

IBM TotalStorage SAN Switch



# 3534 Model F08 Installation and User's Guide

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IBM TotalStorage SAN Switch



# 3534 Model F08 Installation and User's Guide

**Note:**

Before using this information and the product it supports, read the information in “Safety and environmental notices” on page xi and “Notices” on page 55.

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## Safety and environmental notices

This section contains information about:

- Safety notices that this document uses
- Safety inspection for this product
- Environmental guidelines for this product

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### Safety notices and their translations

Safety notices are printed in English throughout this document.

- A *Danger* notice warns you of conditions or procedures that can result in death or severe personal injury.
- A *Caution* notice warns you of conditions or procedures that can cause personal injury that is neither lethal nor extremely hazardous.
- An *Attention* notice warns you of conditions or procedures that can cause damage to machines, equipment, or programs.

For translations of danger and caution notices, see *IBM TotalStorage SAN Fibre Channel Switch 3534 Model F08 Translated Safety Notices*, GC26-7459. The notices are listed in numeric order based on their IDs, which are displayed in parentheses at the end of each notice. See the following examples for the location of the ID numbers.

#### **DANGER**

**An electrical outlet that is not correctly wired could place a hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (1)**

#### **CAUTION:**

**The 3534 Model F08 switch is designed to be installed by the customer, and is certified as "customer setup". Make sure that the system or rack into which the switch will be installed is also designed and certified for customer setup; if it is not, then the switch must be installed by a CE. (1)**

---

### Safety inspection

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 correcting the problem.

#### **CAUTION:**

**The 3534 Model F08 switch is designed to be installed by the customer, and is certified as "customer setup". Make sure that the system or rack into which the switch will be installed is also designed and certified for customer setup; if it is not, then the switch must be installed by a CE. (1)**

### Checking the machine

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 3534 Model F08 is not installed in a rack cabinet, check for loose or broken feet.
4. Check the power cord 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.

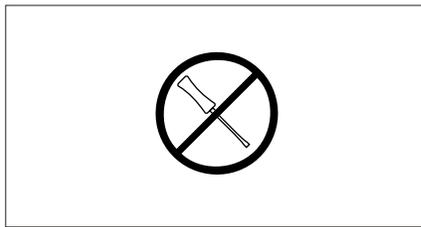
## Checking the safety labels

Perform the following safety label checks:

1. Verify that the power supply cover caution label shown in Figure 1 is installed on the power supply of the 3534 Model F08.

**CAUTION:**

**Do not remove cover, do not service, no serviceable parts. (2)**



SJ000337

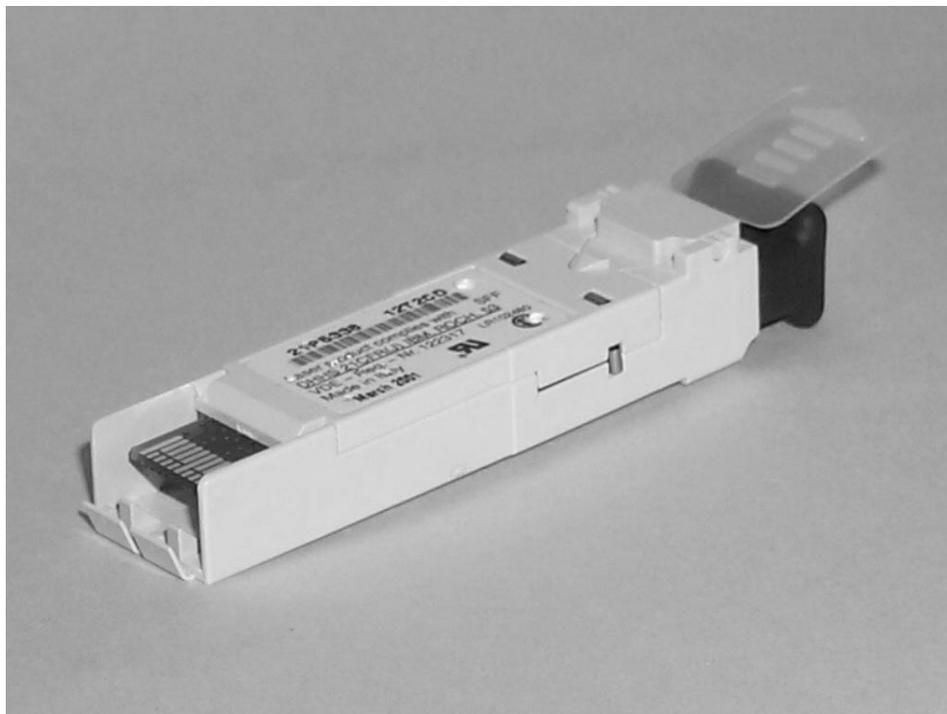
Figure 1. Power supply cover caution label

2. Verify that the small form-factor pluggable device (SFP) label shown in Figure 2 and Figure 3 on page xiii is installed on the 3534 Model F08.



SJ000317

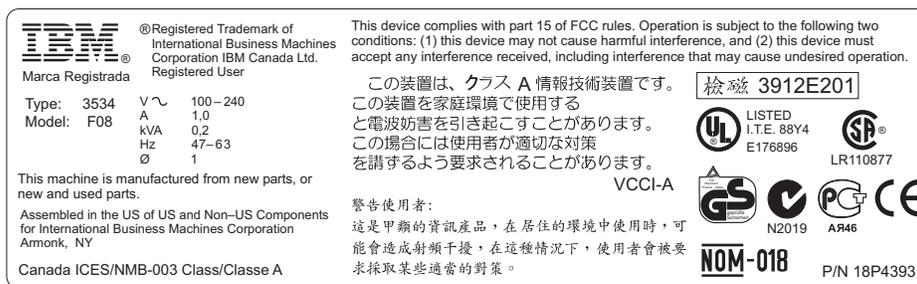
Figure 2. SFP label (front view)



SJ000314

Figure 3. SFP label (back view)

3. Verify that the safety label shown in Figure 4 is installed on the 3534 Model F08, and that the voltage specified on the label matches the voltage at the power source.



SJ000347

Figure 4. Safety label on the 3534 Model F08

## Checking ac grounding

### DANGER

An electrical outlet that is not correctly wired could place a hazardous voltage on the metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (1)

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## Environmental notices and statements

This section describes the environmental notices and statements.

### Battery notice

**CAUTION:**

A lithium battery can cause fire, explosion, or a severe burn. Do not recharge, disassemble, heat above 100°C (212°F), solder directly to the cell, incinerate, or expose cell contents to water. Keep away from children. Replace only with the part number specified for your system. Use of another battery may present a risk of fire or explosion. The battery connector is polarized; do not attempt to reverse the polarity. Dispose of the battery according to local regulations. (3)

### Laser safety

**CAUTION:**

In the United States use only GBIC units or Fibre-Optic products that comply with FDA radiation performance standards, 21 CFR Subchapter J. Internationally use only GBIC units or Fibre-Optic products 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. (4)



SJ000338

This unit might contain a single-mode or a multimode transceiver Class 1 laser product. The transceiver complies with IEC 825-1 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated under the recommended operating conditions.

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.

#### Usage restrictions

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

### 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.



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## About this document

This document introduces the IBM® TotalStorage™ SAN Switch 3534 Model F08, hereafter referred to as the 3534 Model F08. It also describes how to plan for, install, and use the 3534 Model F08.

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## Who should read this document

This document is intended for hardware service personnel who are responsible for installing the 3534 Model F08 in a storage area network (SAN) fabric. It is also intended for network administrators and system administrators whose responsibilities include administration and management of a SAN.

Throughout this document, the term *switch* applies to any IBM 3534 switch, unless the reference is to a specific model.

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## Additional information

This section contains the following information:

- A list of the documents in the 3534 Model F08 library
- A list of the related documents
- The available Web sites
- Instructions on how to get help
- Instructions on how to get software updates
- Information about how to send your comments

## 3534 Model F08 library

The following documents contain information related to this product:

- *IBM TotalStorage SAN Switch 3534 Model F08 Installation and User's Guide*, GC26-7559, (this book)
- *IBM TotalStorage SAN Fibre Channel Switch 3534 Model F08 Translated Safety Notices*, GC26-7459

## Related documents

You can find information that is related to the software that supports the 3534 Model F08 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 Distributed Fabric User's 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 QuickLoop User's Guide*
- *Brocade Secure Fabric OS User's Guide*

- *Brocade SES 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*

<b>Brocade model number</b>	<b>IBM product and model number</b>
Silkworm 2010	3534 Model 1RU
Silkworm 2400	2109 Model S08
Silkworm 2800	2109 Model S16
Silkworm 3200	3534 Model F08
Silkworm 3800	2109 Model F16
Silkworm 3900	2109 Model F32
Silkworm 12000	2109 Model M12

## Web sites

For detailed information about models and firmware that the switch supports, see the following Web site:

[www.ibm.com/storage/fcswitch/](http://www.ibm.com/storage/fcswitch/)

For detailed information about fibre-channel standards, see the fibre-channel Association Web site at:

[www.fibrechannel.com/](http://www.fibrechannel.com/)

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

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

## Getting help

Contact your switch supplier for technical support on hardware, all product repairs, and ordering of spare components. To report problems with the machine, call IBM at the following locations:

- In Canada, call 1-800-465-6666.
  - In the United States, call 1-800-IBM-SERV (426-7378).
- You might be asked to present proof of purchase.

Be prepared to provide the following information to the support personnel:

- The switch serial number
- The switch worldwide name
- The topology configuration
- Any output from the **supportShow** Telnet command
- A detailed description of the problem
- Any troubleshooting steps that were already performed

## Getting software updates

Contact your system vendor for software updates and maintenance releases.

For utility programs to facilitate loading firmware, sample Fabric Watch configurations, and management information base (MIB) files for switch management by simple network management protocol (SNMP), see the following Web site:

[www.storage.ibm.com/ibmsan/products/sanfabric.htm](http://www.storage.ibm.com/ibmsan/products/sanfabric.htm)

## How to send your comments

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

- E-mail

Submit your comments electronically to:

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

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

- Mail or fax

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

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



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## Chapter 1. Introduction

This chapter introduces the 3534 Model F08 and includes the following information:

- Overview of the 3534 Model F08
- System components
- Hardware components
- Software components
- How to manage the 3534 Model F08

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### Overview of the 3534 Model F08

The 3534 Model F08 is an 8-port, dual-speed, auto-sensing Fibre Channel switch. It supports link speeds up to 2 Gbps and is compatible and interoperable with the current series of 2109 and 3534 switches. It can operate as the only switch in the fabric or in a fabric that contains multiple switches.

The 3534 Model F08 has an air-cooled chassis that you can install either as a stand-alone unit or mount in a 1U 48.26 cm (19 in.) rack. It includes the following features:

- Eight optical ports, each with two light-emitting diodes (LEDs). One LED indicates port status and the other LED indicates link speed.
- Automatic negotiation to the highest common speed of all devices that are connected to a particular port. The ports are:
  - Compatible with small form-factor pluggable media (SFP)
  - Universal and self-configuring
  - Capable of individually becoming a fabric enabled port (F\_port), a fabric loop enabled port (FL\_port), or an expansion port (E\_port)
- One serial port with an RS-232 connector
- One 10 Mbps or 100 Mbps Ethernet port with an RJ-45 connector and two LEDs. One LED indicates port status and the other LED indicates link speed.
- Two switch status LEDs, one on the front panel and one on the back, which indicate the overall status of the switch
- One power supply without an ac switch
- Five fan assemblies

**Note:** The 3534 Model F08 contains no serviceable parts except the SFPs. See Chapter 4, “Replacing an SFP”, on page 31.

In addition, each 3534 Model F08 package includes:

- One 3.048 m (10 ft) RS-232 serial cable, which you can convert to an RJ-45 connector by removing the adapter on the end of the cable
- One 1.8288 m (6 ft) power cable
- Four rubber-mounting feet, which you can use if you are installing the switch as a stand-alone unit
- One power-cable extender
- One rack-mount kit, which you can use if you are installing the switch in a rack. See Table 3 on page 17 for a list of the parts included in the kit.
- One documentation CD-ROM

- One copy of this book, the *IBM TotalStorage SAN Switch 3534 Model F08 Installation and User's Guide*

See Appendix A, "Product specifications", on page 33 for the 3534 Model F08 specifications.

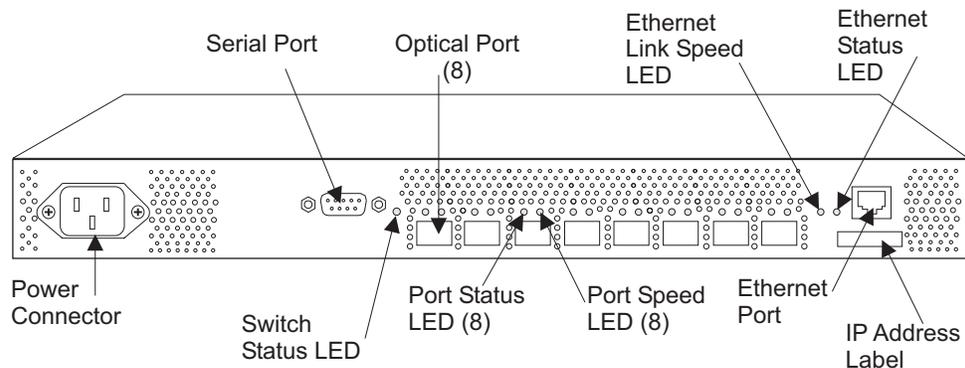
## System components

This section describes the front and back panels of the 3534 Model F08.

### Front panel

Figure 5 shows the front panel of the 3534 Model F08. The front panel contains the following components:

- Power connector
- IP address label
- Serial port
- Switch status LED
- Fiber optic ports and their corresponding LEDs
- Ethernet port and its corresponding LEDs



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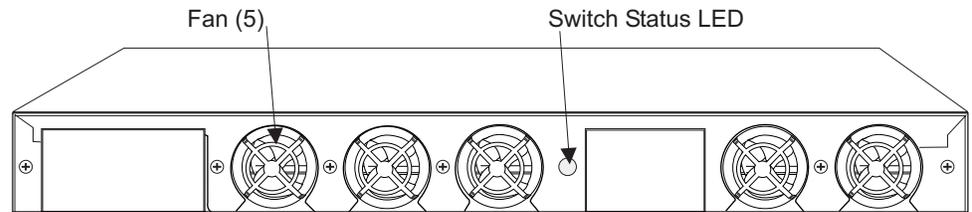
Figure 5. Front panel of the 3534 Model F08

The ports on the front panel are color-coded in groups, indicating which ports can be used in the same inter-switch link (ISL) Trunking group.

**Note:** ISL Trunking enables traffic to be distributed over the combined bandwidth of up to four ISLs between two adjacent switches, while preserving in-order delivery. It is managed through the software. For information about ISL Trunking, see the *Brocade ISL Trunking User's Guide*.

### Back panel

Figure 6 on page 3 shows the back panel of the 3534 Model F08. The back panel contains fans and the switch status LED.



SJ000336

Figure 6. Back panel of the 3534 Model F08

## Hardware components

The 3534 Model F08 system board is a single-board design with a highly integrated CPU. The Intel® 80960VH CPU is a RISC core processor and is the top choice for this platform. It provides over 70% of the functionality for the digital section of the system board. The system uses three types of memory devices: dynamic random access memory (DRAM), Flash File, and Boot Flash. On the Fibre Channel section of the system board, the following three components provide high-speed data transfer:

- The Bloom ASICs
- The Serializer/Deserializer (SERDES)
- The SFP media. SFP media interfaces support SWL and LWL.

## CPU subsystem

An Intel 80960VH CPU is used for management functions and switch initialization. The CPU runs the Fabric OS and is responsible for switch initialization, configuration, and management. Switching functionality is provided by the ASIC.

The following peripherals are also supported:

- An Ethernet port
- A serial port
- Three digital thermometers
- A real-time clock
- General input/output (I/O)

The CPU subsystem is a mixed voltage system that uses 1.8 V, 2.5 V, 3.3 V, and 5 V, depending on the device. The maximum board power consumption is 50 W.

### Features

The 3534 Model F08 CPU subsystem includes the following features:

- A 80960VH-100 MHz CPU
- An SDRAM controller with parity check at 33 MHz
- A peripheral control interconnect (PCI) bus arbiter
- Main memory (SDRAM): 32 MB
- Flash memory: Dual 8 MB
- Boot flash memory: 512 bytes of 8-bit for system start
- 10BASE-T or 100BASE-T port for management connection with RJ45 connector
- One RS232 port with DB9 connector

- Eight light-emitting diodes (LEDs) to indicate the status for each port
- Eight LEDs to indicate the link speed for each port
- One LED on the front panel to indicate the overall switch status
- One LED on the back panel to indicate the overall switch status
- Two LEDs for the Ethernet port to indicate the port status and link speed information
- Three digital thermometers for temperature sensing
- One 3.3 V to 1.8 V dc/dc converter for the Bloom ASIC core supply
- One Bloom ASIC to support up to eight nonblocking ports
- Eight SERDES
- One real-time clock with a battery

### **Embedded processor**

The embedded processor is an Intel 80960VH processor with a clock speed of 100 MHz. It contains the following components:

- A high-performance RISC processor core (compatible with the 2109 and 3534 series of switches)
- An integrated EDO memory controller (for DRAM, SRAM, read-only memory (ROM), and Flash memory)
- A PCI bus interface
- A complex programmable logic device (CPLD) for SDRAM control
- Two direct memory access (DMA) channels
- An I2C interface
- General purpose I/O

You access system memory through the local bus. The external CPLD SDRAM device provides SDRAM controller functionality at 33 MHz. It supports parity checking to enhance the data integrity of the system. The CPU communicates with the ASIC and the 10BASE-T or 100BASE-T Ethernet media access controller (MAC) through the PCI interface. An external PCI bus arbiter enables the Ethernet device to be a bus master.

You can also access the RS232 Universal Asynchronous Receiver Transmitter (UART) serial port through the local bus. Other I/O peripherals, such as the real-time clock, the LEDs, the three digital thermometers, and miscellaneous I/O are handled by the I2C bus of the CPU. The CPU is the only I2C bus master in the system. The RS232 port and drivers, Ethernet MAC/PHY, and LEDs are external components to the CPU. An RJ45 connector provides Ethernet connection to external systems. The DB9 RS232 is a ribbon-cable connection through the on-board 10-pin header.

### **Bus operations**

The interface between the embedded processor, the ASIC, and the 10BASE-T or 100BASE-T Ethernet MAC is implemented by using a PCI bus. All PCI devices on the bus are PCI Revision 2.2 compliant. The PCI bus interface operates at 32-bit, up to 33 MHz and has a worldwide even parity bit. A slave-only PCI interface is provided by each ASIC to allow the processor to program various registers, routing tables, and so on within the chip. An external PCI bus arbiter enables the Ethernet device to be a bus master.

The local bus, a 32-bit multiplexed burst bus, provides the interface between the system memory and the I/O. Because the integrated EDO memory controller on the

CPU allows only direct control for DRAM, SRAM, ROM, and Flash memory, the external CPLD controller is included to provide SDRAM controller functionality.

The I2C bus provides peripheral I/O control for the LEDs, the thermometers, and general I/O functions. The 80960VH CPU serves as the master on the I2C bus.

The Bloom ASIC is an eight-port Fibre Channel switch controller. A proprietary 10-bit wide SSTL2 bus running at 106.25 MHz is used between the Bloom ASIC and the SERDES.

### **Memory and memory architecture**

The system design uses three types of memory devices:

- DRAM
- Flash File
- Boot Flash

One on-board SDRAM chips provides up to 32 MB for system memory. One additional SDRAM chip provides data parity. The printed circuit board (PCB) SDRAM footprint is designed to be compatible with 64 MB, 128 MB, and 256 MB devices. An external CPLD device added to the local bus provides control functions for the 80960VH processor.

The system provides 4 MB of on-board redundant Flash File memory for software and data storage. The Boot Flash is an 8-bit Flash device socket that is used only for system start. The Boot Flash device contains a block area for startup code protection. The PLCC32 socket supports 3.3 V Boot Flash memory up to 512 KB.

As with the 2019 series of switches and the 3534 1RU switch, the 3534 Model F08 is based on a central memory architecture. In this scheme, a set of buffers in the central memory is assigned to each port to be used for receipt of frames. As an ASIC port receives and validates a frame, it stores the frame in one of its receive buffers in the central memory and forwards a routing request (a Put message) to the appropriate destination ports. When a destination port is capable of transmitting the frame, it reads the frame contents from central memory and forwards the frame to its transmit interface. It does not wait for the frame to be written in memory, unless the port is busy. After it has removed an entry for a frame from its internal transmit queue in preparation for transmitting a frame, the destination port sends a transmission complete message (a Finish message) to the port that received the frame. This allows the receiving port to reuse the buffer for subsequent frames received.

Central memory is also incorporated into the ASIC. Frames received on the ports in an ASIC are written into the portion of central memory.

The ASIC contains a RAM device plus data path crossbar logic that is used to implement the central memory. Memory blocks are accessed in a time-sliced fashion. The buffer pool can be split into 2112-byte buffers or into 312-byte mini-buffers. If frames that need to be buffered are smaller than the maximum 2112 bytes, using mini-buffers effectively expands the buffer pool and increases the efficiency of memory usage by providing more (but smaller) receive buffers.

Additionally, the Bloom ASIC provides a special memory interface (SMI). The SMI provides the firmware with a mechanism to read and write frame contents to and from the ASIC. It also supports higher throughput transfers. The SMI includes a set of two buffers that are large enough for an entire maximum-sized frame to be

transferred in a single operation. Additionally, because there are two buffers available, the firmware can perform a read or write on a frame in one of the buffers while the ASIC streams another frame into the other buffer.

## ASIC

The ASIC provides eight Fibre Channel ports that you can use to connect to external node ports (N\_ports) (as an F\_port) or external loop devices (as an FL\_port). You can connect one port (as an E\_port) to another 3534 or 2109 series switch. With the fabric upgrade, you might have up to eight E\_ports.

Each port can operate at either 1.0625 Gbps or 2.125 Gbps link speeds. The ASIC contains the Fibre Channel interface logic, message and buffer queuing logic, receive buffer memory for the eight on-chip ports, and other support logic.

The Bloom ASIC is a PCI slave to the CPU. The ASIC interfaces through an inter-chip 10-bit SSDL2 bus connection clocked at 106.25 MHz. An 8-channel SERDES is used to support eight ports. The interface between ASIC and SERDES is also a 10-bit SSDL2 bus running at 106.25 MHz. The SERDES converts the 10-bit wide parallel data from the SSDL2 bus into high-speed serial data for the SFP media and vice versa. The SERDES supports single data rate (SDR) or double data rate (DDR) transfer between the SERDES and the SFP media. Implementing the SERDES external to the ASIC reduces the risk of silicon packaging as well as the risk of running 2.125 Gbps signals on a board with a long trace length.

The SFP media interfaces with external devices and enables support for shortwave laser and longwave laser. Two LEDs for each port provide port status and link speed information.

**Control Message Interface:** The 3534 Model F08 Control Message Interface (CMI) consists of a set of control signals that are used to pass hardware-level messages between ports. Recipient ports use these control signals to inform transmitting ports when a new frame needs to be added to the output queue of the transmitter. Transmitting ports also use the CMI to inform recipient ports that a frame transmission has been completed. A recipient port is free to reuse a receive buffer when it receives notification that the frame has been transmitted. In the case of multicast, multiple notifications are required to determine when a receive buffer is freed.

The CMI interface for the ASIC is connected inside the ASIC. Each chip time slices its output port to each possible destination chip in the switch. If it has a message to send to a particular destination during the corresponding time slot, the chip uses the time slot to send the message. Otherwise, the output port lines are driven to indicate that no message is present.

## Ports

The 3534 Model F08 supports the following port types:

- Optical ports
- Ethernet port
- Serial port

The ASIC in the 3534 Model F08 connects up to eight SFP modules. SFP devices are encased in metal to ensure low emissions and high thermal management. They are hot-swappable and use industry-standard local channel connectors. Each port

provides ISL, loop, and fabric (E, F, and FL respectively) type connectivity that the 3534 Model F08 senses automatically. No administration is necessary to identify the port type.

### **Optical ports**

For optical ports, the 3534 Model F08 uses SFP fiber-optic transceivers that convert electrical signals to optical signals (and optical signals to electrical signals). Capable of transmitting at both 1 and 2 Gbps speeds, each SFP fiber-optic transceiver supports 850 nm SWL on multimode fiber-optic cable or 1310 nm LWL on single-mode fiber-optic cable. These miniature optical transceivers provide high port density and deliver twice the port density of standard removable gigabit interface converter (GBIC) transceivers.

### **Ethernet port**

The 3534 Model F08 provides a fully IEEE-compliant 10BASE-T or 100BASE-T Ethernet port for switch management console interface. When a device is connected to the port, both ends negotiate to determine the optimal speed. The Ethernet port uses an RJ45 connector. There are two LEDs for the port. One LED indicates transmit and receive activity and one LED indicates speed (10 Mbps or 100 Mbps). You can configure the Transmission Control Protocol/Internet Protocol (TCP/IP) address for the port from the serial port.

### **Serial port**

An RS232 serial port is provided on the 3534 Model F08. The serial port uses a DB9 connector. The connector is a header pin block on the system board. The parameters of the serial port are fixed at 9600 baud, 8 data bits, no parity, no hardware flow control, 1 start, and 1 stop bit.

You use this connector to configure the internet protocol (IP) address and to recover the factory default settings of the switch should Flash memory contents be lost. The serial port connection should not be used to perform normal administration or maintenance functions. Accessible functions are limited to connecting a terminal to the port to reinitialize the switch defaults, which restores the switch to its factory configuration. This is required to restore the switch passwords to a known state and to allow you to set a specific switch IP address.

## **Enclosure**

The 3534 Model F08 enclosure is designed for you to mount it in a 19-in. rack, with a height of 1 RETMA unit, but you can use it in a tabletop configuration.

The 3534 Model F08 enclosure has forced-air cooling. The fans push the air from the rear chassis intake through the enclosure and exhaust the air through venting holes in the front panel. The SFP media is hot-swappable so that it can be removed and replaced without interrupting the system power.

Other than the SFP replacement, the 3534 Model F08 has no user-serviceable parts.

On the front of the unit, there are two port connections (an RS232 connection and an RJ45 connection). The RJ45 connection provides a 10BASE-T or 100BASE-T Ethernet port for a full system management console interface. The RS232 connection provides a serial port interface for setting the IP address of the switch and for resetting the switch to factory defaults.

The fibre-optic cables, Ethernet cables, ac power input cables, and serial port cables are located on the front of the switch.

## Power supply

The 3534 Model F08 power supply is universal and capable of functioning worldwide without using voltage jumpers or switches. It meets IEC 61000-4-5 surge voltage requirements and is auto-ranging in terms of accommodating input voltages and line frequencies.

The power supply meets the following requirements:

Specification	Value
Outlet	Correctly wired and earth-grounded
Maximum output	75 watts
Maximum system power consumption	50 watts
Input voltage	90 – 264 V ac
Input line frequency	47 – 63 Hz
Harmonic distortion	Active power factor correction per IEC1000-3-2
British thermal unit (BTU) rating	60 watts x 3.412 BTU/hr/watts = 204.72 BTU/hr
Inrush current	40 amps maximum, cold start at 25°C (77°F)
Input line protection	Fused in hot line

## LEDs

The 3534 Model F08 provides several LEDs to indicate status on the switch. Each of the eight ports has two status indicators. The first LED for the port is a two-color (green and yellow) LED, and indicates the status for the port. Green indicates normal status, and yellow indicates an error. The second LED is a single-color (green) LED and indicates the link speed for the port. Green indicates 2 Gbps. If the green LED is not lit (dark), it indicates 1 Gbps.

A single-color (green) LED is located on the front of the switch and indicates system power-on status. On the back of the switch, there is a two-color (green and yellow) LED driven by an I2C I/O expander that indicates the mode of the unit. Green indicates normal mode, and yellow indicates diagnostic mode. All LEDs are surface mount components with on-board light pipe and are visible externally with full chassis enclosure.

There are two LEDs for the Ethernet port located on the front panel. One LED indicates the transmit and receive activity, and one LED indicates speed (10 Mbps or 100 Mbps).

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## Software components

The 3534 Model F08 is supported by the Fabric OS version 3.1 or later.

Fabric OS is implemented in firmware and manages the operation of the 3534 Model F08. The switch firmware is designed to make a 3534 Model F08 easy to install and use while retaining the flexibility needed to accommodate your requirements. The Fabric OS is made up of two major software components:

- Firmware that initializes and manages the switch hardware
- Diagnostics that perform component self-testing algorithms for fault isolation during the manufacturing process and in your installation

You can view the internal firmware as a set of embedded applications that run on top of a proprietary real-time operating system that consists of the following components:

- Name server
- Alias server
- SNMP agent

Additionally, host-based software includes the drivers, utilities, and applications that use the switch. Obtain these components from your system vendor or Fibre Channel component supplier.

For more information, see the *Brocade Fabric OS Procedures Guide* and the *Brocade Fabric OS Reference*.

## Features and functions

The software that supports the 3534 Model F08 includes the following features and functions.

### Secure Fabric OS

The Fabric OS supports the Secure Fabric OS, which includes security features that you can use with other security tools to implement increased security in your SAN. For more information, see the *Brocade Secure Fabric OS User's Guide*.

### Web Tools

Web Tools provide a graphical user interface (GUI) that enables an administrator to monitor and manage entire fabrics and individual switches and ports from a standard workstation. For more information, see the *Brocade Advanced Web Tools User's Guide*.

### Auto-sensing speed negotiation

The 3534 Model F08 ASIC supports link operation at either 2 Gbps or 1 Gbps. Auto-sensing negotiation allows easy configuration.

## Optionally licensed features

Version 3.1 or later of the Fabric OS have the following optionally licensed features that enhance the Fibre Channel switch.

### Full fabric switch upgrade

The full fabric switch upgrade feature provides connectivity of up to eight other switches, Advanced Zoning, and Fabric Watch. For more information, see the *Brocade Advanced Zoning User's Guide* and the *Brocade Fabric Watch User's Guide*.

### Performance Bundle (Performance Monitoring and ISL Trunking)

Advanced Performance Monitoring is a comprehensive tool for monitoring the performance of networked storage resources. For more information, see the *Brocade Advanced Performance Monitoring User's Guide*.

ISL Trunking connects up to four ISLs between two switches through an expansion port (E\_port) to merge logically into one link. For more information, see the *Brocade ISL Trunking User's Guide*.

### QuickLoop (Request price quote)

QuickLoop enables servers with host bus adapters that use Fibre Channel Arbitrated Loop private loops to communicate with Fibre Channel storage devices through IBM TotalStorage SAN switches. For more information, see the *Brocade QuickLoop User's Guide*.

### **Secure feature**

The Secure feature provides customizable security restrictions through local and remote management channels on a switch fabric. For more information, see the *Brocade Secure Fabric OS User's Guide*.

### **Fabric Manager**

Fabric Manager provides a GUI that allows the administrator to monitor and manage a fabric from a standard workstation. For more information, see the *Brocade Fabric Manager User's Guide*.

### **Extended fabrics**

Extended fabrics activation extends SAN fabrics beyond the Fibre Channel standard 10 km, which enables high performance applications over extended distances for storage consolidation, data protection, disaster tolerance, and data sharing.

### **Remote switch**

Remote switch activation extends the distance of the SAN fabric by enabling two Fibre Channel switches to interconnect over an asynchronous transfer mode (ATM) wide area network (WAN).

**Note:** To activate these features, go to the following Web site:

[www.ibm.com/storage/key/](http://www.ibm.com/storage/key/)

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## **Switch initialization**

When you start or restart the switch, the following operations are performed:

1. Early power-on self test (POST) diagnostics are run. POST is run before VxWorks is running.
2. VxWorks is initialized.
3. The hardware is initialized. The system is reset, the internal addresses are assigned to Loom chips, the Ethernet port is initialized, the serial port is initialized, and the front panel is initialized.
4. A full POST is run.
5. The links are initialized. Receiver and transmitter negotiation is run to bring the connected ports online.
6. A fabric exploration is run. This determines whether any ports are connected to other switches. If so, it determines the principal switch.
7. Addresses are assigned. After the principal switch is identified, port addresses are assigned. Each 3534 Model F08 tries to keep the same addresses that it used previously. Previous addresses are stored in the configuration Flash memory.
8. The routing table is constructed. After the addresses are assigned, the unicast routing tables are constructed.
9. Normal node port or node loop port (Nx\_port) operation is enabled.

## Routing

The embedded processor maintains two routing tables, one for unicast and one for multicast. The unicast routing tables are constructed during fabric initialization. The multicast tables are initially empty, except for broadcast. After the tables have been constructed, they are loaded into each ASIC.

The unicast tables change if ports or links come online or go offline, or if some other topology changes occur. When new paths become available, the embedded processor can change some routes in order to share the traffic load. The multicast tables change as ports register with the alias server to create, join, or leave a multicast group. Each time a table changes, it must be reloaded into the ASICs.

## Service functions

The ASIC interrupts the embedded processor when a frame arrives that has an error (for example, incorrect source ID), when a frame times out, or when a frame arrives for a destination that is not in its routing tables. In the latter case, the frame might be addressed to an illegal destination ID, or it might be addressed to one of the service functions that the embedded processor provides, such as SNMP, name server, or alias server.

### SNMP

Simple Network Management Protocol (SNMP) allows network devices to be monitored, controlled, and configured remotely from a network management station running a network manager program.

SNMP agent code in the network device allows management by transferring data that is specified by a management information base (MIB).

The 3534 Model F08 agent supports the following functions:

- SNMPv1 manager
- Command-line utilities to access and command the agent
- MIB-II system group, interface group, and SNMP group
- Fabric-element MIB
- IBM-specific MIBs
- Standard generic traps
- IBM-specific traps

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## Diagnostics

The 3534 Model F08 supports a set of POSTs, as well as tests that you can run by using Telnet commands. These diagnostics are used during the manufacturing process as well as for fault isolation of the product in your installation.

For more information, see the *Brocade Diagnostic and System Error Message Reference*.

## Diagnostic environment

Most diagnostics are written to run in the VxWorks environment. However, as VxWorks does not run without a working SDRAM, a SDRAM/boot EEPROM test is run as part of the pre-VxWorks startup code to verify that the basic processor-connected memories are functioning properly.

## Hardware support

Loop-back paths for frame traffic are provided in the hardware for diagnostic purposes. A loop-back path within the ASIC, at the final stages of the Fibre Channel interface, can be used to verify that the internal Fibre Channel port logic is functioning properly, as well as paths between the interface and the central memory. Additionally, the SERIALLINK macro within the ASIC includes a serial data loop-back function that can be enabled through a register in the corresponding ASIC.

Diagnostics are provided to allow traffic to be circulated between two switch ports that are connected with an external cable. This allows the diagnostics to verify the integrity of the final stage of the SERDES interface, as well as the media interface module.

## Diagnostic coverage

The POST and diagnostic commands concentrate on the Fibre Channel ports and verify switch functionality of the 3534 Model F08.

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## Interoperability

This section includes information about interoperability.

### Switch interoperability

The 3534 Model F08 supports both 1 Gbps and 2 Gbps transmit and receive rates with auto-negotiation. The actual data signaling rate that is used on a port is automatically sensed and is set to the rate that is supported by a device or devices that are attached to the port. The 3534 Model F08 has been tested and is compliant with the current FC standards. The 3534 Model F08 is compatible with most current-generation switches N\_ports, NL\_ports, and E\_ports, as well as host adapters, Redundant Array of Independent Disks (RAIDs) storage devices, hubs, and Fibre-SCSI bridge devices, including the 3534 and 2109 series of switches.

### Implementation in existing environments

Because the 3534 Model F08 has a compatible 1 Gbps auto-negotiated signaling rate on each port, you can use it as a replacement for current 3534 and 2109 series switches. As newer technology is added to existing systems that support 2 Gbps signaling, the ports can accept these devices and interoperate with existing 1 Gbps devices. If the 3534 Model F08 is connected to a third-party device but is unable to negotiate the signaling rate, the 3534 Model F08 allows you to manually set the speed of each port through the management interfaces.

### Heterogeneous interswitch operations

Fabric OS version 3.1 or later supports interoperability for the following functions:

- Basic switch functions
  - Link initialization
  - Principal switch selection
  - Routing Fibre Channel shortest path first (FSPF)
- Basic services
  - Simple name service
  - State change notification
  - WWN zoning (typically referred to as soft zoning or name server zoning)

The following facilities are switch-based facilities and will continue to function on any 3534 switch:

- SNMP facilities
- Simple QuickLoops with no zoning
- Translative mode (private target support on fabrics)
- Trunking (only functions between two IBM switches)
- Enhanced performance metrics

The following facilities are IBM value-added facilities that are not supported in a multi-vendor fabric. Use of these facilities causes the Fabric to segment.

- QuickLoop zones
- QuickLoop Fabric assist mode
- Port, protocol, or LUN zoning

IBM is not aware of any areas of noncompliance with any ratified standards at this time.

## Host bus adapter interoperability

For a list of host bus adapters (HBAs) that have been tested and approved for use with the 3534 Model F08, go to the following Web site:

[www.storage.ibm.com/ibmsan/products/2109/san\\_switch\\_solu.html](http://www.storage.ibm.com/ibmsan/products/2109/san_switch_solu.html)

## Operating system support

Fabric OS versions 2.x and 3.x have no specific OS dependencies. The Fabric OS in the switches allows for any Fibre Channel-compliant device to attach to the switches as long as it conforms to the standards for device login, name service, and related Fibre Channel features. Regardless of the operating environment, proper interface to the fabric requires a Fibre Channel HBA with a standards-compliant driver.

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## Reliability

The 3534 Model F08 provides the following features to ensure reliability:

- POST
- Error detection and fault isolation (internal and external CRC checking, parity checking, checksum, and illegal address checking)
- Continuous monitoring of environmental components (fan status and temperature)
- DC power in proper range monitoring
- Low component count

Because buffering is integrated into the ASICs in the 3534 Model F08, you do not need external SRAM chips on the system board.

The 3534 Model F08 utilizes a highly integrated 80960VH processor that incorporates a memory controller, PCI bus arbiter, and I2C controller in the processor chip, reducing the parts count for the processor functions. Because a single system board contains all circuitry, the 3534 Model F08 requires no interboard connections.

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## How to manage the 3534 Model F08

For system debugging and performance analysis, you can manage the 3534 Model F08 using either the in-band or the out-of-band management method. In-band uses Fibre Channel protocol and out-of-band connects to the Ethernet port. You can monitor the following attributes:

- Fabric topology
- Port status
- Physical status

**Note:** The switch automatically performs power-on self-test (POST) diagnostics each time you turn it on and records any detected errors in the error log. For more information about POST, see “Interpreting POST” on page 28.

Table 2 shows the management interfaces that are compatible with the 3534 Model F08 and whether you can use these interfaces in-band, out-of-band, or both.

*Table 2. Management interfaces compatible with the 3534 Model F08*

Management interface	In-band	Out-of-band
Command-line interface through a Telnet connection	X	X
Web Tools	X	X
Standard simple network management protocol (SNMP) applications	X	X
SCSI Enclosure Services (SES)	X	

For more information about these management interfaces, see 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 Distributed Fabric User's 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*
- *Building and Scaling Brocade SAN Fabrics: Design and Best Practices Guide*

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## Chapter 2. Installing and configuring the 3534 Model F08

You can install the 3534 Model F08 as a stand-alone unit or in a rack that meets Electronic Industries Association (EIA) standards.

This chapter describes how to install and configure the 3534 Model F08 and includes the following information:

- Installation and safety considerations
- Installing the 3534 Model F08 as a stand-alone unit
- Installing the 3534 Model F08 in an EIA rack
- Configuring, connecting, and accessing the 3534 Model F08

For information about the features of the 3534 Model F08 and what is included in each 3534 Model F08 package, see “Overview of the 3534 Model F08” on page 1.

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### Installation and safety considerations

You must follow these guidelines when you install the switch:

- Verify that the supply circuit, line fusing, and wire size that will be used are adequate according to the electrical rating on the switch nameplate.
- The switch is designed for an internet protocol (IT) power system with phase-to-phase 230 V. The power supply might still be energized, even if internal power supply over current protection devices have opened.

#### **DANGER**

**When powering the unit with a line-to-line connection greater than 200 V ac, a potential shock hazard can arise during a fault condition. Therefore, double-pole protection is required. (5)**

- Ensure the ambient air temperature does not exceed 40°C (104°F). This is particularly important if the switch is to be installed in a closed or multirack assembly.
- Ensure the volume of air flow available to the switch is at least 300 cubic feet per minute, and that the front and rear air vents are not blocked.

If you are installing the switch in a rack:

- Ensure the ambient air temperature does not exceed 40°C (104°F). This is particularly important if the switch is to be installed in a closed or multirack assembly.
- Ensure the volume of air flow available to the switch is at least 300 cubic feet per minute, and that the front and rear air vents are not blocked.
- The switch requires a rack space that is 1 unit high, 48.26 cm (19 in.) wide, and 60.96 cm (24 in.) deep.
- Verify that all equipment installed in the rack has a reliable branch circuit ground connection. Do not rely on a connection to a branch circuit, such as a power strip.
- Verify that the additional weight of the switch does not unbalance the rack or exceed the weight limits of the rack.
- Secure the rack to ensure stability in the event of an earthquake.

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## Installing the 3534 Model F08 as a stand-alone unit

Follow this procedure to install the switch as a stand-alone unit on a flat surface.

### Time required

Approximately 10 minutes

### Installation instructions

Complete the following steps to install the switch as a stand-alone unit:

1. Unpack the 3534 Model F08. Verify that all ordered items are present.
2. Turn the switch upside down. Lay it on its top.
3. Apply the adhesive rubber feet.

**Attention:** Install the rubber feet on the switch to minimize the chance of the switch sliding off the supporting surface.

- a. Clean the four depressions on the chassis bottom to ensure that they are free of dust.
  - b. Place one rubber foot in each depression with the adhesive side against the chassis.
  - c. Press the rubber feet firmly into place.
4. Return the switch to its normal upright position. Place it on a sturdy flat surface.
  5. When you are ready to supply power to the switch, connect the power cable to the 3534 Model F08 power supply and to a power outlet. (The power supply does not have an ac switch.)

The 3534 Model F08 automatically runs a POST each time power is supplied to it.

#### **DANGER**

**An electrical outlet that is not correctly wired could place a hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (1)**

**Attention:** Ensure that the power cable is routed so that it is not pinched or exposed to stress.

**Note:** Do not connect the switch to the network until the internet protocol (IP) address is correctly set. For more information, see "Configuring, connecting, and accessing the 3534 Model F08" on page 21.

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## Installing the 3534 Model F08 in an EIA rack

Follow this procedure to install the 3534 Model F08 in a rack that meets EIA standards.

#### **CAUTION:**

**The 3534 Model F08 switch is designed to be installed by the customer, and is certified as "customer setup". Make sure that the system or rack into which the switch will be installed is also designed and certified for customer setup; if it is not, then the switch must be installed by a CE. (1)**

### Time required

Approximately 30 minutes

## Items required

You will require the following items to install the 3534 Model F08 in an EIA rack:

- Straight slot screwdriver
- Rack space: 1 rack unit high, 48.26 cm (19 in.) wide, and 60.96 cm (24 in.) deep
- Rack mount kit; see Table 3 for a list of the parts that are included in the kit
- Power cable, provided with the switch
- Power outlet

**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 3.

**Note:** Firmly tighten all the screws that this procedure uses.

## Installation instructions

This section describes the basic procedure of installing the 3534 Model F08 in an EIA rack, and then provides detailed steps.

**Note:** To ensure that the switch is adequately cooled, install it with the port side (the side with the SFP) facing the aisle where exhaust air is released (usually referred to as the service aisle). This prevents the fans from pulling in heated exhaust air.

### Basic procedure

The basic rack-mount installation procedure consists of the following four steps:

1. Mount the moving slide and the lock mounting ears to the switch.
2. Mount the fixed portion of the slide in the rack.
3. Insert the switch and move a portion of the slide into the fixed portion on the rack.
4. Lock the switch in the rack using the mounting ears installed in step 1.

### Detailed steps

**Note:** These steps use parts that are included in the 3534 Model F08 rack mount kit. These parts are listed in Table 7. The installation procedure cross-references the items in this table. Be sure that you use the referenced parts when you perform each step.

To complete the rack-mount installation procedure, follow these detailed steps:

1. Unpack the 3534 Model F08. Verify that all ordered items and parts are present. See Table 3 for a list of parts and the quantities that are supplied in each rack mount kit.

Table 3. Parts supplied with the rack mount kit

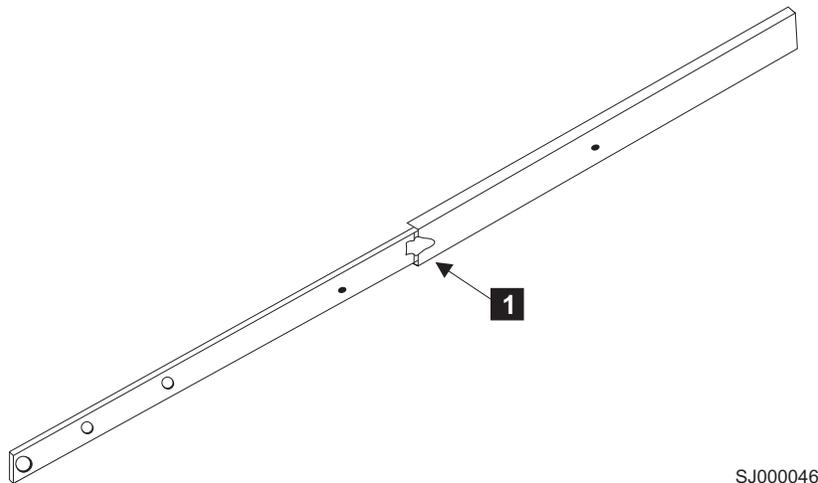
Item	Description	Quantity
<b>1</b>	Rack mount slide (inner and outer slide)	2
<b>2</b>	Right rack mount bracket (optional bracket for the front of the switch)	1
<b>3</b>	Left rack mount bracket (optional bracket for the front of the switch)	1
<b>4</b>	Rack mounting bracket (3-hole)	4

Table 3. Parts supplied with the rack mount kit (continued)

Item	Description	Quantity
<b>5</b>	Nut clip, M5	11
<b>6</b>	Screw, 8-32 x 3/16 in., zinc	11
<b>7</b>	Screw, M5 x 12	11
<b>8</b>	Bracket to slide rack kit (contains items 9 - 12)	1
<b>9</b>	Screw, 8-32 x 3/8 in., zinc	5
<b>10</b>	Washer, flat, No. 8	5
<b>11</b>	Washer, lock, No. 8	5
<b>12</b>	Nut, hex, 8-32	5

**Note:** Because this rack mount kit is distributed with various switches, you might end up with extra parts that are not needed for the installation of your switch into your rack assembly.

2. Separate the inner and outer slides.
  - a. Open one of the slides until the lock engages.
  - b. Press the lock release lever, and remove the inner rail from the outer rail, as shown in Figure 7.



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Figure 7. Moving slide

- c. Repeat steps 2a - 2b for the other rail.

**Note:** For racks with flush-mount doors such as the 9306 Netfinity® racks, you can eliminate the installation of the ears. Instead, use the rack-mount slides by attaching the 3534 Model F08 to the set of mounting holes, which are offset 2.62 cm (3 in.) into the rack.

3. Install the inner (smaller) slide on the 3534 Model F08 chassis.
  - a. Position the flat side of the inner rail along one side of the switch, aligning 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 shown in Figure 8 on page 19.
  - b. Attach the inner rail using two of the 8-32 x 3/16 in. zinc screws **6**.

**Attention:** Using screws longer than 3/16 in. can damage the switch.

- c. Repeat steps 3a on page 18 - 3b on page 18 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** and the left rack mount bracket **3** on the switch chassis. These brackets secure the switch to the rack as shown in Figure 8.

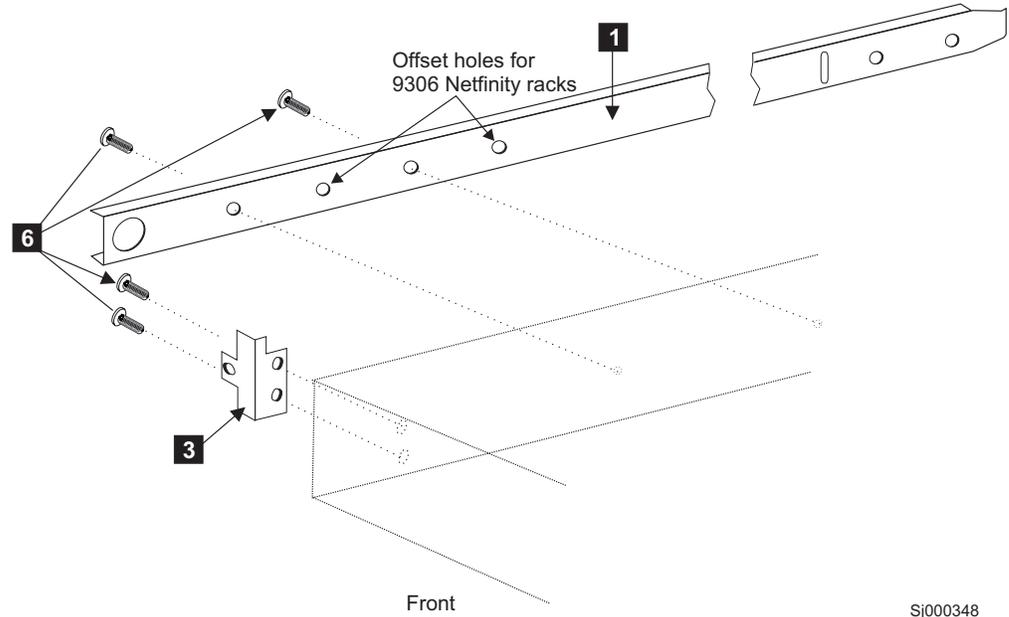
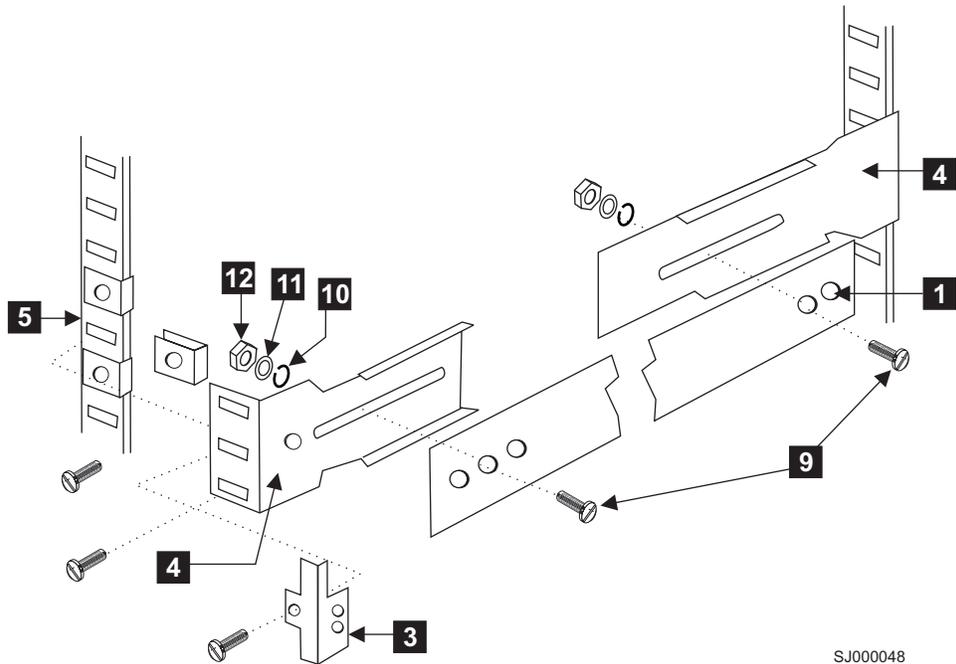


Figure 8. Mounting the moving portion of the slide and the mounting brackets to the switch

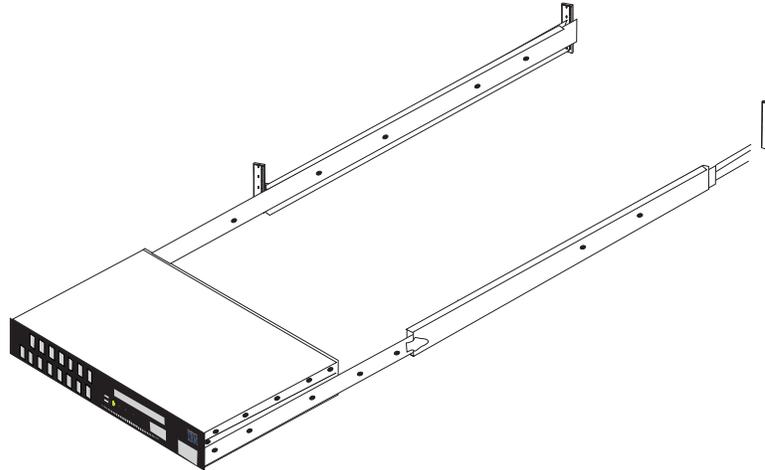
- a. Position the left rack mount bracket at the left front corner of the switch chassis, so that the two holes in the bracket align with the two threaded holes in the switch chassis.
- b. Attach the bracket using two of the 8-32 x 3/16 in. zinc screws **6**.  
**Attention:** Using screws longer than 3/16 in. can damage the switch.
- c. Repeat steps 4a - 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** as shown in Figure 9 on page 20.



SJ000048

Figure 9. Mounting the fixed portion of the rail and the locking ears to the rack

- a. Position a 3-hole bracket **4** at the end of one of the outer slides.
- b. Attach the bracket using the 8-32 x 3/8 in. zinc screws **9**. Make sure that the screw heads are inside the slides.
- c. Place one of 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 - 5b for the three remaining rail ends.
6. Install the outer (larger) slides in the rack, as shown in Figure 9.
  - a. At the desired height, install the five M5 nut clips **5**; put three 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.
  - b. Attach the slides using four M5 x 12 screws **7**.
  - c. Repeat steps 6a - 6b for the other rail.
7. Install the switch in the rack.
  - a. Position the switch in front of the rack. Insert it into the rack by sliding the inner slides on the switch into the outer slides on the rack. See Figure 10 on page 21.



SJ000049

Figure 10. Inserting slides into the rack rails

- b. Verify 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 occurs, adjust the slide positions until the movement is smooth.
8. Optional step: If the right rack mount bracket and the left rack mount bracket were installed on the front corners of the switch (see step 4 on page 19), attach both brackets to the cabinet rack using M5 x 12 screws **7**.

**DANGER**

**An electrical outlet that is not correctly wired could place a hazardous voltage on metal parts of the system or the products that attach to the system. It is the customer's responsibility to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (1)**

9. When you are ready to supply power to the switch, connect the power cable to the 3534 Model F08 power supply and to a power outlet. The power supply does not have an ac switch.

The 3534 Model F08 automatically runs a POST each time power is supplied to it.

**Attention:** Ensure that the power cable is routed so that it is not pinched or exposed to stress when the switch is moved on the slides.

**Note:** Do not connect the switch to the network until the IP address is correctly set or the default IP address is verified as not conflicting with the existing IP addresses in the same network. For more information, see "Configuring, connecting, and accessing the 3534 Model F08".

---

## Configuring, connecting, and accessing the 3534 Model F08

Follow this procedure to configure, connect, and access the 3534 Model F08 for use in a network fabric.

### Time required

Approximately 15 minutes

## Items required

You will need the following items to configure, connect, and access the 3534 Model F08:

- A 3534 Model F08 that is installed and connected to a power source
- A workstation that has a terminal emulator application (such as HyperTerminal)
- A serial cable that is provided with the switch, for connecting the switch to the workstation
- An unassigned IP address
- An Ethernet cable for connecting the switch to the workstation or to a network containing the workstation
- Short wavelength (SWL) or long wavelength (LWL) SFPs and fiber optic cables, as required

## Configuring the switch

To configure the 3534 Model F08, replace the factory IP address and related information with the IP information that is provided by your network administrator. Perform the following steps:

1. Remove the shipping plug from the serial port. Insert the serial cable that is provided with the 3534 Model F08.
2. Connect the other end of the serial cable to an RS-232 serial port on the workstation. If no RS-232 serial port is available on the workstation, you can remove the adapter that is on the end of the serial cable. This enables you to use the RJ-45 connector to create a serial connection.
3. Verify that the switch is on and that a POST has completed.
4. Disable any serial communication programs that are running on the workstation.
5. Open a terminal emulator application, such as HyperTerminal on a PC or TERM in a UNIX<sup>®</sup> environment. Configure the switch. For a Windows<sup>®</sup> 95, 98, 2000, or NT environment, use the configuration parameters shown in Table 4.

Table 4. Configuration parameters

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

In a UNIX environment, type the following command:

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

6. From the terminal emulator application, log on to the switch through the serial connection. The default administrative logon is *admin*, and the default password is *password*.
7. Type the following command:  

```
ipAddrSet
```
8. Type the appropriate information at the following prompts:

**Note:** The variables within brackets represent the default settings that your information replaces.

- Type the new Ethernet IP address:  
Ethernet IP Address [10.77.77.77]:
  - Type the new Ethernet subnetmask:  
Ethernet Subnetmask [0.0.0.0]:
  - Type the new Fibre Channel IP address, if desired:  
Fibre Channel IP Address [none]:
  - Type the new Fibre Channel subnetmask, if desired:  
Fibre Channel Subnetmask [none]:
  - Type the new gateway address:  
Gateway Address [172.17.1.1]:
  - Type y to set the IP address now:  
Set IP address now? [y = set now, n = next reboot]:
9. Type the following command to verify that the address was set correctly:  
ipAddrShow
  10. After you verify the IP address, remove the serial cable and replace the shipping plug in the serial port.

**Note:** Use the serial port only during the initial setting of the IP address and for service purposes. Do not use the serial port during normal switch operation or for regular maintenance.

11. Record the IP address for future reference.

## Connecting and accessing the switch

Complete the following steps to connect the switch to the workstation using an Ethernet cable (this can be a direct connection or through a network), and to access the switch:

1. Remove the shipping plug from the Ethernet port.
2. Insert one end of an Ethernet cable in the Ethernet port.
3. Connect the other end of the Ethernet cable to the workstation or to an Ethernet network that contains the workstation.

**Note:** You can now access the switch remotely, using Telnet or Web Tools. Ensure that the switch is not being modified simultaneously from any other connections during the remaining steps.

4. Log on to the switch using Telnet. The default administrative logon is *admin*, and the default password is *password*.
5. Modify the domain IDs if desired.

**Note:** The default domain ID is 1. If the domain ID is already in use when the switch is connected to the fabric, the domain ID for the new switch is automatically reset to a unique value. You can determine the domain IDs that are currently in use by issuing the Telnet **fabricShow** command. For more information about Telnet commands, see the *Brocade Fabric OS Reference*.

- a. Type the following command to disable the switch:  
switchDisable
- b. Type the following command:  
configure
- c. Type y at the Fabric parameters prompt. For example:

- Fabric parameters (yes, y, no, n): [no] y
- d. Type a unique domain ID (such as the domain ID used by the previous switch, if still available) at the Domain prompt. For example:  
Domain: (1..239) [1] 3
  - e. Complete the remaining prompts, or press CTRL+D to accept the remaining settings without completing all the prompts.
  - f. Type the following command to enable the switch:  
switchEnable
6. Optional step: Specify any custom status policies for the fabric.
    - a. Type the following command at the prompt:  
switchStatusPolicySet
    - b. Specify the desired status policies. To completely deactivate the alarm for a particular condition, type 0 at the prompt for that condition.
  7. Add SFPs and fiber optic cables to the ports as required.

**Note:** The ports and cables that are used in trunking groups must meet specific requirements. For information about these requirements, see the *Brocade ISL Trunking User's Guide*.

- a. Remove the shipping plug from the ports to be used.
- b. Position the SFP so that the key (the tab near the cable end of the SFP) is on top. Insert the SFP into the port until it is firmly seated and the latching mechanism makes a clicking sound.

**Note:** The SFP is keyed so that it can only be correctly inserted into the port. If the module does not slide in easily, try turning it over. Do not force the module.

- c. Connect the fiber-optic cables to the SFPs as appropriate to the fabric topology. Position each cable so that the key (the ridge on one side of the cable connector) is aligned with the slot in the SFP. Insert the cable into the SFP until it is firmly seated, and the latching mechanism makes a clicking sound.

**Note:** The cable is keyed so that it can only be correctly inserted into the SFP. If the cable does not slide in easily, try turning it over. Do not force the cable.

8. Verify the correct operation of the 3534 Model F08. Type the following command at the Telnet prompt:

```
switchShow
```

This command provides information about the status of the switch and the ports. For more information about this and other commands, see the *Brocade Fabric OS Reference*.

**Note:** Back up the configuration after any initial changes and periodically thereafter. This ensures that a complete configuration is available if you need to install a replacement switch. For information about backing up the configuration, see the *Brocade Fabric OS Procedures Guide*.

---

## Chapter 3. Operating the 3534 Model F08

This chapter describes how to operate the 3534 Model F08 and includes the following information:

- Turning the 3534 Model F08 on and off
- Interpreting LED activity
- Interpreting POST
- Running diagnostic tests

---

### Turning the 3534 Model F08 on and off

To turn on the 3534 Model F08, plug it into a power outlet. The power supply does not have an ac switch. To turn the switch off, unplug it from the power outlet.

**Note:** Unplugging the switch triggers a system reset. When the switch is plugged in, all devices are returned to the initial state and the switch runs a POST. For information about the POST, see “Interpreting POST” on page 28.

---

### Interpreting LED activity

You can determine system activity and status by monitoring the activity of the LEDs on the switch.

**Note:** The LEDs might flash yellow during diagnostic tests and green, orange, or yellow during a POST. This is normal. This does not indicate that there is a problem unless the LEDs do not return to a normal pattern after the POST is complete.

The 3534 Model F08 has the following LEDs:

#### **Port Status LED**

These LEDs indicate the status of each port. There are eight port status LEDs that are located above and to the left of each port on the front panel.

#### **Port Speed LED**

These LEDs indicate the speed of each port. There are eight port speed LEDs that are located above and to the right of each port on the front panel.

#### **Switch Status LED**

These LEDs indicate whether the switch is on and has successfully started. There are two switch status LEDs, one on the front panel and one on the back.

#### **Ethernet port LED**

These LEDs indicate the speed and status of the Ethernet link. There are two Ethernet port LEDs that are located to the left of the Ethernet port on the right side of the front panel.

### LEDs on the front panel

Figure 11 on page 26 shows the front panel with the different LEDs identified.

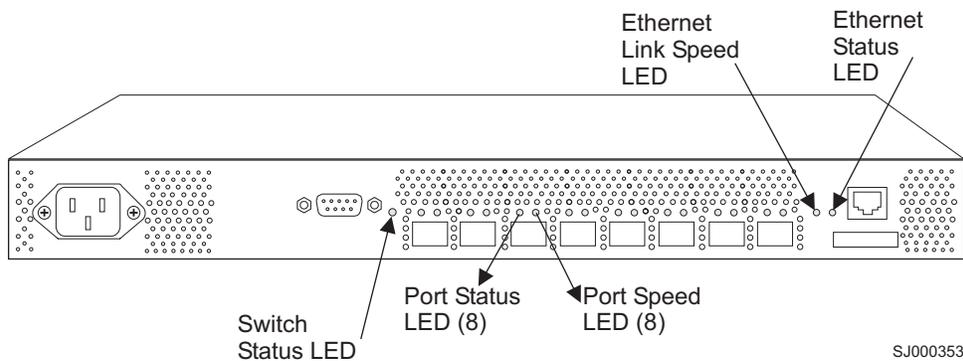


Figure 11. Front panel LEDs

Table 5 lists the front panel LEDs and describes the following items:

- The name of the LED
- The location of the LED
- The color of each LED
- The status of the switch that is associated with each LED color
- The action that you can take in response to that status

Table 5. Front panel LED patterns during normal operation

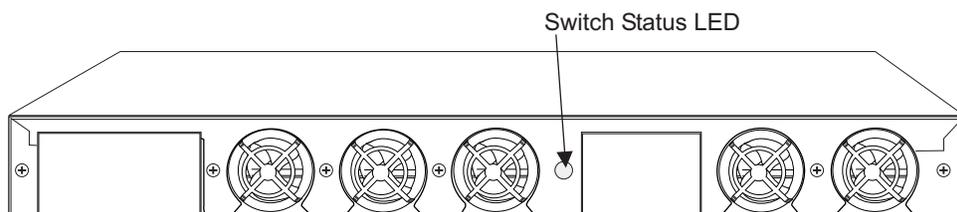
Name of LED	Location of LED	Color of LED	Status of hardware	Action
Switch Status	To the right of the serial port	No light	Either the switch is off, the startup process is not complete, or the startup has failed.	Verify that the switch has power and that the startup process has had time to complete. If there is still no light, contact IBM.
		Steady green	The switch is on, and startup has successfully completed.	No action is required.
		Slow-flashing green	One or more ports has failed its diagnostic check.	Verify that the correct device is connected to the port.

Table 5. Front panel LED patterns during normal operation (continued)

Name of LED	Location of LED	Color of LED	Status of hardware	Action
Port Status	Above and to the left of each port	No light	No light or signal carrier (media or cable) is detected.	Verify that the media and the cable are both firmly seated and functional.
		Steady green	The port is online (it is connected to an external device), but has no traffic.	No action is required.
		Slow-flashing green (on 1 second; off 1 second)	The port is online, but is segmented, which indicates a loopback cable or an incompatible switch.	Verify that the correct device is connected to the port.
		Fast-flashing green (on 1/4 second; off 1/4 second)	The port is in an internal loopback (diagnostic).	No action is required.
		Flickering green	The port is online, and traffic is flowing through it.	No action is required.
		Steady orange	The port is receiving light, or a signal carrier is detected, but it is not yet online.	No action is required.
		Slow-flashing orange (on 1 second; off 1 second)	The port is disabled as a result of diagnostics or a <b>portDisable</b> command.	Reset the port from a management station.
		Fast-flashing orange (on 1/4 second; off 1/4 second)	The port is faulty.	Reset the switch from a management station.
		Alternating green and yellow	The port is bypassed.	Reset the port from a management station.
Port Speed	Above and to the right of each port	No light	The port is transmitting or receiving at 1 Gbps.	No action is required.
		Steady green	The port is transmitting or receiving at 2 Gbps.	No action is required.
Ethernet Link Speed	Leftmost of the two LEDs to the left of the Ethernet port	No light	The port is transmitting or receiving at 10 Mbps.	No action is required.
		Steady green	The port is transmitting or receiving at 100 Mbps.	No action is required.
Ethernet Status	Rightmost of the two LEDs to the left of the Ethernet port	No light	No Ethernet traffic is flowing through the RJ-45 port.	Verify that the switch is on and that the Ethernet cable is firmly seated.
		Flickering green	Ethernet traffic is flowing through the RJ-45 port.	No action is required.

## LEDs on the back panel

Figure 12 shows the back panel of the switch with the switch status LED identified.



SJ000354

Figure 12. Back panel LED

Table 6 lists the back panel LED and describes the following items:

- The name of the LED
- The location of the LED
- The color of the LED
- The status of the switch that is associated with each LED color
- The actions that you can take in response to that status

Table 6. Back panel LED patterns during normal operation

Name of LED	Location of LED	Color of LED	Status of hardware	Action
Switch Status	Center of back panel	No light	Either the switch is off, the startup process is not complete, or the startup has failed.	Verify that the switch is on and that the startup process has had time to complete. If there is still no light, contact IBM.
		Steady green	The switch is on, and startup has successfully completed.	No action is required.
		Steady yellow	A diagnostic test is in progress, or one or more ports are faulty.	If no diagnostic tests are running, check the Port Status LEDs for fault indicators (see Table 5 on page 26).
		Slow-flashing yellow	A diagnostic failure has occurred on one or more ports.	Errors might be listed in the error log. Refer to the <i>Brocade Diagnostic and System Error Message Reference</i> for more information.

## Interpreting POST

The 3534 Model F08 automatically performs a POST when the switch is plugged in, restarted, or the system is reset. A POST includes a number of diagnostic tests. You can monitor test results through the LED activity, error log, Telnet command, from a terminal screen, and so on.

A POST completes in 4.5 minutes. A slightly longer version of the memory test is performed after cold starts. A cold start occurs after a complete power cycle, when

the switch is unplugged, then plugged back in. A warm start is any other type of startup, such as an operating system restart or switch panic.

A POST consists of the following steps:

1. Preliminary POST diagnostics are run.
2. The operating system is initialized.
3. The hardware is initialized.
4. Diagnostic tests are run on a number of the following functions:
  - Internal connections and circuitry
  - Port functionality
  - Ability to send and receive frames
  - Ability to implement QuickLoop functionality
  - All aspects of memory, parity, statistics counters, and correct serialization
5. A universal port configuration is performed.
6. The links are initialized.
7. The fabric is analyzed. If ports are connected to other fabric elements, the principal switch in the fabric is identified.
8. The port addresses are assigned. The switch attempts to keep any previously assigned port addresses.
9. The unicast routing tables are constructed.
10. The port is enabled.

To determine whether a POST has completed without errors, verify that all LEDs return to a normal state after the POST is complete. If one or more LEDs continue to flash, see “Interpreting LED activity” on page 25. Verify that the flashing is not due to the switch being configured to beacon.

**Note:** The **switchBeacon** command sets the switch beaoning mode on or off if the operand is 1 or 0 respectively. When beaoning mode is turned on, the port LEDs flash orange in a running pattern from port 0 - port 7, port 7 - port 0, and then back to port 7 again.

For more information about beaoning, see the *Brocade Fabric OS Procedures Guide*.

**Note:** When POST completes, verify that the switch prompt displays on a computer terminal that is connected to the switch. If the prompt does not display, press the Enter key. If the prompt still does not display, contact IBM.

If errors are detected during a POST, error messages are written to the system error log. You can view this error log by using the **errShow** command. For information about error messages, see the *Brocade Diagnostic and System Error Message Reference*.

---

## Running diagnostic tests

Diagnostic tests are provided to help you to identify problems in the hardware and the firmware. The diagnostic tests include tests of internal connections and circuitry, fixed media, and any SFP modules and fiber-optic cables that are in use. You can run the tests either using Telnet or through a terminal that is set up for a serial connection to the switch. Some tests require that you connect the ports with

external cables. This enables the diagnostics to verify the serializer or deserializer interface, as well as the attached SFP and cable.

All diagnostic tests are run at link speeds of 1 Gbps and 2 Gbps. As a result, the transmit and receive speed of the links can be temporarily locked at one speed or the other while the diagnostic tests are running. For information about the specific diagnostic tests and how to run them, see the *Brocade Diagnostic and System Error Message Reference*.

---

## Chapter 4. Replacing an SFP

This chapter contains the procedures to replace a small form-factor pluggable (SFP) device.

**Note:** Simple network management protocol (SNMP) traps are generated when you remove and install an SFP. You do not need to unplug the switch to replace an SFP.

Figure 13 shows an IBM SFP.



SJ000317

Figure 13. IBM SFP

---

### Time required

Approximately 20 seconds to remove and install an SFP

---

### Items required

None

**Note:** This operation is hands-only..

---

### Removing an SFP

Complete the following steps to remove an SFP:

1. Pull forward on the tab on the front of the SFP.
2. Pull out the SFP.
3. Carefully move the SFP from side to side to unseat it.

---

## Installing an SFP

Complete the following steps to install a new SFP:

1. Insert the SFP into the port.
2. Seat the connector firmly into the appropriate port slot. The latch prong locks and prevents the SFP from being removed accidentally.

**Note:** The SFP is keyed so that it can only be correctly inserted into the port. If the module does not slide in easily, try turning it over. Do not force the module.

---

## Appendix A. Product specifications

This appendix contains the 3534 Model F08 specifications. The 3534 Model F08 is designed as a piece of network equipment. Its primary operating environments are server rooms, network equipment closets, and office environments.

---

### Switch components

The 3534 Model F08 contains the following components:

- A 1U chassis, designed to be mounted in a 48.26 cm (19 in.) rack, with forced-air cooling that flows from the fan side of the switch to the cable side. You can also install the switch as a stand-alone unit.
- Eight ports, compatible with SFP optical media that are capable of operating at 2.125 Gbps or 1.0625 Gbps. Each port has a serializer/deserializer (SERDES) that accepts 10-bit wide parallel data and serializes it into a high-speed serial stream. The parallel data must be 8-bit to 10-bit encoded data, or the equivalent.
- One RS-232 serial port (DB9 connector) on the front panel
- One IEEE-compliant RJ-45 connector on the front panel for use with 10 Mbps or 100 Mbps Ethernet or in-band
- Human-readable and bar code labels on the front and back panels
- 20 LEDs:
  - One LED on the front panel to indicate the overall switch status
  - Two LEDs for each of the eight ports to indicate port status and link speed
  - Two LEDs for the Ethernet port to indicate port status and link speed
  - One LED in the center of the back panel to indicate the overall switch status
- One universal input power supply without an ac switch
- Five fans:
  - Two to cool the power supply
  - Three to cool the system board

Air is pulled in through the rear intake and pushed out through the vents in the front panel. The fans are controlled automatically to run at the same speed:

- 5800 RPM for normal operation
- 9700 RPM if the ambient temperature inside the switch exceeds the upper threshold

See “Environmental specifications” on page 36 for the temperature specifications of the 3534 Model F08.

---

### Facility specifications

To ensure correct operation of the switch, ensure that the facility meets the following specifications:

- An adequate supply circuit, line fusing, and wire size, according to the electrical rating on the switch nameplate.
- An air flow of at least 300 cubic feet per minute available to the switch.
- The power specifications listed in “Power supply specifications” on page 36.
- The environmental specifications listed in “Environmental specifications” on page 36.

- Interference less than the standard levels listed in Table 7, under Immunity.

Additionally, if you are installing the switch in an EIA rack:

- Ensure that all equipment has a reliable branch-circuit ground connection. Do not rely on a connection to a branch circuit, such as a power strip.
- Ensure that the rack is balanced and within the specified weight limits. Secure the rack mechanically to ensure stability in the event of an earthquake.

---

## General specifications

The 3534 Model F08 is an 8-port, dual-speed, auto-sensing Fibre Channel switch. It supports multiple F\_port and FL\_port connections, a single E\_port connection, and distributed name server (DNS). It is electro-magnetic compatibility (EMC) compliant.

Table 7 lists the general specifications for the 3534 Model F08.

*Table 7. General specifications*

Specification	Description
Configured port types	The 3534 Model F08 supports multiple F_port and FL_port connections, and one E_port connection.
EMI rating	An operating 3534 Model F08 that conforms to the EMI radiation levels specified by the following regulations: <ul style="list-style-type: none"> <li>• FCC Rules and Regulations, Part 15B, Class A level</li> <li>• CISPR22 Class A</li> <li>• EN55022 Class A</li> <li>• VCCI Class A ITE</li> <li>• AS/NZS 3548 Class A</li> </ul>
System architecture	Nonblocking shared-memory switch
System processor	Intel® 80960VH, 100 MHz CPU
ANSI Fibre Channel protocol	FC-PH (Fibre Channel Physical and Signaling Interface standard)
Modes of operation	Fibre Channel Class 2 and Class 3
Fabric initialization	Complies with FC-SW 5.0
Internet protocol (IP) over Fibre Channel (FC-IP)	Complies with FC-IP 2.3 of the FCA profile
Aggregate switch input/output (I/O) bandwidth	32 Gbps if all eight ports are running at 2 Gbps, full duplex
Frame buffers	26 buffers per E_port and 16 buffers per F_port at 2112 bytes per frame
Port-to-port latency	Less than 2 microseconds with no contention (the destination port is free)
Data transmission range	<ul style="list-style-type: none"> <li>• Up to 13 m (42.65 ft) for passive copper</li> <li>• Up to 33 m (108.27 ft) for active copper</li> <li>• Up to 300 m (975 ft) for short wavelength optical link</li> <li>• Up to 10 km (32 820 ft) for long wavelength optical link</li> </ul>

Table 7. General specifications (continued)

Specification	Description
Immunity	<ul style="list-style-type: none"> <li>• IEC 61000-4-2 Severity Level 3 for Electrostatic Discharge</li> <li>• IEC 61000-4-3 Severity Level 3 for Radiated Fields</li> <li>• IEC 61000-4-4 Severity Level 3 for Fast Transients</li> <li>• IEC 61000-4-5 Severity Level 3 for Surge Voltage</li> <li>• IEC 61000-4-6 Conducted Emissions</li> <li>• IEC 61000-4-11 Voltage Variations</li> </ul>

## Performance specifications

Table 8 lists the performance specifications for the 3534 Model F08.

Table 8. Performance, mechanical, and environmental specifications for the 3534 Model F08

Performance specifications	
Routing capacity	A minimum aggregate routing capacity of 10 million frames per second is provided for Class 2, Class 3 and Class F frames in an 8-port switch.
Latency	<p>The maximum latency for Class 2, Class 3 and Class F frames from input F_port to output F_port within a single switch is less than 2 microseconds when the destination port is free.</p> <p>Cut-through routing: transmission can begin as the frame arrives.</p> <p>Same latency as the 3534 and the 2109 series of switches.</p>

## Physical specifications

Table 9 lists the physical specifications for the 3534 Model F08.

Table 9. Physical specifications

Dimension	Value
Enclosure	1U, 48.26 cm (19 in.), EIA compliant
Height	4.2 cm (1.69 in.)
Depth	26.4 cm (10.4 in.)
Width	42.8 cm (16.9 in.)
Weight	3.9 kg (8.5 lbs)

## Environmental specifications

Table 10 lists the environmental ranges that are acceptable when the 3534 Model F08 is operating and when it is nonoperating.

Table 10. Environmental specifications

Condition	Switch state	Acceptable range
Temperature	Operating	10° - 40°C (50° - 104°F)
	Nonoperating	10° - 50°C (50° - 126°F)
Humidity	Operating	8% - 80% RH noncondensing, at 40°C (104°F)
	Nonoperating	8 - 80% RH noncondensing, at 40°C (104°F)
Altitude	Operating	0 - 3 km (0 - 9843 ft) above sea level
	Nonoperating	0 - 12 km (0 - 39 372 ft) above sea level
Shock	Operating	150G, 2.7 MS duration, half sine
	Nonoperating	60G, 13 MS duration, trapezoid
Vibration	Operating	0.5G, 5-500-5 Hz
	Nonoperating	2G, 5-500-5 Hz
Input voltage		90 - 264 V ac
Frequency		47 - 63 Hz
Power consumption		50 W maximum

## Power supply specifications

The 3534 Model F08 has a universal power supply that is capable of functioning worldwide without voltage jumpers or switches. The power supply meets the following conditions:

- IEC 61000-4-5 surge voltage specifications
- Is *autoranging*, which means that it accommodates different input voltages and line frequencies

Table 11 lists the power supply specifications.

Table 11. Power supply specifications

Specification	Value
Outlet	Correctly wired, earth-grounded
Maximum output	75 watts
Maximum system power consumption	50 watts
Input voltage	90 - 264 V ac
Input line frequency	47 - 63 Hz
Harmonic distortion	Active power factor correction per IEC 1000-3-2
BTU rating	60 watts x 3.412 BTUs per hour per watt = 204.72 BTUs per hour
Inrush current	40 amps maximum, cold start 25°C (77°F)

Table 11. Power supply specifications (continued)

Specification	Value
Input line protection	Fused in hot line

---

## Memory specifications

The 3534 Model F08 contains the types and amounts of memory listed in Table 12.

The centralized memory maximizes switch throughput by guaranteeing full transmit and receive bandwidth to all Fibre Channel ports at all times.

Table 12. Memory specifications

Memory type	Amount
Main memory	32 MB of SDRAM
Flash memory	Dual 8 MB
Boot flash memory	512 KB of 8-bit wide memory for system startup

---

## Optical port specifications

The optical ports in the 3534 Model F08 are compatible with short wavelength (SWL) and long wavelength (LWL) transceivers and fiber-optic cables. The type of SFP in use determines the strength of the light signal.

The optical ports meet all the required safety standards. For details, see “Regulatory specifications” on page 38.

---

## Serial port specifications

The serial port is on the front panel of the switch and uses an RS-232 connector.

**Note:** For dust and electrostatic discharge (ESD) protection, keep the cover on the serial port whenever it is not in use.

You can use the serial port to connect to a terminal to set the switch IP address without connecting to the fabric. You can also use it to reinitialize the switch defaults, which restores the factory configuration and returns the switch passwords to a known state. The serial ports parameters are 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

The switch requires a straight serial cable with a female 9-pin subminiature-D connector. Only pins 2, 3, and 5 are supported. If pin 7 is used, this signal must always be driven high, using the pinouts listed in Table 13.

Table 13. Cabling pinouts if pin 7 is used

Pin	Signal	Description
1		
2	TxData	Transmit data
3	RxData	Receive data
4		

Table 13. Cabling pinouts if pin 7 is used (continued)

Pin	Signal	Description
5	GND	Logic ground
6		
7	CTS	Clear to send
8		
9		

## Regulatory specifications

The 3534 Model F08 is certified for the regulatory specifications that are listed in Table 14.

Table 14. Regulatory specifications

Country or region	Safety specification	EMC specification
Canada	CSA 22.2 No. 60950 Third Ed.	CSA C108.8 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	Nemko IEC 60950+A1+A2+A3+A4+A11 (CB Report)	
European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom)	73/23/EEC based on compliance to EN 60950:92 +A1:93+A2:93+A3:95+A4:96+A11:97 (CB report inclusive of county deviations); TUV-GS (Germany)	89/336/EEC EN 55022:1998 Class A EN 60825-1:1994/A11, -2 EN 61000-4-2 Severity Level 3 for Electro Static 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

Table 14. Regulatory specifications (continued)

Country or region	Safety specification	EMC specification
Australia and New Zealand		AS/NZS 3548:1995 Class A (radio interference)



---

## Appendix B. Standards and protocol compliance

IBM is committed to providing products that comply with industry standards and protocols.

---

### Standards

The 3534 Model F08 is compliant with the following standards:

- Fibre Channel ANSI Specifications
  - FC-PH, version 4.3 (Fibre Channel Physical)
  - FC-PH-2, version 7.4 (Fibre Channel Physical, Enhanced) for Multicast and Broadcast functions
  - FC-PH-3, version 9.4
  - FC-SW-2, version 4.4 (Fibre Channel Switched Fabric)
  - FC-FG Revision 3.5 (Fabric Generic Requirements)
  - FC-AL, version 4.5 (Arbitrated Loop)
  - FC-AL-2, version 5.7 (Arbitrated Loop Extensions)
  - FC-FLA, version 2.7 (Fabric Loop Attach)
  - FC-GS-2, version 5.3 (Generic Services)
  - FC-GS-3, version 6.42 or later (Generic Services)
  - FC-PLDA, version 2.1 (Private Loop Direct Attach)
  - FC-Tape Fibre Channel Tape (FC-Tape)
  - FCP-2Rev4 (Fibre Channel Protocol)
  - FC-FS Revision 0.2 or later
  - FC-IP
- SCSI Enclosure Services, Rev 8a
- EA/TIA RS-232 Serial Port specification
- Gigabit Interface Converter Definition Document, Sun, and so on
- IEEE 802.3 for Ethernet

---

### Protocol compliance

The 3534 Model F08 complies with the following standards and protocols.

### Support for Fibre Channel ports

All ports on the 3534 Model F08 are universal ports and support F\_port (point-to-point), FL\_port (loop), and E\_port (switch-to-switch) port connections.

### Fibre Channel class operation

The 3534 Model F08 supports Fibre Channel Class 2, Class 3, and Class F operations on all ports.

### Auto-configuration

All ports support E\_ports to allow for cascading switches to form larger fabrics. E\_ports are auto-configuring. Linking ports from any two switches automatically configures an E\_port connection to form the fabric. The 3534 Model F08 supports a trunking option that binds up to four ports together as a high-performance trunk group. In this trunking configuration, interswitch data transfers can occur at an

aggregate rate of 800 MBps in both directions. The trunk group is automatically configured on the ports of the switch as the links between the switches are connected.

## **In-order delivery**

The 3534 Model F08 guarantees in-order delivery of frames between source F\_port or FL\_port and destination F\_port or FL\_port. In-order delivery is supported across any arbitrary switch configurations or fabric topologies.

## **Flexibility of fabric topology and operation**

The 3534 Model F08 implements the FSPF routing protocol as specified in the T11 FC-SW-2 standard. Fabric topology and operation are automatically adjusted and dynamically distributed to the fabric as new switches and links are added to the fabric. This is completed with no operator intervention. When a link is added or removed, the routes are recalculated. The switch adopts a minimal disruption algorithm to minimize the impact of the route recalculation. To minimize disruption, the switch only reroutes traffic due to a new shortest path (if one has been established) or if new load sharing is required.

## **Fibre Channel simple name service**

Fabric OS includes support for the Fibre Channel simple name service as specified in FC-GS-3 version 6.42 or the latest published standard.

## **Fibre Channel state change notification service**

Fabric OS supports the Fibre Channel state change notification service as specified in FC-GS-3 version 6.42 or the latest published standard.

## **Fibre Channel alias and multicast services**

Fabric OS supports the alias and multicast services as specified in FC-GS-3 version 6.42 or the latest published standard.

## **Support for Fibre Channel protocol**

The 3534 Model F08 supports the FCP-2Rev4 standard.

## **Support for FC-IP**

Fabric OS supports FC-IP (as defined by IETF), including the address resolution protocol (ARP) service for IP nodes that are connected to the switch.

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## Appendix C. Safety certifications and regulatory compliance

The 3534 Model F08 switch complies with all the safety and regulatory standards listed in this chapter.

---

### Safety

The 3534 Model F08 switch is certified to :

- UL1950/CSA950 binational
- IEC950/EN 60950 (Nemko & TUV; CE)

Additionally, the following Product Safety/Country or Region Testing/Certifications has been completed.

- Federal Communications Commission (FCC) statement (United States)
- Voluntary Control Council for Interference (VCCI) mark (Japan)
- BSMI (Taiwan)
- C-tick mark (Australia)
- CE Mark (Europe)
- Canada class number
- GOST approval (Russia)
- NOM mark (Mexico)

---

### EMI/EMC

Radiated Electro-Magnetic Interference (EMI) emissions for the 3534 Model F08 power supply operating in a single or redundant power configuration comply with EMI levels specified by the following regulations:

- FCC Docket No. 20780, Part 15J, Class B level
- CISPR22 Class A
- EN55022 Class B
- VCCI Class A ITE

Additionally, the 3534 Model F08 power supply has received a CE Mark for susceptibility and complies with the following Electro-Magnetic Compatibility (EMC) regulations:

- EN 61000-3-2 (Harmonics)
- EN 61000-3-3 (Voltage Fluctuations)
- EN 55024 (Immunity)

## Immunity

The 3534 Model F08 switch provides immunity 50% greater than the levels specified by EN 55024 and complies with the following specifications:

- EN 61000-4-2, Severity Level 3 for ESD
- EN 61000-4-3, Severity Level 3 for RF Fields
- EN 61000-4-4, Severity Level 3 for EFT/Burst
- EN 61000-4-5, Severity Level 3 for Surge Voltage
- EN 61000 4-11, Power, Sag, Dip, and Variations

---

## Appendix D. Blank planning worksheets

This appendix contains the following blank worksheets that you can use when you plan the installation of a 3534 Model F08 in an operational environment:

- Planning worksheet
- Port configuration worksheet
- Zone definition worksheet
- Zone configuration worksheet

Make as many copies of the blank worksheets as you need to plan the installation of your switches. Give your system administrator copies of the completed worksheets.

---

### Planning worksheet

Table 15. Planning worksheet

Item	Description
Firmware level	
Firmware location:	
Server name	
Username	
Directory	
Switch name	
Domain ID	
FCnetID (Fibre Channel IP address)	
FC netmask	
WWN	
Role	
Syslog daemon IP address	
Users defined - access level	
SNMP information:	
System description	
System contacts	
System location	
Event trap level 0 - 5	
Enable authentication traps	
RW community string	
RO community string	
Trap recipients IP address	
License keys	

---

## Port configuration worksheet

Table 16. Port configuration worksheet

Port number	Device name	Device port	Cable length	Port type	Notes	Cable number
0						
1						
2						
3						
4						
5						
6						
7						

---

## Zone definition worksheet

Table 17. Zone definition worksheet

<b>Zone member type</b> (switch, port, WWN)	<b>Zone member</b>	<b>Zone configuration name</b>	<b>Comments</b>
Port (ID, P)			

---

## Zone configuration worksheet

Table 18. Zone configuration worksheet

<b>Zone member type</b> (switch, port, WWN)	<b>Zone member</b>	<b>Zone configuration name</b>	<b>Connects to</b>
Port (ID, P)			



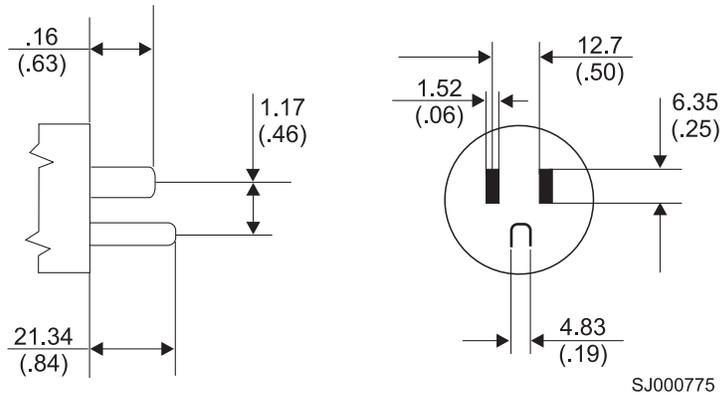


Figure 15. Power cable for Canada and the United States

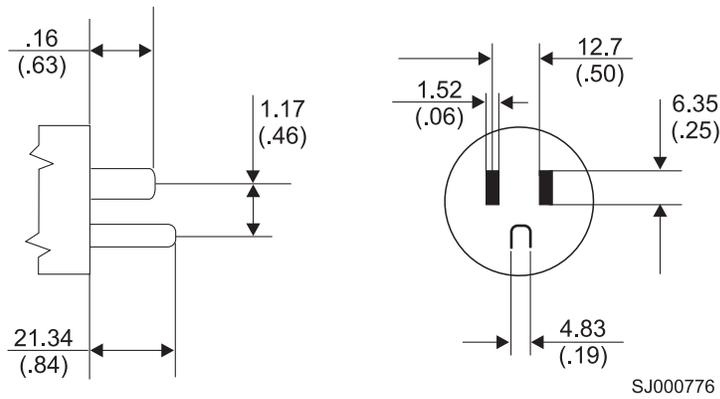


Figure 16. Power cable for Chicago

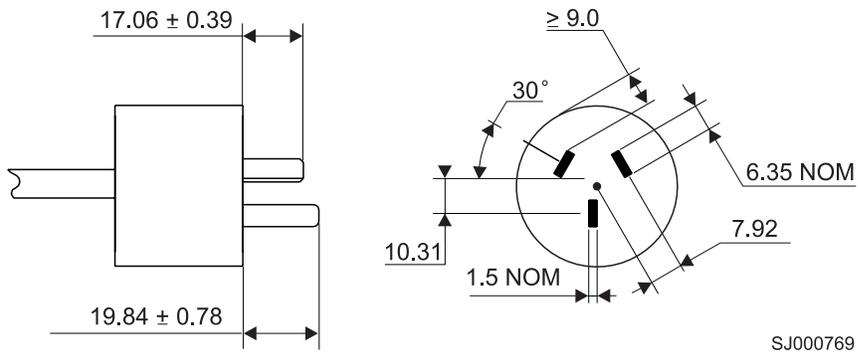


Figure 17. Power cable for China

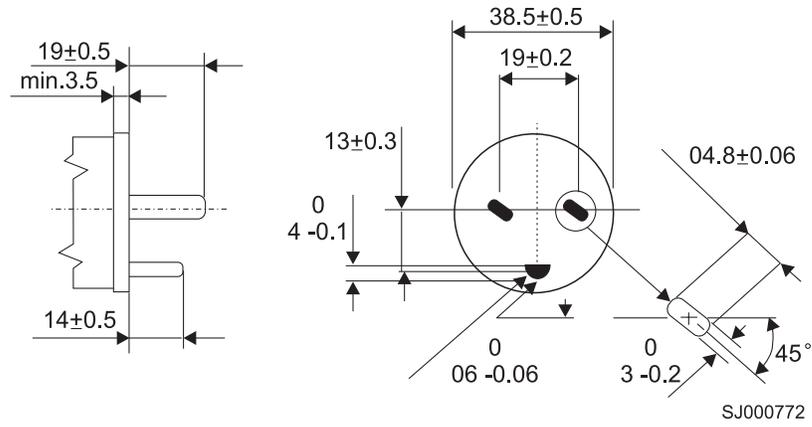


Figure 18. Power cable for Denmark

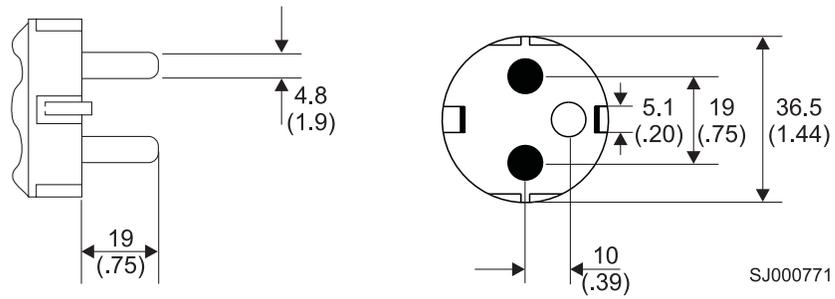


Figure 19. Power cable for France

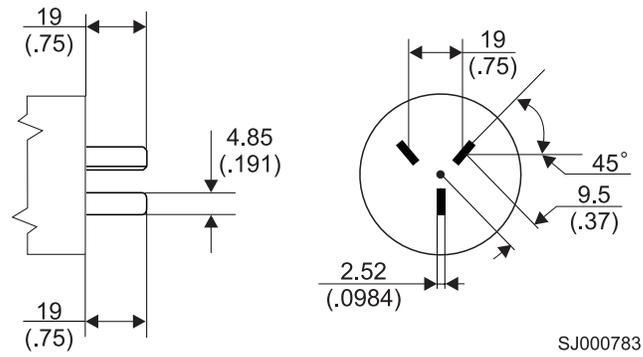


Figure 20. Power cable for Israel

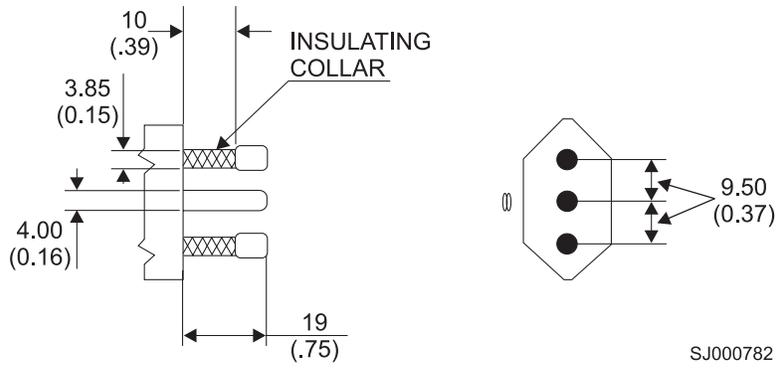


Figure 21. Power cable for Italy

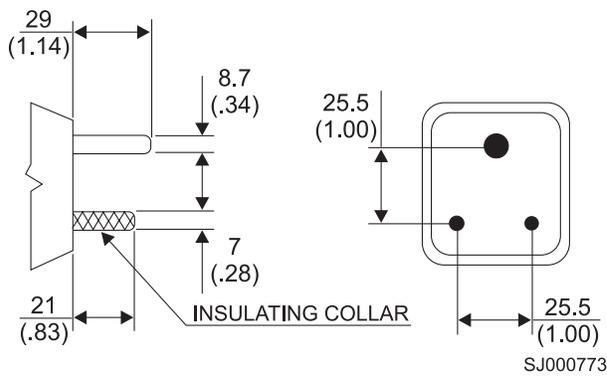


Figure 22. Power cable for South Africa

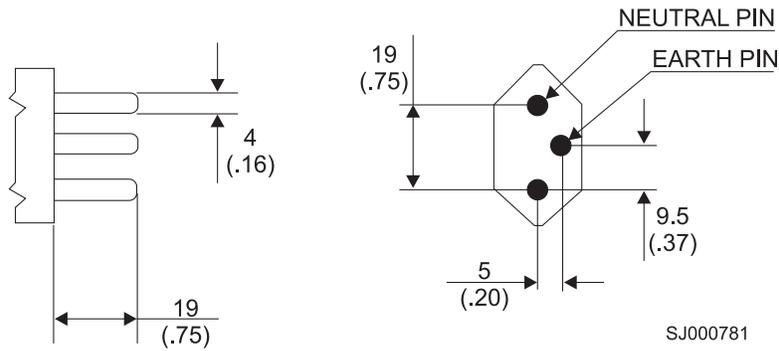


Figure 23. Power cable for Switzerland

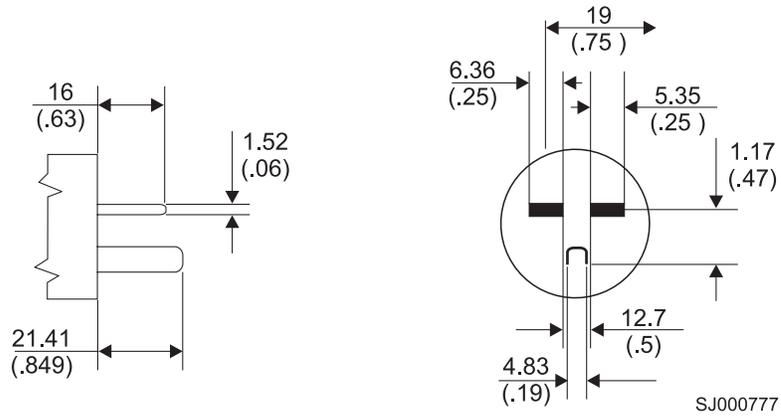


Figure 24. Power cable for Thailand

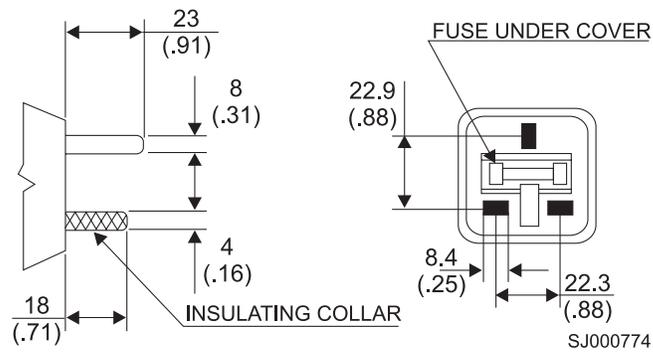


Figure 25. Power cable for United Kingdom

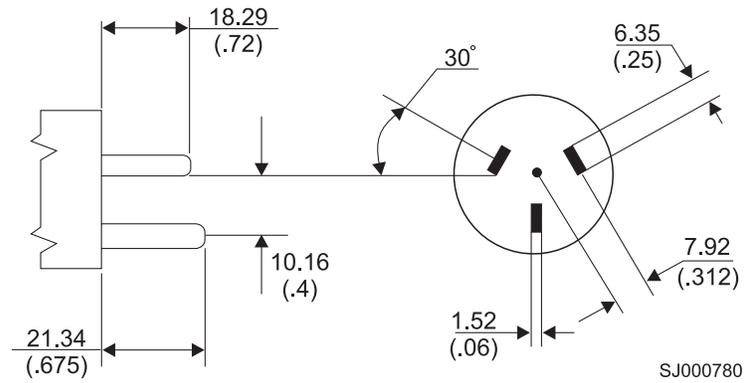
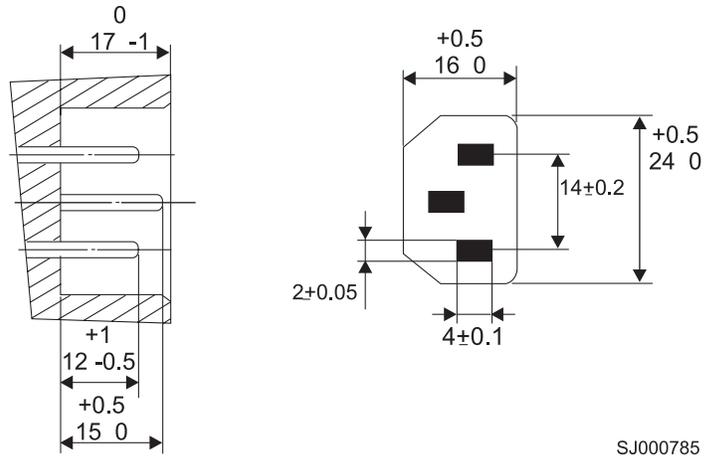


Figure 26. Power cable for Uruguay



SJ000785

Figure 27. PDU cable that is shipped with the 3534 Model F08

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This section gives the electronic emission notices or statements for the United States and other countries.

## Federal Communications Commission (FCC) statement

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

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

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

## Industry Canada compliance statement

**Avis de conformité a la réglementation d'Industrie Canada:** Cet appareil numérique de la classe A est conforme a la norme NMB-003 du Canada.

## Chinese class A compliance statement

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

中华人民共和国“A类”警告声明

声明

此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取切实可行的措施。

## European Community compliance statement

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

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

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

The standards compliance label on the 3534 Model F08 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/IEC61000-3-3 (European and Japanese Harmonics Specification)
- Ring wave test

Where shielded or special cables (for example, cables fitted with ferrites) are used in the test to make the product comply with the limits:

Properly shielded and grounded cables and connectors must be used in order to reduce the potential for causing interference to radio and TV communications and to other electrical or electronic equipment. Such cables and connectors are available from IBM authorized dealers. IBM cannot accept responsibility for any interference caused by using other than recommended cables and connectors.

## Germany compliance statement

Zulassungsbescheinigung laut Gesetz ueber die elektromagnetische

Vertraeglichkeit von Geraeten (EMVG) vom 30. August 1995.

Dieses Geraet ist berechtigt, in Uebereinstimmung mit dem deutschen EMVG das EG-Konformitaetszeichen - CE - zu fuehren.

Der Aussteller der Konformitaetserklaeung ist die IBM Deutschland.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2) 2:

Das Geraet erfuellt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse A.

EN 55022 Klasse A Geraete beduerfen folgender Hinweise:

Nach dem EMVG: <sup>1</sup>

“Geraete duerfen an Orten, fuer die sie nicht ausreichend entstoert sind, nur mit besonderer Genehmigung des Bundesministeriums fuer Post und Telekommunikation oder des Bundesamtes fuer Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Stoerungen zu erwarten sind.” (Auszug aus dem EMVG, Paragraph 3, Abs.4)

Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung mit der entsprechenden

Kostenverordnung (Amtsblatt 14/93) kostenpflichtig.

Nach der EN 55022:

“Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstoerungen verursachen. in diesem Fall kann vom Betreiber verlangt werden, angemessene Massnahmen durchzufuehren und dafuer aufzukommen.”

Anmerkung:

Um die Einhaltung des EMVG sicherzustellen, sind die Geraete wie in den Handbuechern angegeben zu installieren und zu betreiben.

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## **Korean Government Ministry of Communication (MOC) statement**

Please note that this device has been approved for business purposes with regard to electromagnetic interference. If you find that this is not suitable for your use, you may exchange it for one with a non-business use.

## **Taiwan class A compliance statement**

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VS07171L



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## Glossary

This glossary provides definitions for the fibre-channel and switch terminology that the IBM 3534 Model F08 uses.

This glossary includes selected 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.
- The *IBM Glossary of Computing Terms*, available online at the following Web site: [www.ibm.com/ibm/terminology/](http://www.ibm.com/ibm/terminology/)
- The *Storage Networking Dictionary*, available online at the Storage Networking Industry Association (SNIA) Web site: [www.snia.org/education/dictionary/](http://www.snia.org/education/dictionary/)

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.

**8B/10B encoding.** An algorithm for encoding data for transmission in which each 8-bit data byte is converted to a 10-bit transmission character. 8B/10B encoding supports continuous transmission with a balanced number of ones and zeros in the code stream and detects single bit transmission errors.

**access control list (ACL).** A list that specifies the users and groups allowed to access a particular file or directory.

**ACL.** See *access control list*.

**address identifier.** An address value used to identify the source (S\_ID) or destination (D\_ID) of a frame.

**Address Resolution Protocol (ARP).** In the Internet suite of protocols, the protocol that dynamically maps an Internet Protocol (IP) address to an address used by a supporting metropolitan or local area network such as Ethernet or token-ring.

**alias address identifier.** One or more address identifiers which can be recognized by a node port (N\_port) in addition to its N\_port identifier. Alias address identifiers are used to form groups of N\_ports so that frames can be addressed to a group rather than to individual N\_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).** An organization that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States.

**ANSI.** See *American National Standards Institute*.

**API.** See *application programming interface*.

**application programming interface (API).** A set of run-time routines or system calls that allows an application program to use a particular service provided by either the operating system or another licensed program.

**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.** 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. See also *arbitrated loop*.

**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 identify a participating device in an arbitrated loop.

**arbitration wait timeout value (AW\_TOV).** The minimum time an arbitrating L\_port waits for a response before beginning loop initialization.

**ARP.** See *Address Resolution Protocol*.

**ASIC.** See *application-specific integrated circuit*.

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

**ATM.** See *asynchronous transfer mode*.

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

**AW\_TOV.** See *arbitration wait timeout value*.

**bandwidth.** (1) The capacity of a communications line, normally expressed in bits per second (bps). (2) The range of frequencies an electronic system can transmit or receive. The greater the bandwidth of a system, the more information the system can transfer in a given period of time. See also *throughput*.

**basic input/output system (BIOS).** The personal computer 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*.

**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 probability that a transmitted bit will be erroneously received. The BER is measured by counting the number of bits in error at the output of a receiver and dividing by the total number of bits in the transmission. BER is typically expressed as a negative power of 10. See also *error*.

**block.** A unit of application data from a single information category that is transferred within a single sequence.

**bloom.** Application-specific integrated circuit (ASIC) technology on which the 3534 Model F08 is based.

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

**broadcast.** (1) The simultaneous transmission of the same data to all nodes connected to a network. (2) The simultaneous transmission of data to more than one destination. See also *multicast* and *unicast*.

**BTU.** See *British thermal unit*.

**buffer-to-buffer credit (BB\_credit).** Used to determine how many frames can be sent to a recipient when buffer-to-buffer flow control is in use. See also *buffer-to-buffer flow control* and *end-to-end credit*.

**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*.

**cascading.** The process of connecting two or more Fibre Channel hubs or switches together to increase the number of ports or extend distances. See also *fabric* and *inter-switch link*.

**cascading switches.** Switches that are interconnected to build large fabrics.

**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, which consists of two virtual circuits capable of transmitting in opposite directions. See also *link*.

**class F.** Connectionless service for inter-switch control traffic, which provides notification of delivery or nondelivery between two expansion ports (E\_ports).

**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 identical to that of class 2 frames.

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

**CMI.** See *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*.

**community.** The relationship between a Simple Network Management Protocol (SNMP) agent and one or more SNMP managers. The community describes which SNMP manager requests that the SNMP agent should honor.

**control message interface (CMI).** A set of control signals that are used to pass hardware-level messages between ports.

**CPU.** See *central processing unit*.

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

**credit.** The number of receive buffers allocated to a transmitting node port (N\_port), node loop port (NL\_port), or fabric port (F\_port). The credit is the maximum number of outstanding frames that can be transmitted by that N\_port, NL\_port, or F\_port without causing a buffer overrun condition at the receiver.

**cut-through.** A switching technique that allows a routing decision to be made and acted upon as soon as the destination address of a frame is received. See also *route*.

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

**data word.** A type of transmission word that occurs within frames. The frame header, data field, and CRC all consist of data words. See also *frame*, *ordered set*, and *transmission word*.

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

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

**DID.** See *destination ID*.

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

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

**DLS.** See *dynamic load sharing*.

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

**domain\_ID.** A unique identifier for the switch in a fabric. The domain\_ID is usually automatically assigned by the switch, but can also be assigned manually. The value of domain\_ID can be a value between 1- 239.

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

**dynamic load sharing (DLS).** A dynamic distribution of traffic over available paths that permits recomputing of routes when an 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\_D\_TOV.** See *error detect timeout value*.

**EE\_credit.** See *end-to-end credit*.

**effective 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 Industry Association.

**EIA rack.** A storage rack that meets the standards set by the Electronics Industry Association (EIA).

**electromagnetic compatibility (EMC).** The design and test of products to meet legal and corporate specifications dealing with the emissions and susceptibility of 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.

**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-to-end credit (EE\_credit).** A credit scheme used to manage end-to-end flow control during the exchange

of frames between two communicating devices. See also *end-to-end flow control* and *buffer-to-buffer credit*.

**end-to-end flow control.** Flow control that occurs between two connected Fibre Channel node ports (N\_ports). See also *end-to-end credit*.

**E\_port.** See *expansion port*.

**error.** In Fibre Channel technology, 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.** A set of one or more non-concurrent related sequences passing between a pair of Fibre Channel ports. An exchange encapsulates a "conversation" such as a small computer systems interface (SCSI) task or an Internet Protocol (IP) exchange. Exchanges can be bidirectional and can be short or long lived.

**expansion port (E\_port).** In the building of a larger switch fabric, 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.

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

**fabric.** A complex network using hubs, switches, and gateways.

**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. This feature is available only when both QuickLoop and zoning are installed on the switch.

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

**fabric loop port (FL\_port).** A loop-capable fabric port that is used to connect node loop ports (NL\_ports) to the switch in a loop configuration.

**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 part of a Fibre Channel fabric. An F\_port on a Fibre Channel fabric connects to a node's node port (N\_port). See also *fabric loop port* and *Fx\_port*.

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

**FC.** See *Fibre channel*.

**FC-AL.** See *Fibre Channel Arbitrated Loop*.

**FCP.** See *Fibre Channel protocol*.

**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 form of Fibre Channel network in which up to 126 nodes are connected in a loop topology, with each node's loop port (L\_port) transmitter connecting to the L\_port receiver of the node to its logical right. Nodes connected to a Fibre Channel Arbitrated Loop arbitrate for the single transmission that can occur on the loop in any instant using a Fibre Channel Arbitrated Loop protocol that is different from Fibre Channel switched and point-to-point protocols. An arbitrated loop can be private (no fabric connection) or public (attached to a fabric by a fabric loop port (FL\_port)).

**Fibre Channel Protocol (FCP).** An evolving American National Standards Institute (ANSI) interconnection standard for high-speed data transfer among computers and storage devices defined by the Fibre Channel Protocol (FCP). At the physical level, data is transmitted serially over pairs of point-to-point links between Fibre Channel (FC) ports. With appropriate components, data can be transferred at 100 MBps up over a distance of 10 km (6.2 mi) between FC ports. The ports can be configured in ring and switched interconnect topologies which allow each port to exchange data with any other port that is part of the same fabric.

**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 when any one of its components fails. In some cases, a field replaceable unit may contain other field replaceable units.

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

**fill word.** A transmission word that is an IDLE or an ARBx primitive signal. Fill words are transmitted between frames, primitive signals, and primitive sequences to keep a Fibre Channel network active.

**firmware.** Proprietary code that is usually delivered as microcode as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC system board.

**FLOGI.** See *fabric login*.

**FL\_port.** See *fabric loop port*.

**F\_port.** See *fabric port*.

**frame.** In Fibre-channel technology, the structure used to transmit data between ports. A frame 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.

**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.** Describing a communications connection over which each device can transmit and receive simultaneously. 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*.

**gateway.** A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architecture.

**GBIC.** See *gigabit interface converter*.

**generic port (G\_port).** A port on a Fibre Channel switch that can function either as a fabric port (F\_port)

or as an expansion port (E\_port). The functionality of a G\_port is determined during port login. A G\_port functions as an F\_port when connected to a node port (N\_port), and as an E\_port when connected to an E\_port.

**gigabit interface converter (GBIC).** A transceiver that converts between electrical signals used by host bus adapters (and similar Fibre Channel and Ethernet devices) and either electrical or optical signals suitable for transmission. Gigabit interface converters allow designers to design one type of device and adapt it for either copper or optical applications. Unlike gigabit link modules, GBICs can be hot-swapped.

**gigabit switch.** A 16-port, Fibre-channel gigabit switch.

**G\_port.** See *generic port*.

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

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

**half-duplex.** Describing a communications connection over which only one device at a time can transmit data. 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.** A method for achieving address translation. Two hardware translative modes are available to a QuickLoop-enabled switch: Standard Translative Mode, which allows public devices to communicate with private devices across the fabric; and QuickLoop Mode, which allows private devices to communicate with other private devices across the fabric.

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

**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.

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

**hub.** A Fibre Channel device that connects nodes into a logical loop by using a physical star topology. Hubs will automatically recognize an active node and insert

the node into the loop. A node that fails or is powered off is automatically removed from the loop.

**ID.** See *identifier*.

**identifier (ID).** A sequence of bits or characters that identifies a user, program, device, or system to another user, program, device, or system.

**IDLE.** Continuous transmission of an ordered set over a Fibre-channel link when no data is being transmitted for the purpose of keeping the link active and maintaining bit, byte, and word synchronization.

**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.** The system component that originates an input/output (I/O) command over an I/O bus or network. I/O adapters, network interface cards, and intelligent controller device I/O bus control application-specific integrated circuits (ASICs) are typical initiators. 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 that are cabled together and are configured to handle traffic as a seamless group.

**Internet Protocol (IP).** A protocol that routes data through a network or interconnected networks. Internet Protocol (IP) acts as an intermediary between the higher protocol layers and the physical network.

**inter-switch link (ISL).** A Fibre link between two switches.

**IOD.** See *in-order delivery*.

**IP.** See *internet protocol*.

**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 E\_port that is online but not operational between switches due to overlapping domain ID or nonidentical parameters such as E\_D\_TOVs. See also *expansion port*.

**IU.** See *information unit*.

**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*.

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

**latency.** The time from the initiation of an operation until something actually starts happening (for example, data transmission begins).

**LED.** See *light-emitting diode*.

**light-emitting diode (LED).** A semiconductor chip that gives off visible or infrared light when activated.

**link.** In Fibre Channel technology, two unidirectional fibers carrying data in opposite directions, along with their associated transmitters and receivers. See also *circuit*.

**link services.** A protocol for link-related actions.

**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.

**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. LWL can also refer to the type of gigabit interface converter (GBIC) or small form-factor pluggable (SFP). See also *short wavelength*.

**loop.** A configuration of devices connected to the fabric by way of a fabric loop port (FL\_port) interface card.

**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 hex 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. Loop initialization can be used to assign arbitrated loop physical addresses (AL\_PAs), detect loop failure, or reset a node.

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

**looplet.** 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 port (L\_port).** A port used to connect a node to a Fibre Channel Arbitrated Loop (FC-AL). See also *non-participating 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*.

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

**LWL.** See *long wavelength*.

**MAC.** See *media access control*.

**management information base (MIB).** A definition for management information that specifies the information available from a host or gateway and the operations allowed.

**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 ISL in the trunking group is designated as the master port for that group. See also *ISL Trunking*.

**media access control (MAC).** Algorithms that control access to physical media, especially in shared media networks.

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

**multicast.** Transmission of the same data to a selected group of destinations. See also *broadcast* and *unicast*.

**multimode.** A type of optical fiber which incorporates shortwave lasers and which is used with gigabaud link modules. Typically, it is used for links of up to 500 m (1640.42 ft).

**name server.** In networking, the server that translates network names to addresses. See also *simple name server*.

**NL\_port.** See *node loop port*.

**node.** A Fibre-channel device that contains a node port (N\_port) or node loop port (NL\_port).

**node loop port (NL\_port).** A port specific to Fibre Channel Arbitrated Loop (FC-AL). An NL\_port has the same functional, logical, and message handling

capability as a node port (N\_port), but connects to an arbitrated loop rather than to a fabric. Some implementations can function either as N\_ports or as NL\_ports depending on the network to which they are connected. An NL\_port must replicate frames and pass them on when in passive loop mode.

**node name.** The name assigned to a node during network definition.

**node port (N\_port).** A port that connects a node to a fabric or to another node. N\_ports connect to fabric ports (F\_ports) or to other N\_ports of other nodes. N\_ports handle creation, detection, and flow of message units to and from the connected systems. N\_ports are end points in point-to-point links.

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

**N\_port.** See *node port*.

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

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

**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*.

**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, which mark frame boundaries and describe frame contents; primitive signals, which indicate events; and primitive sequences, which indicate or initiate port states. Ordered sets are used to differentiate Fibre Channel control information from data frames and to manage the transport of frames.

**packet.** In networking, a group of bits that has a defined format and fixed maximum size, sent as a unit 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 *non-participating mode*.

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

**Performance Monitoring.** A feature that provides error and performance information to the administrator and end 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*.

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

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

**port\_name.** The unique identifier assigned to a Fibre-channel port and communicated during login and port discovery.

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

**power-on self-test (POST).** A series of internal diagnostic tests that are activated each time the system power is turned on.

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

**private loop.** A Fibre Channel Arbitrated Loop (FC-AL) with no fabric attachment.

**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 set of rules controlling the communication and transfer of data between two or more devices or systems in a communications network.

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

**public loop.** A Fibre Channel Arbitrated Loop (FC-AL) with an attachment to a fabric.

**public NL\_port.** A node loop port (NL\_port) that logs into the fabric, can function within either a public or a private loop, and can communicate with either private or public NL\_ports.

**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.

**RAID.** See *redundant array of independent disks*.

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

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

**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.

**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 two or more disk drives that present the image of a single disk drive to the system. In the event of a single device failure, the data can be read or regenerated from the other disk drives in the array.

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

**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 the Fabric operating system (OS) and enables two fabric switches to be connected over an asynchronous transfer mode (ATM) connection. Remote Switch requires a compatible Fibre Channel-to-ATM gateway. The distance between each switch and the respective ATM gateway can be up to 10 km (6.214 mi).

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

**resource allocation timeout value (R\_A\_TOV).** A value 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 recovery 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*.

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

**route.** The path that network traffic follows from its source to its destination. See also *Fibre Channel shortest path first*.

**routing.** The assignment of the path by which a message is to reach its destination.

**RPC.** See *remote procedure call*.

**RR\_TOV.** See *resource recovery timeout value*.

**RSCN.** See *registered state change notification*.

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

**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.

**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.

**sequence.** A group of related frames transmitted in the same direction between two node ports (N\_ports).

**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. SWL can also refer to the type of gigabit interface converter (GBIC) or small form-factor pluggable (SFP). See also *long wavelength*.

**SID.** See *source ID*.

**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. 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.** A type of optical fiber, typically used with gigabit link modules incorporating longwave lasers. Typically used for long-distance links up to 10 km (6.21 mi).

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

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

**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*.

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

**storage area network (SAN).** A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services. See also *fabric*.

**switch.** A network infrastructure component to which multiple nodes attach. Unlike hubs, switches typically have internal bandwidth that is a multiple of link bandwidth, and the ability to rapidly switch node connections from one to another. A typical switch can accommodate several simultaneous full-link bandwidth transmissions between different pairs of nodes.

**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*.

**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.

**throughput.** A measure of the amount of information transmitted over a network in a given period of time. For

example, a network's data transfer rate is measured in bits per second (bps). Throughput is a measure of performance. It is also measured in Kbps or Mbps. See also *bandwidth*.

**topology.** In Fibre Channel technology, the configuration of the Fibre Channel network and the resulting communication paths allowed. There are three possible topologies: point-to-point, which allows a direct link between two communication ports; switched fabric, which allows multiple node ports (N\_ports) to be linked to a switch by fabric ports (F\_ports); and arbitrated loop, which allows multiple node loop ports (NL\_ports) to be connected in a loop.

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

**transmission word.** A group of four transmission characters.

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

**trunking ports.** Ports that are in the trunking group.

**tunneling.** To treat a transport network as though it were a single communication link or local area network (LAN).

**U.** The unit of measure for rack-mounted equipment.

**UDP.** See *User Datagram Protocol*.

**ULP.** See *upper-layer protocol*.

**ULP\_TOV.** See *upper-layer timeout value*.

**unicast.** Transmission of data 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-layer protocol (ULP).** A protocol used on a Fibre Channel network at or above the FC-4 level.

**upper-layer timeout value (ULP\_TOV).** The minimum time that a SCSI ULP process waits for SCSI status before initiating ULP recovery.

**User Datagram Protocol (UDP).** In the Internet suite of protocols, a protocol that provides unreliable, connectionless datagram service. It enables an application program on one machine or process to send a datagram to an application program on another machine or process. UDP uses the Internet Protocol (IP) to deliver datagrams.

**WAN.** See *wide area network*.

**well-known address.** An address used to uniquely identify a particular node in the network to establish connections between nodes.

**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 may use or provide public communications facilities. (T)

**workstation.** A powerful, single-user microcomputer, usually with a high-resolution display. Workstations are often used in conjunction with networked applications in which programs run on the workstation using data that resides on a server, which is connected to the workstation by a network.

**worldwide name (WWN).** A unique identifier for 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*.

**zone.** A collection of Fibre Channel node ports (N\_ports) or node loop ports (NL\_ports) (that is, device ports) that are permitted to communicate with each other using the fabric. Any two N\_ports or NL\_ports that are not members of at least one common zone are not permitted to communicate using the fabric. Zone membership can be specified by: 1) port location on a switch (that is, domain\_ID and port number); or, 2) the N\_port\_name of the device; or, 3) the address identifier of the device; or, 4) the node name of the device. Well-known addresses are implicitly included in every 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.

**zoning.** In Fibre Channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones. See also *zone*.



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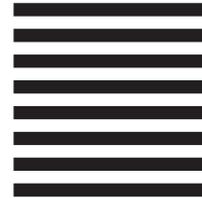
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