating a loopback cable or incompatible switch.	Verify that the correct device is connected to port and that the switch and port settings are correct.
	Fast-flashing green (on 1/4 second, off 1/4 second)	Port is in internal loopback (diagnostic).	No action required.
	Flickering green	Port is online with traffic flowing through port.	No action required.
	Steady amber	Port is receiving light or signal carrier but is not yet online.	No action required.
	Slow-flashing amber (on one second, off one second)	Port is disabled as the result of diagnostics or portDisable command. If all ports are slow-flashing amber, the switch could be disabled.	Enable the port using the portEnable command. See the <i>Brocade Fabric OS Reference</i> for more information. If all ports are slow-flashing amber, enable the switch using the switchEnable command.
	Fast-flashing amber (on 1/4 second, off 1/4 second)	Port is faulty.	Perform the following steps (See the <i>Brocade Fabric OS Reference</i> for the telnet commands): <ol style="list-style-type: none"> 1. Check the Port Status LED error log, transceiver, and cable or loopback plug. 2. Clear the error log. 3. Rerun the diagnostics to verify that the error condition is fixed.
	Alternating green and amber	Port is bypassed.	Check configuration of fibre-channel loop.
Port Speed (below the ports on the right)	No light	Port is transmitting/receiving at 1 Gb/sec.	No action required.
	Steady green	Port is transmitting/receiving at 2 Gb/sec.	No action required.

Ethernet LED patterns

Each Ethernet port has two LEDs (see Figure 16 on page 23 for the Ethernet port location). Table 8 describes the location, color, and meaning for the Ethernet LED activity.

Table 8. Ethernet LED patterns

LED name, location	LED color	Status of hardware	Recommended action
Ethernet Speed (below the port on the right)	No light	Port speed is 10 Mb/sec.	No action required.
	Steady green	Port speed is 100 Mb/sec.	
Ethernet link (below the port on the left)	Amber	Link is valid.	No action required.
	Blinking green	Traffic.	

POST and boot specifications

When the switch is turned on or rebooted, the switch performs POST. Total boot time with POST is a minimum of 3 minutes.

POST can be omitted after subsequent reboots by using the **fastboot** command. For more information about this command, refer to the *Brocade Fabric OS Reference*.

POST

The success/failure results of the diagnostic tests that run during POST can be monitored through the error log or the command line interface.

POST includes the following steps:

1. Preliminary POST diagnostics are run.
2. Operating system is initialized.
3. Hardware is initialized.
4. Diagnostic tests are run on several functions, including circuitry, port functionality, memory, statistics counters, and serialization.

Boot

Boot completes in approximately 3 minutes if POST is run. In addition to POST, boot includes the following steps after POST is complete:

1. Universal port configuration is performed.
2. Links are initialized.
3. Fabric is analyzed, and if any ports are connected to other switches, the switch participates in a fabric configuration.
4. Switch obtains a domain ID and assigns port addresses.
5. Unicast routing tables are constructed.
6. Normal port operation is enabled.

Interpreting POST results

POST is a system check that is performed each time the switch is powered on, rebooted, or reset. During POST, the LEDs flash different colors. Any errors that occur during POST are listed in the error log.

To determine that POST completed successfully and whether or not any errors were detected:

1. Verify that the switch LEDs indicate that all components are healthy. See Table 6 on page 24 and Table 7 on page 25 for description and interpretation of LED patterns. If one or more LEDs do not display a healthy state, verify that the LEDs on the switch are not set to beacon; use the **switchshow** command.
2. Verify the switch prompt displays on the terminal of a computer workstation connected to the switch. If there is no switch prompt when POST completes, press **Enter**. If the switch prompt still does not display, try opening another Telnet session or accessing through another management tool. If this is not successful, the switch did not successfully complete POST. Contact your switch supplier for repair.
3. Review the switch system log for errors. Any errors detected during POST are written to the system log, accessible through the **errshow** command.

For information about all referenced commands, and on accessing the error log, refer to *Brocade Fabric OS Procedures Guide*. For information about error messages, refer to the *Brocade Diagnostic and System Error Message Reference Manual*.

Chapter 4. Monitoring and maintaining

After you install and configure your Model H08 or your Model H16, you can monitor the health of the fabric as well as maintain the health of the switch. This chapter provides the following information:

- “Management features of the Model H08 and the Model H16”
- “Maintaining the Model H08 and the Model H16”

Management features of the Model H08 and the Model H16

Using any of the management tools built into the Model H08 and the Model H16 listed in Table 9, you can monitor fabric topology, port status, physical status, and other information used for performance analysis and system debugging.

When running IP over Fibre Channel, these management tools must be run on both HBA and switch and must be supported by both HBA and HBA driver.

Table 9. Management options for the Model H08 and the Model H16

Management tool	Out-of-band support	In-band support
Command line interface Up to two admin sessions and four user sessions simultaneously. For more information, see the <i>Brocade Fabric OS Procedures Guide</i> and the <i>Brocade Fabric OS Reference Manual</i>	Ethernet or serial connection	IP over Fibre Channel
Brocade Fabric Manager	Ethernet connection	IP over Fibre Channel
Brocade Advanced Web Tools For information, see the <i>Brocade Advanced Web Tools Administrator's Guide</i>	Ethernet connection	IP over Fibre Channel
Standard SNMP applications For information, see the <i>Brocade MIB Reference Manual</i> .	Ethernet connection	IP over Fibre Channel
Management server For information, see the <i>Brocade Fabric OS Procedures Guide</i> and the <i>Brocade Fabric OS Reference Manual</i> .	Ethernet connection	Native in-band interface (over HBA only)
Brocade SCSI Enclosure Services For information, see the <i>Brocade SES User's Guide</i> .	Not supported	SCSI over Fibre Channel

Maintaining the Model H08 and the Model H16

The Model H08 and the Model H16 do not require any regular physical maintenance. They were designed to minimize the chance of failure.

Ensure that the environmental conditions, described in “System specifications” on page 37, are met. This helps prevent failure of the switch due to distress or abuse.

Installing an SFP

If your Model H08 or your Model H16 did not come with installed SFPs, or you are replacing older ones, follow the instructions below to install your SFP.

Note: SFPs are supplied by several different manufacturers. The illustrations and steps below are based on SFPs with wire bales. Other SFPs have plastic tabs rather than the wire bales. Adjust your installation to match the type of SFP you are installing.

1. Making sure that the bale (wire handle) is in the unlocked position, place the SFP in the correctly oriented position on the port, as shown in Figure 17.
2. Slide the SFP into the port until you feel it click into place and close the bale.

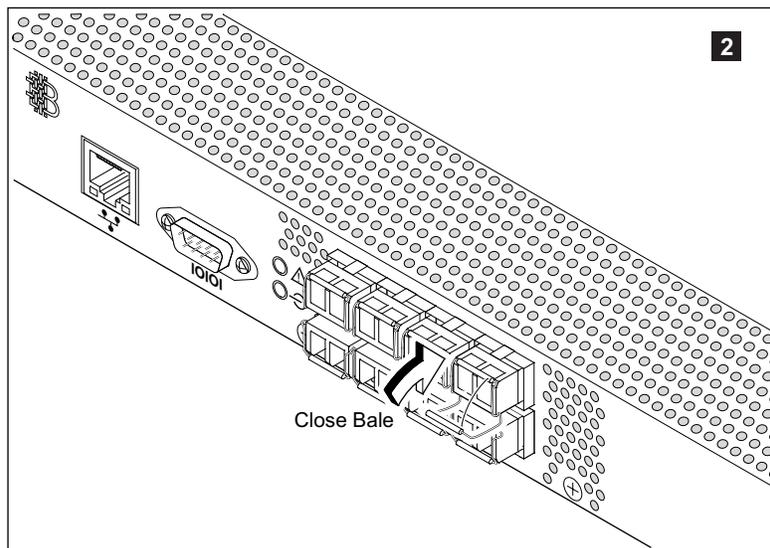
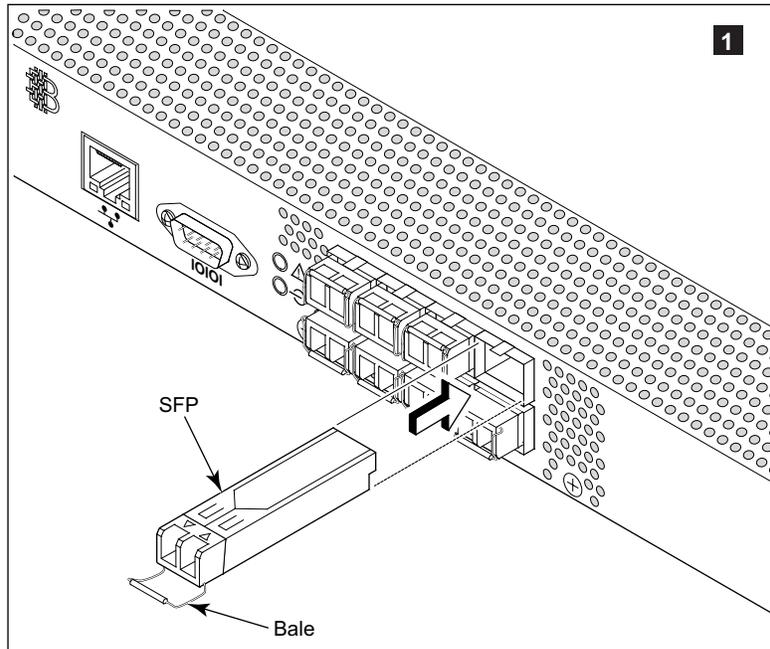


Figure 17. Installing an SFP

Removing an SFP

In some cases you might need to remove an SFP transceiver, either because it is no longer needed or because you must replace it.

To remove SFP transceivers, perform these steps:

1. Press and hold the cable release, as shown in Figure 18.
2. Remove the cable from the transceiver.
3. Pull the bale (wire handle) to release the transceiver.
4. Grasping it by the bale, gently but firmly pull the transceiver out of the port.

Attention: If the SFP you are removing does not have a bale, use a small implement such as a screwdriver to press the release trigger beneath the port. You can damage non-baled SFPs by the removal process. Refer to the *Brocade Compatibility Matrix* for a list of supported SFPs and devices.

5. Repeat this procedure for the remaining ports as required.

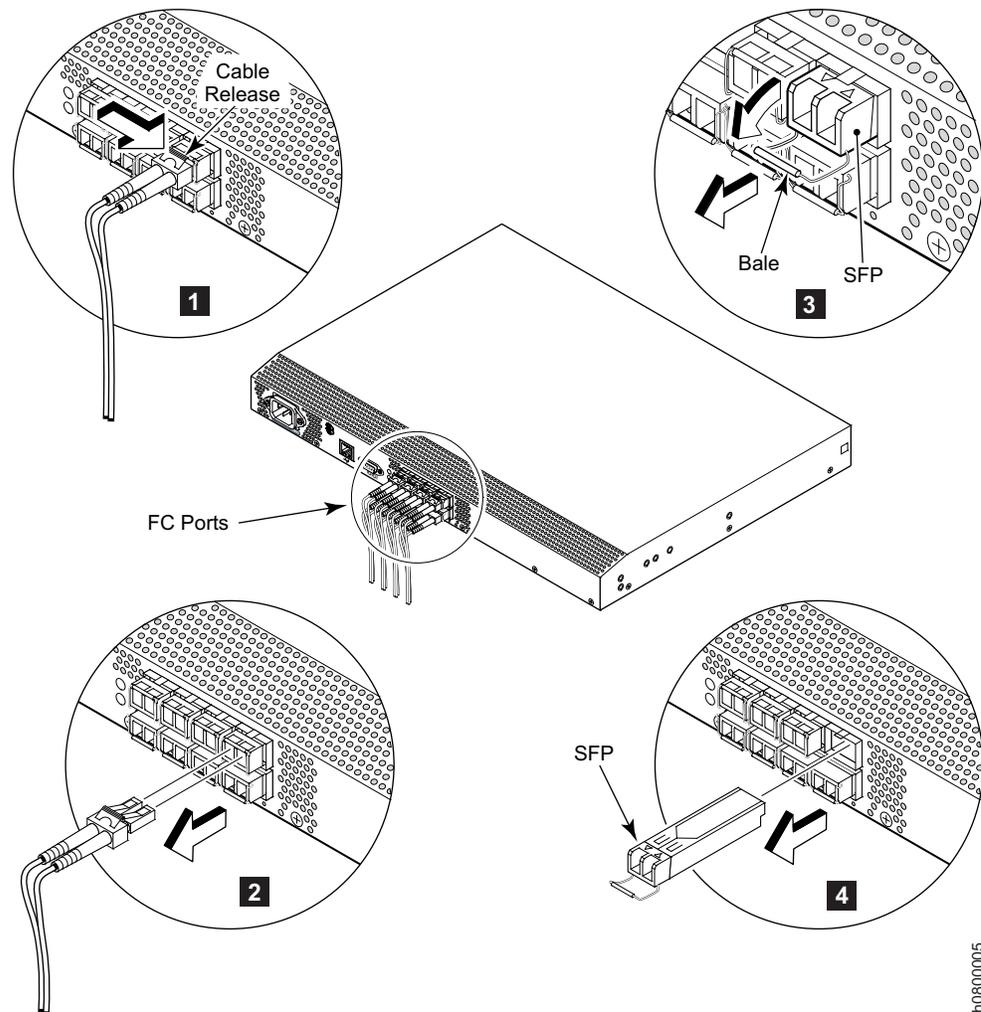


Figure 18. Removing an SFP

h0800005

Testing an SFP

Use the following procedure to determine if an SFP is faulty and needs to be replaced.

The **crossPortTest** command verifies the intended functional operation of the switch by sending frames from port M's transmitter and looping them back through the loopback plugs into port N's receiver with **-lb_mode** set to 1.

-nframes Specifies the number of frames to transmit on the test port.

-lb_mode =1 (with loopback plugs)

1. Remove the fiber cable from two SFPs on different port quad.
2. Insert the loopback plugs into the SFPs
3. Login as "admin" on the H08 or H16 switch
4. Enter admin password "xxxxxxx". Press Enter
5. Type the command "crossPortTest -nframes 5000 -lb_mode 1". Press Enter
6. If the test passes, both the switch and the SFPs are good. They do not need to be replaced.
7. If one of the ports has failed, swap the SFPs including the loopback plugs, and run the test again.
8. Type the command "crossPortTest -nframes 5000 -lb_mode 1". Press Enter
9. If the problem moves with the SFP, the SFP is faulty. Replace the SFP.
10. If the problem remains on the same port, verify that the port and switch configurations are correct before replacing the switch.

Table 10. Example of running a functional test of the port with loopback plug:

```
SW1 login: admin
Password:
SW1:admin> crossPortTest -nframes 5000 -lb_mode 1

Running crossporttest .....
Test Complete: crossporttest Pass 5000 of 5000
Duration 0 hr, 1 min & 43 sec (0:1:43:765).
passed.
SW1:admin>
```

Diagnostic tests

In addition to POST, Fabric OS includes diagnostic tests to help troubleshoot the hardware and the firmware. This includes tests of internal connections and circuitry, fixed media, and the transceivers and cables in use.

The tests are implemented by command, either through a Telnet session or through a terminal set up for a serial connection to the switch. Some tests require the ports to be connected by external cables, to allow diagnostics to verify the serializer/deserializer interface, transceiver, and cable.

All diagnostic tests are run at link speeds of both 1 Gb/sec and 2 Gb/sec.

Attention: Diagnostic tests can temporarily lock the transmit and receive speed of the links during diagnostic testing.

For information about specific diagnostic tests, refer to the *Brocade Fabric OS Procedures Guide*.

Changing the switch serial number

Attention: This procedure is to be used only if a switch has failed and it is being replaced by a new switch.

In the event of a hardware failure, the replacement switch should be configured to display the serial number of the original failed switch, in order to maintain continuity in the IBM service system. Once you have installed the replacement switch, follow the steps below to change the serial number displayed through the switch or fabric management program.

Note: This soft serial number procedure requires the user to login as "root".

1. Login as "root" on the H08 or H16 switch.
2. Enter the root password "xxxxxxx". Press Enter.
3. Type the command "fruinfoaset chassis 1". Press Enter.
4. ID: (none). Press Enter.
5. PN: (none). Press Enter.
6. SN: (none) > type "switch Serial Number". Press Enter.
7. RV: (none). Press Enter.
8. Chassis SN: (FAxxXxxxxx). Press Enter.

To verify that the serial number has been entered correctly, follow these steps:

9. Type the command "fruinfoaset chassis 1". Press Enter.
10. ID: (none). Press Enter.
11. PN: (none). Press Enter.
12. SN: (none) > Verify "switch Serial Number" entered. Press Enter.
13. RV: (none). Press Enter.
14. Chassis SN: (FA0xxXxxxxx). Press Enter.

If the serial number displayed is not correct, repeat the above steps, beginning with 3.

Appendix A. Product specifications

This appendix contains the following information:

- “Data transmission ranges”
- “Fibre Channel port specifications”
- “Serial port specifications”
- “Power supply specifications” on page 36
- “Weight and physical dimensions” on page 36
- “Memory specifications” on page 36
- “System specifications” on page 37

Data transmission ranges

Table 11 provides the data transmission ranges for different cable types and port speeds.

Table 11. Laser data transmission ranges

Port speed	Cable	Short wavelength	Long wavelength
1 Gb/sec	50 μ	500 m (1,640 ft)	n/a
1 Gb/sec	62.5 μ	300 m (984 ft)	n/a
1 Gb/sec	9 μ	n/a	10 km (6.2 miles)
2 Gb/sec	50 μ	300 m (984 ft)	n/a
2 Gb/sec	62.5 μ	150 m (492 ft)	n/a
2 Gb/sec	9 μ	n/a	10 km (6.2 miles)

Fibre Channel port specifications

The Fibre Channel ports in the Model H08 and the Model H16 are compatible with SWL and LWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards. For more information about these standards, see “Regulatory certifications” on page 49.

The ports are capable of operating at 2.125 Gb/sec or 1.0625 Gb/sec, and are able to autosense the highest speed of which all attached devices are capable.

Serial port specifications

The serial port is located on the port side of the switch. It is a three-wire RS-232 port with a DB-9 male connector, designed to connect to a DTE port.

Note: To provide dust and ESD protection, keep the safety plug on the serial port whenever the port is not in use.

You can use the serial port to connect to a computer workstation to configure the switch IP address without connecting to the fabric. The serial port's parameters are 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

The port requires a straight (extension) serial cable with a female 9-pin subminiature-D connector. Only pins 2, 3, and 5 are supported.

Power supply specifications

The power supplies are universal and capable of functioning worldwide without using voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has its own built-in fan for cooling, pushing the air toward the port side of the switch. Power supplies are not removable.

Table 12 lists the power supply specifications of the Model H08 and the Model H16.

Table 12. Model H08 and Model H16 power supply specifications

Specification	Values
Outlet	Correctly wired and earth-grounded
Maximum output from each power supply	Model H08: 50 watts, with fans operating Model H16: 75 watts, with fans operating
Maximum system power consumption	90–264 watts (depending on transceiver vendor)
Input voltage	100–240 VAC (nominal 80% efficiency), autoranging
Input line frequency	47–63 Hz
Harmonic distortion	Active power factor correction per IEC1000-3-2
BTU rating	Model H08: 120 BTU Model H16: 266 BTU
Inrush current Model H08	Model H08: 20A Model H16: 25A, each line input
Input line protection	Fused in both hot and neutral lines

Weight and physical dimensions

Table 13 lists the weight and physical dimensions of the Model H08 and the Model H16.

Table 13. Switch specifications

	Model H08	Model H16	Slide-Rail Kit
Height	4.29 cm (1.69 in)	4.29 cm (1.69 in)	
Width	42.85 cm (16.87 in)	42.85 cm (16.87 in)	
Depth	30.734 cm (12.10 in)	30.734 cm (12.10 in)	
Weight	3.72 kg (8.2 lb) with no media installed	4.27 kg (9.4 lb) with no media installed	1.18 kg (2.6 lb)

Memory specifications

Table 14 shows the Model H08 and the Model H16 memory specifications.

Table 14. Memory specifications

Memory type	Installed Memory
Main memory (SDRAM)	128 MB

Table 14. Memory specifications (continued)

Memory type	Installed Memory
Kernel flash	16 MB
Boot flash	512 KB
Compact flash	256 MB

System specifications

Table 15 lists the system specifications for the Model H08 and the Model H16.

Table 15. General specifications

Specification	Descriptions
Configurable port types	F_Port, FL_Port, and E_Port
System architecture	Nonblocking shared-memory switch
System processor	PPC405GP, 200 MHz CPU
ANSI Fibre-channel protocol	FC-PH (Fibre Channel Physical and Signalling Interface standard)
Modes of operation	Fibre Channel Class 2, Class 3, Class F
Fabric initialization	Complies with FC-SW 5.0
FC-IP (IP over Fibre Channel)	Complies with FC-IP 2.3 of FCA profile
Aggregate switch I/O bandwidth	64 Gb/sec if all 16 ports running at 2 Gb/sec, full duplex
Port-to-port latency	Less than 2 microseconds with no contention (destination port is free)
EMC (electromagnetic compatibility)	<p>Emissions</p> <p>An operating Model H08 and Model H16 conforms to the emissions requirements specified by the following regulations:</p> <ul style="list-style-type: none"> • FCC Rules & Regulations, Part 15 subpart B, Class A • CISPR22 Class A • EN55022 Class A • VCCI Class A ITE • AS/NZS 3548 Class A • CNS13438 Class A • ICES-003 Class A <p>Immunity</p> <ul style="list-style-type: none"> • IEC 61000-4-2 Severity Level 3 for Electrostatic Discharge • IEC 61000-4-3 Severity Level 3 for Radiated Fields • IEC 61000-4-4 Severity Level 3 for Fast Transients • IEC 61000-4-5 Severity Level 3 for Surge Voltage • IEC 61000-4-6 Conducted Emissions • IEC 61000-4-11 Voltage Variations

Appendix B. Power cables

This appendix contains a list of power cables. Table 16 lists the country or region, feature number, part number, and the type of power cable. Illustrations of the power cables follow Table 17.

Table 16. Power cables

Country or region	Feature code	Part number	Power cable
Australia	9831	13F9940	2.74 m (9 ft), 250 V, 10A
Canada and United States	9800	6952300	2.74 m (9 ft), 125 V, 10A
Chicago	9986	6952301	1.83 m (6 ft) 250 V, 10A
China	9840	02K0546	2.74 m (9 ft), 250 V, 6A
Denmark	9821	13F9997	2.74 m (9 ft), 250 V, 10A
France	9820	13F9979	2.74 m (9 ft), 250 V, 10A
Israel	9827	14F0087	2.74 m (9 ft), 250 V, 10A
Italy	9830	14F0069	2.74 m (9 ft), 250 V, 10A
South Africa	9828	14F0015	2.74 m (9 ft), 250 V, 10A
Switzerland	9828	14F0051	2.74 m (9 ft), 250 V, 10A
Thailand	9833	1838574	2.74 m (9 ft), 250 V, 10A
United Kingdom	9825	14F0033	2.74 m (9 ft), 250 V, 10A
Uruguay	9834	36L8880	2.74 m (9 ft), 250 V, 10A

Table 17. PDU cable

Country or region	Feature code	Part number	Power Cable
The PDU cable that is shipped with the 2005 Model H08 or H16	None	36L8886	2.74 m (9 ft), 125 V, 10A

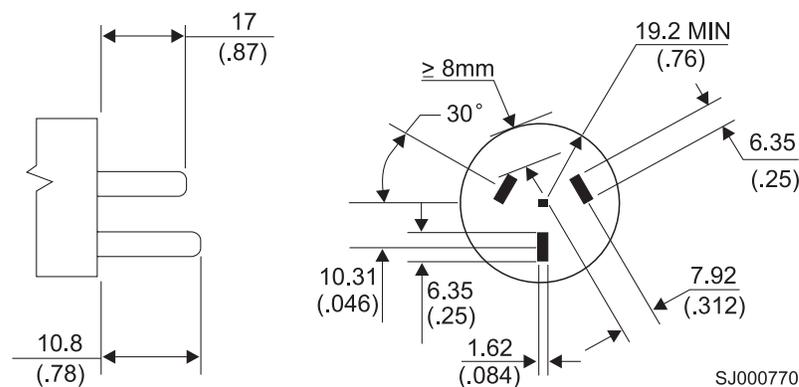


Figure 19. Power cable for Australia

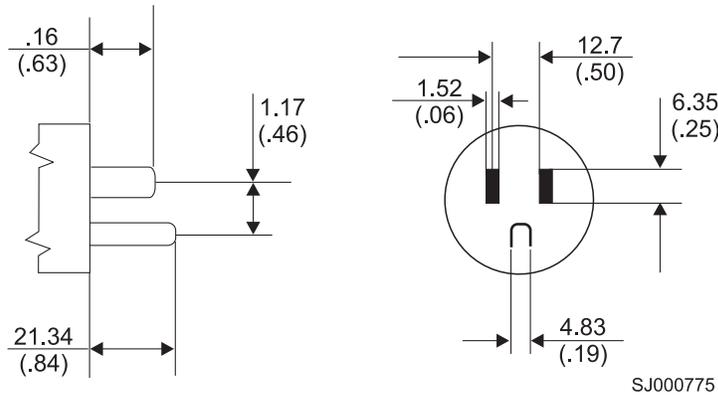


Figure 20. Power cable for Canada, United States, and Chicago

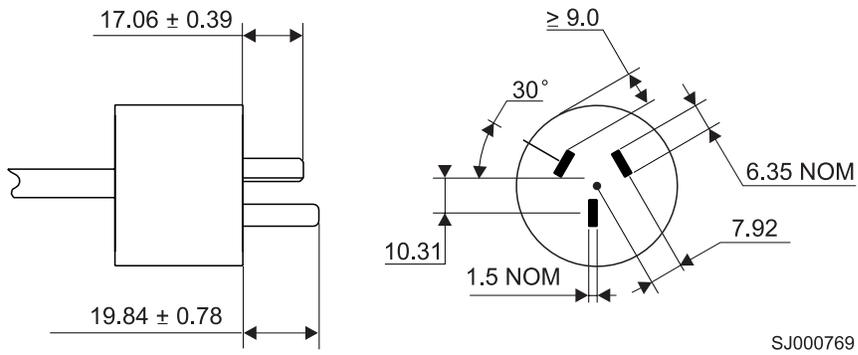


Figure 21. Power cable for China

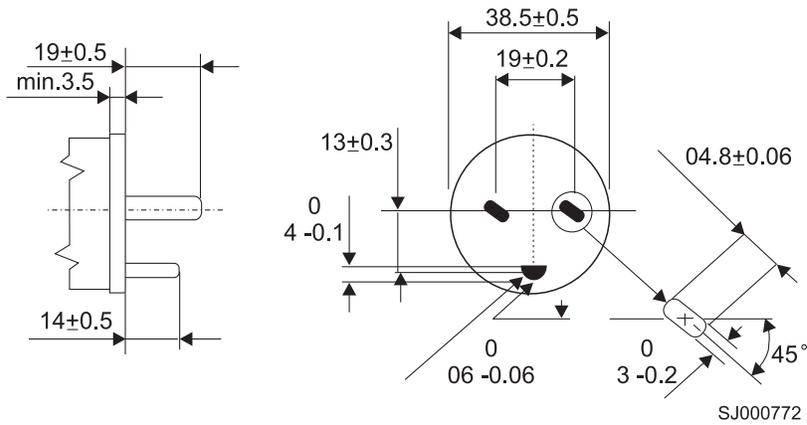


Figure 22. Power cable for Denmark

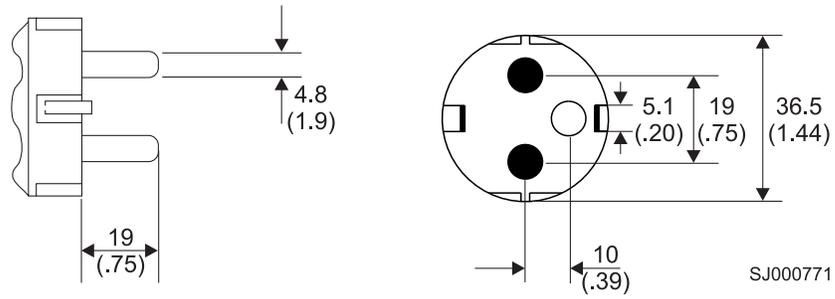


Figure 23. Power cable for France

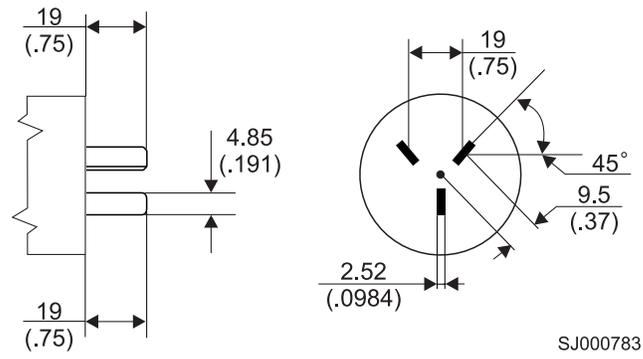


Figure 24. Power cable for Israel

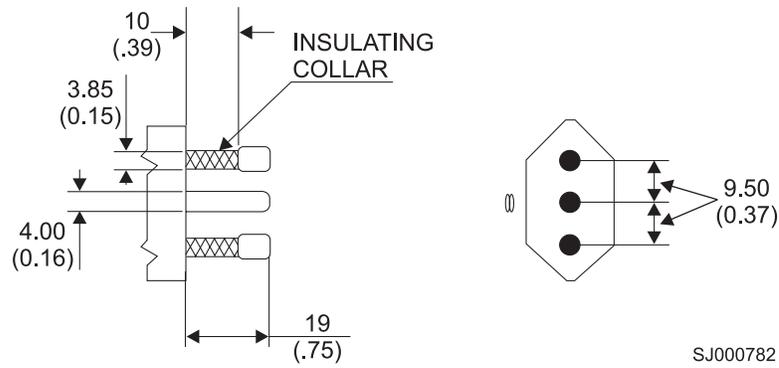


Figure 25. Power cable for Italy

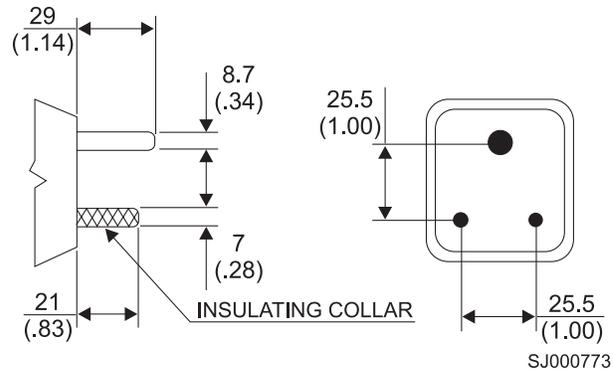


Figure 26. Power cable for South Africa

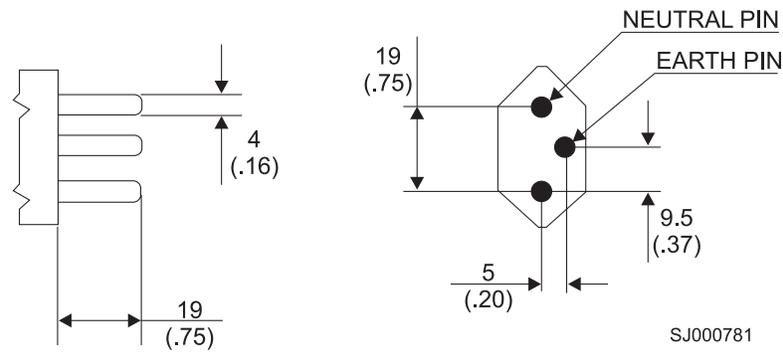


Figure 27. Power cable for Switzerland

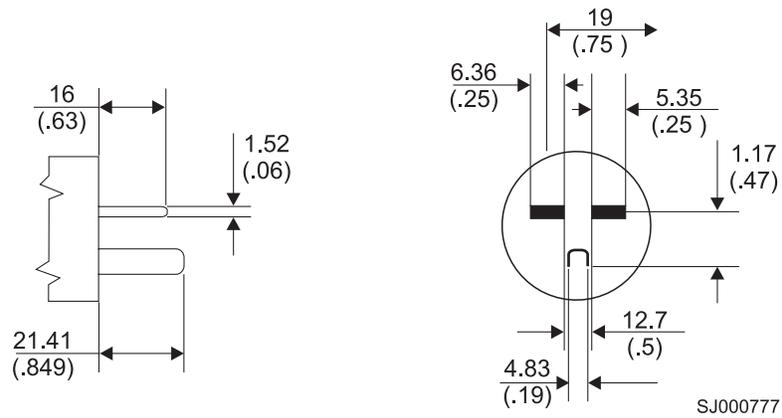


Figure 28. Power cable for Thailand

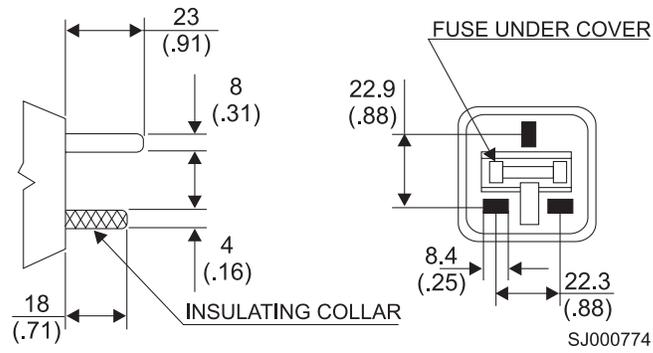


Figure 29. Power cable for United Kingdom

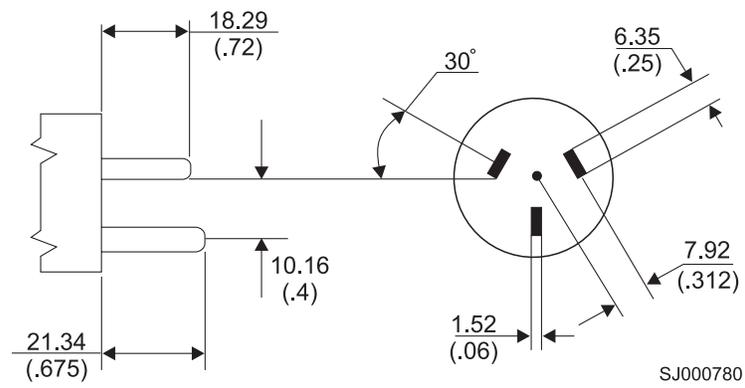


Figure 30. Power cable for Uruguay

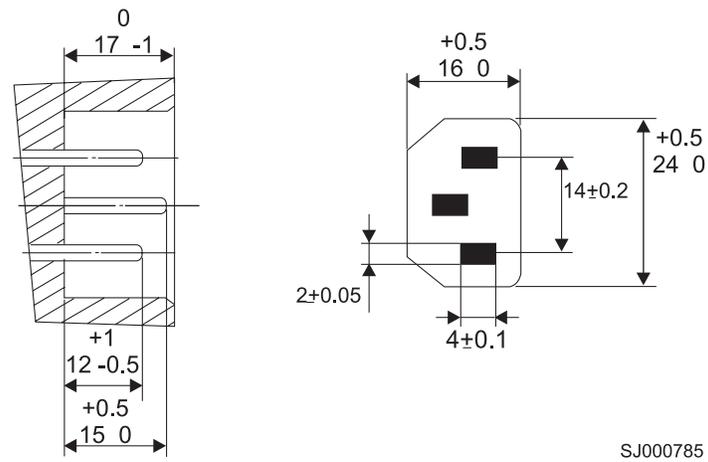


Figure 31. PDU cable that is shipped with the 2005 Model H08 and Model H16

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The standards compliance label on the Model H08 and Model H16 contains the CE mark, which indicates that this system conforms to the provisions of the following European Council Directives, laws, and standards:

- Electro Magnetic Compatibility (EMC) Directive 89/336/EEC and the Complementary Directives 92/31/EEC and 93/68/EEC.
- Low Voltage Directive (LVD) 73/23/EEC and the Complementary Directive 93/68/EEC.
- EN50082-2/EN55024:1998 (European Immunity Requirements)
 - EN61000-3-2
 - EN61000-3-3/IEIDA (European and Japanese Harmonics Specification)

Germany Electromagnetic Compatibility Directive

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

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

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

Informationen in Hinsicht EMVG Paragraph 4 Abs. (1) 4:

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Regulatory certifications

Table 18 lists the safety and electromagnetic compatibility (EMC) specifications for which the Model H08 and Model H16 are certified.

Table 18. Model H08 and Model H16 regulatory certifications

Country	Safety Specification	EMC Specification
Canada	CSA 22.2 No. 60950 Third Ed.	ICES-003 Class A
United States	UL 60950 Third Ed., Info.Tech. Equip.	FCC Part 15, Subpart B, (CFR title 47) Class A
Japan	IEC 60950+A1+A2+A3+A4+A11	VCCI V-3/2000.04, Class A
International	IEC 60950+A1+A2+A3+A4+A11	CISPR22 Class A
Norway	IEC 60950+A1+A2+A3+A4+A11 (NEMKO CB Report)	
European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom)	EN 60950:92+A1:93+A2:93+A3:95+A4:96+A11:97 73/23/EEC TUV (Germany only)	89/336/EEC EN 55022:1998 Class A EN 55024 (Immunity) EN60825-1:1994/A11, -2 EN 61000-4-2 Severity Level 3 for Electrostatic Discharge EN 61000-4-3 Severity Level 3 for Radiated Fields EN 61000-4-4 Severity Level 3 for Electrical Fast Transients EN 61000-4-5 Severity Level 3 for Surge Voltage EN 61000-4-6 Conducted Emissions EN 61000-4-8 Magnetic Fields EN 61000-4-11 Line Interruption
Australia and New Zealand		AS/NZS 3548:1995 Class A (radio interference)

Glossary

This glossary provides definitions for Fibre Channel and switch terminology used for IBM TotalStorage SAN switches and related products. It also provides additional definitions of technical terms and abbreviations. If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at <http://www.ibm.com/ibm/terminology/>

This glossary 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.

Numerics

8b/10b encoding. An encoding scheme that converts each 8-bit byte into 10 bits. Used to balance ones and zeros in high-speed transports

16-port card. The Fibre Channel port card provided with SAN switch directors. Contains 16 ports and the corresponding light-emitting diodes (LEDs). See also *port card*.

A

access control list (ACL). Enables an organization to bind a specific worldwide name (WWN) to a specific switch port or set of ports, preventing a port in another physical location from assuming the identity of a real

WWN. Can also refer to a list of the read/write access of a particular community string. See also *device connection controls*.

account level switches. Switches that have four login accounts into the operating system (in descending order): root, factory, admin, and user. See also *admin account*.

ACL. See *access control list*.

address identifier. A 24-bit or 8-bit value used to identify the source or destination of a frame.

admin account. A login account intended for use by the customer to control switch operation. See also *account level switches*.

alias. An alternate name for an element or group of elements in the fabric. Aliases can be used to simplify the entry of port numbers and worldwide names (WWNs) when creating zones.

alias address identifier. An address identifier recognized by a port in addition to its standard identifier. An alias address identifier can be shared by multiple ports.

alias AL_PA. An arbitrated loop physical address (AL_PA) value recognized by a loop port (L_port) in addition to the AL_PA assigned to the port. See also *arbitrated loop physical address*.

alias server. A fabric software facility that supports multicast group management.

AL_PA. See *arbitrated loop physical address*.

American National Standards Institute (ANSI). The governing body for Fibre Channel standards in the U.S.A.

ANSI. See *American National Standards Institute*.

API. See *application programming interface*.

application programming interface (API). A defined protocol that allows applications to interface with a set of services.

application-specific integrated circuit (ASIC). In computer chip design, an integrated circuit created by first mounting an array of unconnected logic gates on a substrate and later connecting these gates in a particular configuration for a specific application. This design approach allows chips for a variety of applications to be made from the same generic gate array, thereby reducing production costs

ARB. See *arbitrate primitive signal*.

arbitrate primitive signal (ARB). A primitive signal that is transmitted as the fill word by a loop port (L_port) to indicate that the L_port is arbitrating to access to the loop. Applies only to the arbitrated loop topology.

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). An 8-bit value used to uniquely identify an individual port within a loop. A loop can have one or multiple AL_PAs.

arbitration wait timeout value (AW_TOV). The minimum time an arbitrating loop port (L_port) waits for a response before beginning loop initialization.

area number. A number that is assigned to each potential port location in the switch. Used to distinguish ports that have the same port number but are on different port cards.

ASIC. See *application-specific integrated circuit*.

asynchronous transfer mode (ATM). A broadband technology for transmitting data over local area networks (LANs) or wide area networks (WANs), based on relaying cells of fixed size. Provides any-to-any connectivity, and nodes can transmit simultaneously.

ATM. See *asynchronous transfer mode*.

auto-negotiate speed. Process that allows two devices at either end of a link segment to negotiate common features, speed (for example, 1 Gbps or 2 Gbps) and functions.

autoranging. A power supply that accommodates different input voltages and line frequencies.

autosense. Process during which a network device automatically senses the speed of another device.

AW_TOV. See *arbitration wait timeout value*.

B

backup FCS switch. The switch or switches assigned as backup in case the primary fabric configuration server (FCS) switch fails. See also *fabric configuration server switch* and *primary FCS switch*.

bandwidth. (1) The total transmission capacity of a cable, link, or system. Usually measured in bits per second (bps). (2) The range of transmission frequencies available to a network. See also *throughput*.

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

BB_credit. See *buffer-to-buffer credit*.

beacon. When all the port light-emitting diodes (LEDs) on a switch are set to flash from one side of the switch to the other, to enable identification of an individual switch in a large fabric. A switch can be set to beacon by Telnet command or through Web Tools.

beginning running disparity. The disparity at the transmitter or receiver when the special character associated with an ordered set is encoded or decoded. See also *disparity*.

BER. See *bit error rate*.

BIOS. See *basic input/output system*.

BISR. Built-in self-repair.

bit error rate (BER). The rate at which bits are expected to be received in error. Expressed as the ratio of error bits to total bits transmitted. See also *error*.

blade. One component in a system that is designed to accept some number of components (blades). Blades could be individual servers that plug into a multiprocessing system or individual port cards that add connectivity to a switch. A blade is typically a hot swappable hardware device. See *16-port card*.

blind-mate connector. A two-way connector used in some switches to provide a connection between the system board and the power supply.

block. As applies to fibre channel, upper-level application data that is transferred in a single sequence.

bloom. Application-specific integrated circuit (ASIC) technology that the 2109 Model M12 is based on.

boot flash. Flash memory that stores the boot code and boot parameters. The processor runs its first instructions from boot flash. Data is cached in random access memory (RAM).

boot monitor. Code used to initialize the control processor (CP) environment after powering on. Identifies the amount of memory available and how to access it, and retrieves information about system buses.

British thermal unit (BTU). A measurement of heat produced in one hour.

broadcast. The transmission of data from a single source to all devices in the fabric, regardless of zoning. See also *multicast* and *unicast*.

BTU. See *British thermal unit*.

buffer-to-buffer credit. The number of frames that can be transmitted to a directly-connected recipient or within an arbitrated loop. Determined by the number of receive buffers available. See also *buffer-to-buffer flow control*.

buffer-to-buffer flow control. Management of the frame transmission rate in either a point-to-point topology or in an arbitrated loop. See also *buffer-to-buffer credit*.

C

CAM. Content addressable memory.

cascade. Two or more interconnected Fibre Channel switches that can build large fabrics. Switches can be cascaded up to 239 switches, with a recommended maximum of seven inter-switch links (no path longer than eight switches). See also *fabric* and *inter-switch link*.

central processing unit (CPU). A part of a computer that includes the circuits that control the interpretation and execution of instructions. A CPU in the circuitry and storage that executes instructions. Traditionally, the complete processing unit was often regarded as the CPU, whereas today the CPU is often a microchip. In either case, the centrality of a processor or processing unit depends on the configuration of the system or network in which it is used.

chassis. The metal frame in which the switch and switch components are mounted.

circuit. An established communication path between two ports. Consists of two virtual circuits capable of transmitting in opposite directions. See also *link*.

class 1. Service that provides a dedicated connection between two ports (also called connection-oriented service), with notification of delivery or nondelivery.

class 2. Connectionless service between ports with notification of delivery or nondelivery.

class 3. Connectionless service between ports without notification of delivery. Other than notification, the transmission and routing of class 3 frames is the same as class 2 frames.

class F. Connectionless service for inter-switch control traffic. Provides notification of delivery or nondelivery between two expansion ports (E_ports).

class of service. A specified set of delivery characteristics and attributes for frame delivery.

CLI. See *command line interface*.

CMI. Control message interface.

comma. A unique pattern (either 1100000 or 0011111) used in 8b/10b encoding to specify character alignment within a data stream. See also *K28.5*.

command line interface (CLI). Interface that depends entirely on the use of commands, such as through

Telnet or simple network management protocol (SNMP), and does not involve a graphical user interface.

community (SNMP). A relationship between a simple network management protocol (SNMP) agent and a set of SNMP managers that defines authentication, access control, and proxy characteristics.

compact flash. Flash memory that stores the run-time operating system and is used like hard disk storage. Not visible within the memory space of the processor. Data is stored in file system format. Also called user flash.

control processor (CP). The central processing unit that provides all control and management functions in a switch.

control processor card (CP card). The central processing unit of the director/switch, which contains two control processor (CP) card slots to provide redundancy. Provides Ethernet, serial, and modem ports with the corresponding light-emitting diodes (LEDs).

core switch. A switch whose main task is to interconnect other switches. Also referred to as a backbone switch. See also *edge switch*.

CP. See *control processor*.

CP card. See *control processor card*.

CPLD. Complex programmable logic device.

CPU. See *central processing unit*.

CRC. See *cyclic redundancy check*.

credit. When applied to a switch, the maximum number of receive buffers provided by a fabric port (F_port) or fabric loop port (FL_port) to its attached node port (N_port) or node loop port (NL_port), respectively, such that the N_port or NL_port can transmit frames without over-running the F_port or FL_port.

CSA. Canadian Standards Association.

cut-through. A switching technique that allows the route for a frame to be selected as soon as the destination address is received. See also *route*.

cyclic redundancy check (CRC). A check for transmission errors included in every data frame.

D

data communications equipment (DCE) port. A port that is capable of interfacing between a data terminal equipment (DTE) port and a transmission circuit. DCE devices with an RS-232 (or EIA-232) port interface transmit on pin 3, and receive on pin 2. See also *data terminal equipment (DTE) port*.

data rate. The rate at which data is transmitted or received from a device. Interactive applications tend to require a high data rate, while batch applications can usually tolerate lower data rates.

data terminal equipment (DTE) port. A port that is capable of interfacing to a transmission circuit through a connection to a data communications equipment (DCE) port. DTE devices with an RS-232 (or EIA-232) port interface transmit on pin 3, and receive on pin 2 in a 9-pin connector (reversed in 25-pin connectors). See also *data communications equipment (DCE) port*.

DB-9 connector. A 9-pin version of the RS-232C port interface.

DCC. A dc converter.

DCE port. See *data communications equipment (DCE) port*.

DDR. Double data rate. See *data rate*.

defined zone configuration. The complete set of all zone objects that are defined in the fabric. The defined configuration can include multiple zone configurations. See also *enabled zone configuration* and *zone configuration*.

device. Hosts and storage that connect to a switch. Example devices are servers, redundant array of independent disks (RAID) arrays, and tape subsystems.

device connection controls. Enables organizations to bind an individual device port to a set of one or more switch ports. Device ports are specified by a worldwide name (WWN) and typically represent host bus adapters (HBAs) (servers). See also *access control lists*.

DID. The 3-byte destination ID of the destination device, in the 0xDomainAreaALPA format.

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

disparity. The relationship of ones and zeros in an encoded character. *Neutral disparity* means an equal number of each, *positive disparity* means a majority of ones, and *negative disparity* means a majority of zeros.

DLS. See *dynamic load sharing*.

DMA. See *direct memory access*.

DNS. Distributed name server.

domain_ID. Unique identifier for the switch in a fabric. Usually automatically assigned by the switch, but can also be assigned manually. Can be any value between 1–239.

DRAM. See *dynamic random access memory*.

DTE port. See *data terminal equipment (DTE) port*.

dual fabric. Two identical fabrics that allow redundancy in the event that one fabric fails. Use a dual fabric for mission critical applications.

dual-fabric SAN. A storage area network (SAN) that is composed of two independent fabrics. Synonymous with multi-fabric SAN. The two-fabric architecture makes dual-fabric SANs redundant.

DWDM. Dense wavelength digital multiplexing.

dynamic load sharing (DLS). Dynamic distribution of traffic over available paths. Allows for recomputing of routes when a fabric port or fabric loop port (Fx_port) or expansion port (E_port) changes status.

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

E

edge fabric. A single fabric that uses two or more switches as a core to interconnect multiple edge switches. Synonymous with dual-core fabric. See also *resilient core*.

edge switch. A switch whose main task is to connect nodes into the fabric. See also *core switch*.

E_D_TOV. See *error detect timeout value*.

EE_credit. See *end-to-end credit*.

effective zone configuration. The particular zone configuration that is currently in effect. Only one configuration can be in effect at once. The effective configuration is built each time a zone configuration is enabled.

EIA. Electronic Industries Alliance.

EIA rack. A storage rack that meets the standards set by the Electronics Industries Alliance (EIA).

electromagnetic compatibility (EMC). The design and test of products to meet legal and corporate specifications dealing with the emissions and susceptibility to frequencies in the radio spectrum. Electromagnetic compatibility is the ability of various electronic equipment to operate properly in the intended electromagnetic environment.

electromagnetic interference (EMI). Waves of electromagnetic radiation, including but not limited to radio frequencies, generated by the flow of electric current.

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

ELP. Extended link parameters.

ELWL. See *extra long wavelength*.

EMC. See *electromagnetic compatibility*.

EMI. See *electromagnetic interference*.

enabled zone configuration. The currently enabled configuration of zones. Only one configuration can be enabled at a time. See also *defined zone configuration* and *zone configuration*.

end port. A port on an edge switch that connects a device to the fabric.

end-to-end credit (EE_credit). The number of receive buffers allocated by a recipient port to an originating port. Used by class 1 and class 2 services to manage the exchange of frames across the fabric between source and destination. See also *end-to-end flow control* and *buffer-to-buffer credit*.

end-to-end flow control. Governs flow of class 1 and class 2 frames between node ports (N_ports). See also *end-to-end credit*.

E_port. See *expansion port*.

error. As applies to fibre channel, a missing or corrupted frame, timeout, loss of synchronization, or loss of signal (link errors). See also *loop failure*.

error detect timeout value (E_D_TOV). The time that the switch waits for an expected response before declaring an error condition. Adjustable in 1 microsecond increments from 2—10 seconds.

ESD. See *electrostatic discharge*.

exchange. The highest level Fibre Channel mechanism used for communication between node ports (N_ports). Composed of one or more related sequences, and can work in either one or both directions.

expansion port (E_port). A port is designated an expansion port (E_port) when it is used as an inter-switch expansion port to connect to the E_port of another switch, to build a larger switch fabric.

Extended Fabrics. A feature that runs on Fabric operating system (OS) and allows creation of a Fibre Channel fabric interconnected over distances of up to 100 km (62.14 mi).

extra long wavelength (ELWL). Laser light with a periodic length greater than 1300 nm (for example, 1420 or 1550). ELWL lasers are used to transmit Fibre Channel data over distances greater than 10 km. Also known as XLWL.

F

fabric. A network that uses high-speed fibre connections to connect switches, hosts, and devices. A fabric is an active, intelligent, nonshared interconnect scheme for nodes.

Fabric Access. Allows the application to control the fabric directly for functions such as discovery, access (zoning) management, performance, and switch control. Consists of a host-based library that interfaces the application to switches in the fabric over an out-of-band TCP/IP connection or in-band using an IP-capable host bus adapter (HBA).

Fabric Assist. A feature that enables private and public hosts to access public targets anywhere on the fabric, provided they are in the same Fabric Assist zone.

fabric configuration server (FCS) switch. One or more designated switches that store and manage the configuration and security parameters for all switches in the fabric. FCS switches are designated by worldwide name (WWN), and the list of designated switches is communicated fabric-wide. See also *backup FCS switch*, *primary FCS switch*.

fabric login (FLOGI). The process by which a device gains access to the fabric.

fabric loop port (FL_port). A fabric port that is loop capable. Used to connect node loop ports (NL_ports) to the switch in a loop configuration.

Fabric Manager. A feature that allows the storage area network (SAN) manager to monitor key fabric and switch elements, making it easy to quickly identify and escalate potential problems. It monitors each element for out-of-boundary values or counters and provides notification when defined boundaries are exceeded. The SAN manager can configure which elements, such as error, status, and performance counters, are monitored within a switch.

fabric mode. One of the modes for a loop port (L_port). An L_port is in fabric mode when it is connected to a port that is not loop capable and is using fabric protocol. See also *loop port* and *loop mode*.

fabric name. The unique identifier assigned to a fabric and communicated during login and port discovery.

Fabric OS. An operating system made up of two software components: the firmware that initializes and manages the switch hardware, and diagnostics.

fabric port (F_port). A port that is able to transmit under fabric protocol and interface over links. Can be used to connect a node port (N_port) to a switch. See also *fabric loop port* and *Fx_port*.

Fabric Watch. A feature that runs on Fabric operating system (OS) and allows monitoring and configuration of fabric and switch elements.

failover. The act that causes control to pass from one redundant unit to another.

FAN. Fabric address notification.

FC. See *fibre channel*.

FCA. See *Fibre Channel arbitrated loop*.

FC-AL. See *Fibre Channel arbitrated loop*.

FC-AL-3. The Fibre Channel Arbitrated Loop standard defined by ANSI. Defined on top of the FC-PH standards.

FCC. Federal Communications Commission.

FC-FLA. The Fibre Channel Fabric Loop Attach standard defined by ANSI.

FCMGMT. Fibre Alliance Fibre Channel Management.

FCP. See *Fibre Channel protocol*.

FC-PDLA. The Fibre Channel Private Loop Direct Attach standard defined by ANSI. Applies to the operation of peripheral devices on a private loop.

FC-PH-1,2,3. The Fibre Channel Physical and Signaling Interface standards defined by ANSI.

FC-PI. The Fibre Channel Physical Interface standard defined by ANSI.

FCS switch. See *fabric configuration server switch*.

FC-SW-2. The second generation of the Fibre Channel Switch Fabric standard defined by ANSI. Specifies tools and algorithms for the interconnection and initialization of Fibre Channel switches in order to create a multiswitch Fibre Channel fabric.

fibre channel (FC). A technology for transmitting data between computer devices at a data rate of up to 4 Gbps. It is especially suited for attaching computer servers to shared storage devices and for interconnecting storage controllers and drives.

Fibre Channel arbitrated loop (FC-AL). A standard defined on top of the FC-PH standard. It defines the arbitration on a loop where several FC nodes share a common medium.

Fibre Channel protocol (FCP). The protocol for transmitting commands, data, and status using Fibre Channel FC-FS exchanges and information units. Fibre channel is a high-speed serial architecture that allows either optical or electrical connections at data rates from 265 Mbps up to 4-Gbps.

Fibre Channel service (FS). A service that is defined by Fibre Channel standards and exists at a well-known address. For example, the Simple Name Server is a Fibre Channel service. See also *Fibre Channel service protocol*.

Fibre Channel service protocol (FSP). The common protocol for all fabric services, transparent to the fabric type or topology. See also *Fibre Channel service*.

Fibre Channel shortest path first (FSPF). A routing protocol used by Fibre Channel switches.

Fibre Channel transport. A protocol service that supports communication between Fibre Channel service providers. See also *Fibre Channel service protocol*.

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

File Transfer protocol (FTP). In Transmission Control protocol/Internet protocol (TCP/IP), an application protocol used for transferring files to and from host computers.

fill word. An IDLE or ARB ordered set that is transmitted during breaks between data frames to keep the Fibre Channel link active.

firmware. The basic operating system provided with the hardware.

FLA. Fabric loop attach.

flash partition. Two redundant usable areas, called *partitions* into which firmware can be downloaded in the director/switch.

FLOGI. See *fabric login*.

FL_port. See *fabric loop port*.

F_port. See *fabric port*.

frame. The Fibre Channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, any optional headers, the data payload, a cyclic redundancy check (CRC), and an end-of-frame delimiter. There are two types of frames: link control frames (transmission acknowledgements, and so on) and data frames.

frame delimiter. A part of an ordered set that marks frame boundaries and describes frame contents. See also *ordered set*.

FRU. See *field replaceable unit*.

FS. See *Fibre Channel service*.

FSP. See *Fibre Channel service protocol*.

FSPF. See *Fibre Channel shortest path first*.

FTP. See *File Transfer protocol*.

full duplex. A mode of communication that allows the same port to simultaneously transmit and receive frames. See also *half duplex*.

Fx_port. A fabric port that can operate as either a fabric port (F_port) or fabric loop port (FL_port). See also *fabric port* and *fabric loop port*.

G

gateway. Hardware that connects incompatible networks by providing the necessary translation for both hardware and software.

GBIC. See *gigabit interface converter*.

Gbps. Gigabits per second.

GBps. Gigabytes per second.

generic port (G_port). A generic port that can operate as either an expansion port (E_port) or a fabric port (F_port). A port is defined as a G_port when it is not yet connected or has not yet assumed a specific function in the fabric.

gigabit interface converter (GBIC). A removable serial transceiver module designed to provide gigabaud capability for fibre channel (FC) and other products that use the same physical layer.

gigabit switch. A 16-port, Fibre Channel gigabit switch.

G_port. See *generic port*.

H

half duplex. A mode of communication that allows a port to either transmit or receive frames at any time, but not simultaneously (with the exception of link control frames, which can be transmitted at any time). See also *full duplex*.

hard address. The arbitrated loop physical address (AL_PA) that a node loop port (NL_port) attempts to acquire during loop initialization.

hardware translative mode. Method for achieving address translation. The two hardware translative modes that are available to a QuickLoop-enabled switch are standard translative mode and QuickLoop mode. See also *standard translative mode* and *QuickLoop mode*.

HBA. See *host bus adapter*.

heartbeat. Through clustering software, the application server continually communicates with the clustered

spare using network heartbeats to indicate to the other machines that everything is operating correctly. This heartbeat is typically carried over a dedicated network for clustering traffic. In cases of a problem (for example, a software crash on the operational server or a hardware component failure), a heartbeat link indicates to the other server that something has failed or is otherwise inoperative. If that heartbeat is lost, the spare server takes over the function provided by the application service. Depending on the clustering software, either the entire server or only specific services on the server can be failed over or failed back.

high availability. An attribute of the switch that identifies it as being capable of operating well in excess of 99 percent of the time. High Availability is typically identified by the number of nines in that percentage. For example, a switch that is rated at five nines would be capable of operating 99.999 percent of the time without failure.

high port count fabric. A fabric containing 100 or more ports.

host bus adapter (HBA). The interface card between a server or workstation bus and the Fibre Channel network.

hot pluggable. A field replaceable unit (FRU) capability that indicates it can be extracted or installed while customer data is otherwise flowing in the chassis.

hub. A Fibre Channel wiring concentrator that collapses a loop topology into a physical star topology. Nodes are automatically added to the loop when active and removed when inactive.

I

IC bus. A serial, 2-wire bus used to monitor field replaceable unit (FRU) temperatures and control the system including blade power control.

ID. Identification.

IDB. Interface descriptor block.

IDLE. Continuous transmission of an ordered set over a Fibre Channel link when no data is being transmitted, to keep the link active and maintain bit, byte, and word synchronization.

IEC. International Electrotechnical Commission.

IETF. Internet Engineering Task Force.

information unit (IU). A set of information as defined by either upper-level process protocol definition or upper-level protocol mapping.

initiator. A server or workstation on a Fibre Channel network that initiates communications with storage devices. See also *target*.

in-order delivery (IOD). A parameter that, when set, guarantees that frames are either delivered in order or dropped.

integrated fabric. The fabric created by six switches cabled together and configured to handle traffic as a seamless group.

Internet protocol (IP). In the Internet suite of protocols, a connectionless protocol that routes data through a network or interconnected networks and acts as an intermediary between the higher protocol layers and the physical network.

inter-switch link (ISL). A Fibre Channel link that connects two switches (a link from the expansion port (E_port) of one switch to the E_port of another).

IOD. See *in-order delivery*.

IP. See *internet protocol*.

IPA. Initial process associator.

ISL. See *inter-switch link*.

ISL Trunking. A feature that enables distribution of traffic over the combined bandwidth of up to four inter-switch links (ISLs) (between adjacent switches), while preserving in-order delivery. A set of trunked ISLs is called a *trunking group*; each port employed in a trunking group is called a *trunking port*. See also *master port*.

isolated E_port. An expansion port (E_port) that is online but not operational between switches due to overlapping domain ID or nonidentical parameters such as error delay timeout values (E_D_TOVs). See also *expansion port*.

IU. See *information unit*.

J

JBOD. Just a bunch of disks.

K

K28.5. A special 10-bit character used to indicate the beginning of a transmission word that performs fibre channel control and signaling functions. The first seven bits of the character are the comma pattern. See also *comma*.

kernel flash. Flash memory that stores the bootable kernel code and is visible within the memory space of the processor. Data is stored as raw bits.

key pair. In public key cryptography, a pair of keys consisting of a public and private key of an entity. The public key can be publicized, but the private key must be kept secret.

L

LAN. See *local area network*.

latency. The period of time required to transmit a frame, from the time it is sent until it arrives.

LED. See *light-emitting diode*.

light-emitting diode (LED). A semiconductor chip that gives off visible or infrared light when activated. It is used to indicate the status of elements on a switch.

link. As applies to fibre channel, a physical connection between two ports, consisting of both transmit and receive fibers. See also *circuit*.

link services. A protocol for link-related services.

LIP. See *loop initialization primitive*.

LM_TOV. See *loop master timeout value*.

local area network (LAN). A computer network located on a user's premises within a limited geographical area. (T)

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.

long wavelength (LWL). A type of fiber optic cabling that is based on 1300 nm lasers and supports link speeds of 1.0625 Gbps. Can also refer to the type of GBIC or SFP. See also *short wavelength*.

loop. A configuration of devices that are connected to the fabric by way of a fabric loop port (FL_port) interface card.

loop circuit. A temporary bidirectional communication path established between loop ports (L_ports).

loop failure. Loss of signal within a loop for any period of time, or loss of synchronization for longer than the timeout value.

loop_ID. A hexadecimal value representing one of the 127 possible arbitrated loop physical address (AL_PA) values in an arbitrated loop.

loop initialization. The logical procedure used by a loop port (L_port) to discover its environment. Can be used to assign arbitrated loop physical address (AL_PA) addresses, detect loop failure, or reset a node.

loop initialization primitive (LIP). The signal used to begin initialization in a loop. Indicates either loop failure or resetting of a node.

looplest. A set of devices connected in a loop to a port that is a member of another loop.

loop master timeout value (LM_TOV). The minimum time that the loop master waits for a loop initialization sequence to return.

loop mode. One of the modes for a loop port (L_port). An L_port is in loop mode when it is in an arbitrated loop and is using loop protocol. An L_port in loop mode can also be in participating mode or nonparticipating mode. See also *loop port*, *fabric mode*, *participating mode*, and *nonparticipating mode*.

loop port (L_port). A node port (NL_port) or fabric port (FL_port) that has arbitrated loop capabilities. An L_port can be either in fabric mode or loop mode. See also *fabric mode*, *loop mode*, *nonparticipating mode*, and *participating mode*.

loop port state machine (LPSM). The logical entity that performs arbitrated loop protocols and defines the behavior of loop ports (L_ports) when they require access to an arbitrated loop.

L_port. See *loop port*.

LPSM. See *loop port state machine*.

LSR. Link state record.

LSU. Link state update.

LUN. See *logical unit number*.

LWL. See *long wavelength*.

M

MAC. Media access controller.

MAC address. See *Media Access Controller address*.

management information base (MIB). A simple network management protocol (SNMP) structure to help with device management, providing configuration and device information.

master port. As relates to trunking, the port that determines the routing paths for all traffic flowing through the trunking group. One of the ports in the first inter-switch link (ISL) in the trunking group is designated as the master port for that group. See also *ISL Trunking*.

Media Access Controller address. The hardware address of a device connected to a shared network medium.

MIB. See *management information base*.

modem serial port. The upper serial port on the control processor card (CP card). Can be used to connect the CP card to a modem with a standard 9-pin modem cable. Consists of a DB-9 connector wired as an RS-232 device, and can be connected by serial

cable to a data communications equipment (DCE) device. A Hayes-compatible modem or Hayes-emulation is required. The device name is ttyS1. See also *data communications equipment port* and *terminal serial port*.

multicast. The transmission of data from a single source to multiple specified node ports (N_ports), as opposed to all the ports on the network. See also *broadcast* and *unicast*.

multimode. A fiber optic cabling specification that allows up to 500 m (1640.5 ft) between devices.

N

name server. Frequently used to indicate Simple Name Server. See also *simple name server*.

NEMA. National Electrical Manufacturers Association.

NL_port. See *node loop port*.

NMS. Network Management System.

node. A Fibre Channel device that contains a node port (N_port) or node loop port (NL_port).

node loop port (NL_port). A node port that is loop capable. Used to connect an equipment port to the fabric in a loop configuration through a fabric loop port (FL_port).

node name. The unique identifier for a node, communicated during login and port discovery.

node port (N_port). A node port that is not loop capable. Used to connect an equipment port to the fabric.

nonparticipating mode. A mode in which a loop port (L_port) in a loop is inactive and cannot arbitrate or send frames, but can retransmit any received transmissions. This mode is entered if there are more than 127 devices in a loop and an arbitrated loop physical address (AL_PA) cannot be acquired. See also *participating mode*.

nonvolatile random access memory (NVRAM). Random access memory (storage) that retains its contents after the electrical power to the machine is shut off. A specific part of NVRAM is set aside for use by the system ROS for the boot device list.

N_port. See *node port*.

NVRAM. See *nonvolatile random access memory*.

Nx_port. A node port that can operate as either a node port (N_port) or node loop port (NL_port). See also *node port* and *node loop port*.

O

operating system (OS). A collection of system programs that control the overall operation of a computer system.

ordered set. A transmission word that uses 8b/10b mapping and begins with the K28.5 character. Ordered sets occur outside of frames, and include frame delimiters, primitive signals, and primitive sequences. Ordered sets are used to differentiate Fibre Channel control information from data frames and to manage the transport of frames. See also *frame delimiter*, *primitive signal*, and *primitive sequence*.

OS. See *operating system*.

P

packet. A set of information transmitted across a network. See also *frame*.

participating mode. A mode in which a loop port (L_port) in a loop has a valid arbitrated loop physical address (AL_PA) and can arbitrate, send frames, and retransmit received transmissions. See also *nonparticipating mode*.

path selection. The selection of a transmission path through the fabric. Switches use the Fibre Channel shortest path first (FSPF) protocol.

PCI. Peripheral control interconnect.

PDU. Power distribution unit.

Performance Monitoring. A feature that provides error and performance information to the administrator and user for use in storage management.

phantom address. An arbitrated loop physical address (AL_PA) value that is assigned to a device that is not physically in the loop. Also known as phantom AL_PA.

phantom device. A device that is not physically in an arbitrated loop, but is logically included through the use of a phantom address.

PLDA. See *private loop direct attach*.

PLOGI. See *port login*.

PMC. PCI mezzanine card.

P/N. Part number.

point-to-point. A Fibre Channel topology that employs direct links between each pair of communicating entities. See also *topology*.

port cage. The metal casing extending out of the optical port on the switch, and in which the gigabit

interface converter (GBIC) or small form-factor pluggable (SFP) can be inserted.

port card. A Fibre Channel card that contains optical or copper port interfaces, and acts like a switch module. See also *16-port card*.

port login (PLOGI). The port-to-port login process by which initiators establish sessions with targets. See also *fabric login*.

port module. A collection of ports in a switch.

port_name. The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.

POST. See *power-on self-test*.

power-on self-test (POST). A series of diagnostics that are automatically run by a device when the power is turned on.

primary FCS switch. Primary fabric configuration server switch. The switch that actively manages the configuration and security parameters for all switches in the fabric. See also *backup FCS switch* and *FCS switch*.

primitive sequence. A part of an ordered set that indicates or initiates port states. See also *ordered set*.

primitive signal. A part of an ordered set that indicates events. See also *ordered set*.

principal switch. The switch that assumes the responsibility to assign domain IDs. The role of principal switch is negotiated after a “build fabric” event.

private device. A device that supports arbitrated loop protocol and can interpret 8-bit addresses, but cannot log into the fabric.

private loop. An arbitrated loop that does not include a participating fabric loop port (FL_port).

private loop direct attach (PLDA). A subset of fibre channel standards for the operation of peripheral devices.

private NL_port. A node loop port (NL_port) that communicates only with other private NL_ports in the same loop and does not log into the fabric.

protocol. A defined method and a set of standards for communication.

public device. A device that supports arbitrated loop protocol, can interpret 8-bit addresses, and can log into the fabric.

public loop. An arbitrated loop that includes a participating fabric loop port (FL_port), and can contain both public and private node loop ports (NL_ports).

public NL_port. A node loop port (NL_port) that logs into the fabric, can function within either a public or private loop, and can communicate with either private or public NL_ports.

Q

quad. A group of four adjacent ports that share a common pool of frame buffers.

QuickLoop. (1) A feature that makes it possible to allow private devices within loops to communicate with public and private devices across the fabric through the creation of a larger loop. (2) The arbitrated loop created using this software. A QuickLoop can contain a number of devices or looplets; all devices in the same QuickLoop share a single arbitrated loop physical address (AL_PA) space.

QuickLoop mode. A hardware translative mode that allows private devices to communicate with other private devices across the fabric. See also *hardware translative mode* and *standard translative mode*.

R

RAID. See *redundant array of independent disks*.

RAM. See *random access memory*.

RAN. Remote Asynchronous Notification.

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

R_A_TOV. See *resource allocation timeout value*.

read only memory (ROM). Memory in which stored data cannot be changed by the user except under special conditions.

receiver ready (R_RDY). A primitive signal indicating that the port is ready to receive a frame.

reduced instruction set computer (RISC). A computer that uses a small, simplified set of frequently used instructions for rapid processing.

redundant array of independent disks (RAID). A collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking.

registered state change notification (RSCN). A switch function that allows notification of fabric changes to be sent from the switch to specified nodes.

remote fabric. A fabric that spans across wide area networks (WANs) by using protocol translation (a process also known as tunneling) such as fibre channel

over asynchronous transfer mode (ATM) or fibre channel over Internet protocol (IP).

remote procedure call (RPC). A facility that a client uses to request the execution of a procedure call from a server.

Remote Switch. A feature that runs on Fabric operating system (OS) and enables two fabric switches to be connected over an asynchronous transfer mode (ATM) connection. This requires a compatible Fibre Channel to ATM gateway, and can have a distance of up to 10 km (6.214 mi) between each switch and the respective ATM gateway.

request rate. The rate at which requests arrive at a servicing entity. See also *service rate*.

resilient core. A single fabric that uses two or more switches as a core to interconnect multiple edge switches. Synonymous with dual-core fabric.

resource allocation timeout value (R_A_TOV). Used to time out operations that depend on the maximum possible time that a frame can be delayed in a fabric and still be delivered. This value is adjustable in one microsecond increments from 10—120 seconds.

resource recover timeout value (RR_TOV). The minimum time a target device in a loop waits after a loop initialization primitive (LIP) before logging out a small computer systems interface (SCSI) initiator. See also *error detect timeout value* and *resource allocation timeout value*.

RISC. See *reduced instruction set computer*.

RLS probing. Read link status of the arbitrated loop physical addresses (AL_PAs).

ro. Read only.

ROM. See *read only memory*.

route. As applies to a fabric, the communication path between two switches. Can also apply to the specific path taken by an individual frame, from source to destination. See also *Fibre Channel shortest path first*.

routing. The assignment of frames to specific switch ports, according to frame destination.

RPC. See *remote procedure call*.

R_RDY. See *receiver ready*.

RR_TOV. See *resource recovery timeout value*.

RS-232 port. A port that conforms to a set of Electrical Industries Association (EIA) standards. Used to connect data terminal equipment (DTE) and data communications equipment (DCE) devices for

communication between components, terminals, and modems. See also *DB-9 connector*, *DCE port*, and *DTE port*.

RSCN. See *registered state change notification*.

RSH. Remote shell.

RTC. Real time clock.

rw. Read-write.

S

SAN. See *storage area network*.

SAN island. A group of storage devices and servers connected to switches in a fabric.

SC. Standard connector.

SCSI. See *small computer systems interface*.

SCSI Enclosure Services (SES). A subset of the small computer systems interface (SCSI) protocol used to monitor temperature, power, and fan status for enclosure devices.

SDRAM. See *synchronous dynamic random access memory*.

Secure Fabric OS. An optionally-licensed software product that runs on top of the Fabric OS and provides customizable security restrictions through local and remote management channels on a switch.

secure sockets layer (SSL). A security protocol that provides communication privacy. SSL enables client/server applications to communicate in a way that is designed to prevent eavesdropping, tampering, and message forgery.

sequence. A group of related frames transmitted in the same direction between two node ports (N_ports).

SERDES. Serializer/deserializer.

service rate. The rate at which an entity can service requests. See also *request rate*.

SES. See *SCSI Enclosure Services*.

SFP. See *small form-factor pluggable*.

short wavelength (SWL). A type of fiber optic cabling that is based on 850 nm lasers and supports 1.0625 Gbps link speeds. Can also refer to the type of gigabit interface converter (GBIC) or small form-factor pluggable (SFP). See also *long wavelength*.

SID. The 3-byte source ID of the originator device, in the 0xDomainAreaALPA format.

SID-DID. Source identifier-destination identifier.

SIMMS. Single in-line modules.

simple name server (SNS). A switch service that stores names, addresses, and attributes for up to 15 minutes, and provides them as required to other devices in the fabric. SNS is defined by Fibre Channel standards and exists at a well-known address. Can also be referred to as directory service. See also *Fibre Channel service*.

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).

single mode. The fiber optic cabling standard that corresponds to distances of up to 10 km (6.214 mi) between devices.

small computer systems interface (SCSI). A parallel bus architecture and a protocol for transmitting large data blocks up to a distance of 15–25 m (49–82 ft).

small form-factor pluggable (SFP). An optical transceiver used to convert signals between optical fiber cables and switches.

SMI. Special memory interface.

SNIA. Storage Network Industry Association.

SNMP. See *simple network management protocol*.

SNMPv1. The original standard for SNMP, now labeled v1.

SNS. See *simple name server*.

SOF. Start-of-frame.

SSL. See *secure sockets layer*.

standard translative mode. A hardware translative mode that allows public devices to communicate with private devices across the fabric. See also *hardware translative mode* and *QuickLoop mode*.

storage area network (SAN). A network of systems and storage devices that communicate using Fibre Channel protocols. See also *fabric*.

subordinate switch. All switches in the fabric other than the principal switch. See also *principal switch*.

switch. Hardware that routes frames according to Fibre Channel protocol and is controlled by software.

switch name. The arbitrary name assigned to a switch.

switch port. A port on a switch. Switch ports can be expansion ports (E_ports), fabric ports (F_ports), or fabric loop ports (FL_ports).

SWL. See *short wavelength*.

synchronous dynamic random access memory (SDRAM). The main memory for the switch. Used for volatile storage during switch operation.

T

Tachyon. A type of host bus adapter.

target. A storage device on a Fibre Channel network. See also *initiator*.

TCP. See *transmission control protocol*.

tenancy. The time from when a port wins arbitration in a loop until the same port returns to the monitoring state. Also referred to as loop tenancy.

terminal serial port. The lower serial port on the control processor card (CP card) of the director switch. This port sends switch information messages and can receive commands. Can be used to connect the CP card to a computer terminal. Has an RS-232 connector wired as a data terminal equipment (DTE) device, and can be connected by serial cable to a data communications equipment (DCE) device. The connector pins 2 and 3 are swapped so that a straight-through cable can be used to connect to a terminal. The device name is ttyS0. Can also be referred to as the console port. See also *DCE port*, *DTE port*, and *modem serial port*.

throughput. The rate of data flow achieved within a cable, link, or system. Usually measured in bits per second (bps). See also *bandwidth*.

topology. As applies to fibre channel, the configuration of the Fibre Channel network and the resulting communication paths allowed.

translative mode. A mode in which private devices can communicate with public devices across the fabric.

transmission character. A 10-bit character encoded according to the rules of the 8b/10b algorithm.

Transmission control protocol (TCP). A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for Internet protocol.

transmission word. A group of four transmission characters.

trap (SNMP). The message sent by a simple network management protocol (SNMP) agent to inform the SNMP management station of a critical error. See also *simple network management protocol*.

tunneling. A technique for enabling two networks to treat a transport network as though it were a single communication link or local area network (LAN).

Tx. Transmitted.

U

U. Unit of measure for rack-mounted equipment.

UART. Universal Asynchronous Receiver Transmitter.

UDP. See *user datagram protocol*.

ULP. See *upper-level protocol*.

ULP_TOV. See *upper-level timeout value*.

unicast. The transmission of data from a single source to a single destination. See also *broadcast* and *multicast*.

universal port (U_port). A switch port that can operate as a generic port (G_port), expansion port (E_port), fabric port (F_port), or fabric loop port (FL_port). A port is defined as a U_port when it is not connected or has not yet assumed a specific function in the fabric.

U_port. See *universal port*.

upper-level protocol (ULP). The protocol that runs on top of Fibre Channel. Typical upper-level protocols are small computer system interface (SCSI), Internet protocol (IP), HIPPI, and IPI.

upper-level timeout value (ULP_TOV). The minimum time that a small computer system interface (SCSI) upper-level protocol (ULP) process waits for SCSI status before initiating ULP recovery.

user datagram protocol (UDP). A protocol that runs on top of Internet protocol (IP) and provides port multiplexing for upper-level protocols.

user flash. See *compact flash*.

V

VC. See *virtual circuit*.

VCCI. Voluntary Control Council for Interference

virtual circuit (VC). A one-way path between node ports (N_ports) that allows fractional bandwidth.

W

WAN. See *wide area network*.

WDM. Wave[®] division multiplexing.

well-known address. As pertaining to fibre channel, a logical address defined by the Fibre Channel standards as assigned to a specific function, and stored on the switch.

wide area network (WAN). A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan network, and that can use or provide public communications facilities. (T)

workstation. A computer used to access and manage the fabric. Can also be referred to as a management station or host.

worldwide name (WWN). Uniquely identifies a switch on local and global networks.

World Wide Web (WWW). A network of servers that contain programs and files. Many of the files contain hypertext links to other documents available through the network.

WWN. See *worldwide name*.

WWW. See *World Wide Web*.

X

XLWL. See *extra long wavelength*.

Z

zone. A set of devices and hosts attached to the same fabric and configured as being in the same zone. Devices and hosts within the same zone have access permission to others in the zone, but are not visible to any outside the zone. See also *zoning*.

zone alias. An alias for a set of port numbers or worldwide names (WWNs). Zone aliases can be used to simplify the entry of port numbers and WWNs. For example, "host" could be used as an alias for a WWN of 110:00:00:60:69:00:00:8a.

zone configuration. A set of zones designated as belonging to the same zone configuration. When a zone configuration is in effect, all valid zones in that configuration are also in effect.

zone member. A port, node, worldwide name (WWN), or alias, which is part of a zone.

zone scheme. The level of zoning granularity selected. For example, zoning can be done by switch or port, worldwide name (WWN), arbitrated loop physical address (AL_PA), or a mixture. See also *zone configuration*.

zone set. See *zone configuration*.

Zoning. A feature that runs on Fabric operating system (OS) and allows partitioning of the fabric into logical groupings of devices. Devices in a zone can only access and be accessed by devices in the same zone. See also *zone*.

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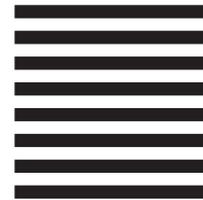
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