installation and reference
guide

hp surestore
fc 1Gb/2Gb switch 16B

www.hp.com

Notice

Warranty

If you have any questions about the warranty for this product, contact your dealer or local Hewlett-Packard sales representative

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Safety notices

Any servicing, adjustment, maintenance, or repair must be performed only by authorized service-trained personnel.

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About This Guide

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Glossary

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Related Publications

Related product information can be found in the following publications. Those publications with part numbers are provided as printed copies with your product. The HP Surestore FC 1Gb/2Gb Switch 16B Documentation CD contains all publications listed in the table below and is also provided with your product.

Title	Part Number
HP Surestore FC 1Gb/2Gb Switch 16B Quick Start Guide	A7340-96002
HP Surestore FC 1Gb/2Gb Switch 16B Documentation CD	A7340-11001
HP Surestore FC 1Gb/2Gb Switch 16B Installation and Reference Guide	Available only on CD
Fabric OS Reference Manual, version 3.0	Available only on CD
Fabric OS Procedures Guide, version 3.0	Available only on CD
Fabric OS Version 3.0.1 Release Notes	Available only on CD
Fabric Watch User's Guide, version 3.0	Available only on CD
QuickLoop User's Guide, version 3.0	Available only on CD
Web Tools User's Guide, version 3.0	Available only on CD
Distributed Fabrics User's Guide, version 3.0	Available only on CD
Zoning User's Guide, version 3.0	Available only on CD
MIB Reference Manual, version 3.0	Available only on CD
ISL Trunking User's Guide, version 3.0	Available only on CD
Advanced Performance Monitoring User's Guide, version 3.0	Available only on CD
Merging Heterogeneous Fabrics Instructions	Available only on CD

Information about Fibre Channel standards and Fibre Channel in general can be found on the Fibre Channel Industry Association Web site, located at:

`http://www.fibrechannel.com`

Getting Help

For the most current technical support information for the FC 16B, visit the HP Web site at `http://www.hp.com/support/fc16B.`   This includes hardware and software support, all repairs, and spare components.

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

- Switch serial number
- Switch world wide name
- Output from the `supportShow` telnet command
- Detailed description of the problem
- Topology configuration
- Troubleshooting steps already performed

Getting Software Updates

For information on obtaining software updates contact your HP account representative.

Use of Notes, Cautions, and Warnings

The following notices are used in this document:

Note:	A note provides a helpful tip, emphasizes important information, or provides a reference to related information.

Caution	A caution notice warns of potential damage to equipment, firmware, software, or data if the correct procedure is not followed.

Warning	A warning notice warns of potential injury to personnel and possible damage to equipment, firmware, software, or data if the correct procedure is not followed.

Introducing the HP Surestore FC 1Gb/2Gb Switch 16B

This chapter provides the following information:

- *Overview* on page 1-1

- *Monitoring and Managing the FC 16B* on page 1-3

Overview

The HP Surestore FC 1Gb/2Gb Switch 16B is a 16-port Fibre Channel gigabit switch that supports link speeds up to 2 Gbps. Each port automatically negotiates to the highest common speed of all devices connected to the port. The ports are compatible with SFPs (small form factor pluggable media), are universal and self-configuring, and are capable of individually becoming an F_Port (fabric enabled), FL_Port (fabric loop enabled), or an E_Port (expansion port).

The FC 16B includes the Brocade Fabric Operating System™ version 3.0.1, and is compatible with HP's installed base of Fibre Channel hubs, bridges, and switches. It can operate in a fabric containing multiple switches or as the only switch in a fabric.

The FC 16B is one rack unit in height, has an air-cooled chassis, and can be set up as a stand-alone unit or mounted in a 19-inch rack. The FC 16B includes the following:

- 16 optical ports, each with two LEDs (light-emitting diodes), one to indicate port status and one to indicate link speed

- One serial port with an RS-232 connector

- One 10/100 Mbps Ethernet port with an RJ-45 connector

- A "switch power" LED on the SFP media side, indicating whether the switch has power

- A "switch status" LED on the power supply side, indicating the overall status of the switch

- One or two power supplies, with built-in fans and LEDs (if two power supplies are installed, they are redundant and individually hot-swappable)

- Two fan trays, individually hot-swappable

The SFP Media Side

Figure 1-1 shows the SFP media side of the FC 16B, which contains the serial port, Ethernet port, fiber optic ports and their corresponding LEDs, and the switch power LED.
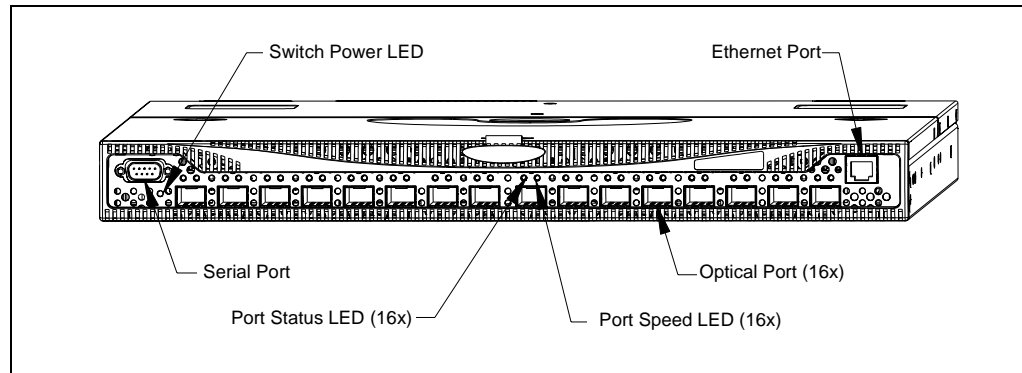
Figure 1-1   The SFP media side of the FC 16B

The ports of the FC 16B are color-coded in groups, with four purple ports alternating with four unmarked ports, to indicate which ports can be used in the same ISL Trunking group.

Note: ISL Trunking is a Fabric OS feature that enables distribution of traffic over the combined bandwidth of up to four ISLs between two directly adjacent switches, while preserving in-order delivery. For information about ISL Trunking, refer to the *ISL Trunking User Guide*.

The Power Supply Side

Figure 1-2 shows the power supply side of the FC 16B switch, which provides access to the fan trays and power supplies and the Switch Status LED. Each power supply also has an LED that indicates the status of that power supply. The power supplies, fan trays, and the entire switch are all FRUs (field replaceable units).
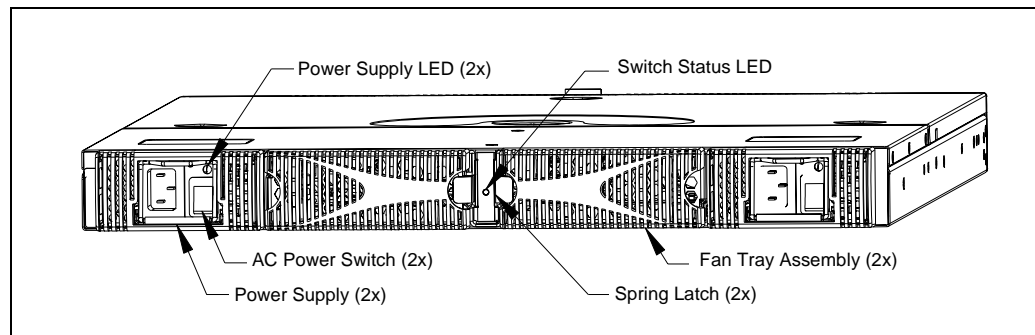
Figure 1-2   The power supply side of the FC 16B

Monitoring and Managing the FC 16B

The FC 16B can be managed in-band using Fibre Channel protocol, or out-of-band by connecting to the Ethernet port. The management functions allow the administrator to monitor fabric topology, port status, physical status, and other information to aid in system debugging and performance analysis.

Note: The switch automatically performs POST (power on self-test diagnostics) each time it is turned on, and any errors are recorded in the error log. For more information about POST, see *POST Specifications* on page A-6.

The FC 16B is compatible with the following management interfaces:

- Command line interface through a telnet connection
  For more information refer to the *Fabric OS Procedures Guide* and the *Fabric OS Reference Manual*.

- Web Tools
  For more information refer to the *Web Tools User's Guide*.

- Standard SNMP applications
  For more information refer to the *MIB Reference Manual*.

All these management methods can be used either in-band (Fibre Channel) or out-of-band (Ethernet).

In addition, the FC 16B supports the following software:

- Zoning
  For information refer to the *Zoning User's Guide*.

- QuickLoop
  For information refer to the *QuickLoop User's Guide*.

- Fabric Watch
  For information refer to the *Fabric Watch User's Guide*.

- Advanced Performance Monitoring
  For information refer to the *Advanced Performance Monitoring User's Guide*.

- Extended Fabrics
  For information refer to the *Distributed Fabrics User's Guide*.

- Remote Switch
  For information refer to the *Distributed Fabrics User's Guide*.

- ISL Trunking
  For information refer to the *ISL Trunking User's Guide*.

Chapter

2

Installing and Configuring the HP Surestore FC 1Gb/2Gb Switch 16B

The HP Surestore FC 1Gb/2Gb Switch 16B can be installed either as a stand-alone unit or in a rack that meets EIA (Electronic Industries Association) standards.

This chapter provides the following information:

- *Safety Guidelines* on page 2-1
- *Package Contents* on page 2-2
- *Installing the Switch as a Stand-Alone Unit* on page 2-2
- *Installing the Switch in a Rack* on page 2-3
- *Configuring and Connecting the Switch* on page 2-9

Safety Guidelines

Follow these safety guidelines to ensure successful and safe operation of the switch:

- The supply circuit, line fusing, and wire size must conform to the electrical rating on the switch nameplate.
- The ambient air temperature near the switch must not exceed 40 degrees Celsius. This is particularly important to verify if the switch is installed in a closed or multi-rack assembly.
- The volume of air flow available to the switch must be at least 300 cubic feet per minute. The air vents must not be blocked.

Follow these safety guidelines for rack-mount installation:

- The rack space must be 1U high, 19 inches wide, and 24 inches deep.
- All equipment installed in the rack should have a reliable branch circuit ground connection. Do not rely on a connection to a branch circuit, such as a power strip.
- The additional weight of the switch should not unbalance the rack or exceed the rack's weight limits.
- The rack should be mechanically secured to insure stability in the event of an earthquake.

⚠ WARNING   For safety reasons, when installing this product in an equipment rack, you must consider rack stability against tipping. Please refer to the *Hewlett-Packard Rack System/E User's Manual* provided with the equipment rack to determine rack stability (also available in electronic format through the HP Web site at http://www.hp.com/racksolutions/). If the necessary stability is not achieved, through the placement of

additional equipment or ballast, the equipment rack must be anchored to the building structure before operation.

Package Contents

The major items contained in the FC 16B shipping carton(s) include the following items:

- One FC 16B switch, two fan trays, and one or two power supplies installed
- One 10 ft. RS-232 serial cable (convertible to an RJ-45 connector through removal of the adapter on the end of the cable)
- Two 6 ft. power cables (according to the number of power supplies included with the switch)
- Four rubber mounting feet (used only for setting up the switch as a stand-alone unit)
- Two rails and one bag of rail mounting hardware (required if the switch is to be installed in a rack):
- *hp surestore FC 1Gb/2Gb Switch 16B Quick Start Guide*
- HP Surestore FC 1Gb/2Gb Switch 16B Documentation CD-ROM

Installing the Switch as a Stand-Alone Unit

This section provides instructions for setting up the switch as a stand-alone unit on a flat surface. The following items are required:

- FC 16B
- Power cables
- Rubber mounting feet

To set up the switch as a stand-alone unit:

1. Check contents of the shipping carton to verify all the required parts and hardware are available.

2. Apply the rubber feet by completing the following steps:

CAUTION   Installing the rubber feet on the switch is recommended to help prevent the switch from accidentally sliding off the supporting surface.

---

    a. Clean the four depressions that are at each corner of the bottom of the switch to ensure they are free of dust.

    b. Place a rubber foot in each depression, with the adhesive side against the chassis, and press into place.

3. Place the switch on a flat, sturdy surface.

4. Provide power to the switch by completing the following steps:

   a. Connect the power cable to the FC 16B power supply and to a power outlet. Ensure the power cable is routed so that it is not exposed to stress.

   b. Turn on the power supply (flip the AC switch to "I") when ready to supply power to the switch. The switch automatically runs POST (power on self-test) each time it is turned on.

   c. If the FC 16B includes a second power supply, repeat Steps 4a and 4b for the remaining power supply.

Note   Do not connect the switch to the network until the IP address is correctly set. For instructions on how to set the IP address, see *Configuring and Connecting the Switch* on page 2-9.

Installing the Switch in a Rack

This section provides instructions for installing the FC 16B in an HP or Compaq/Rittal rack.
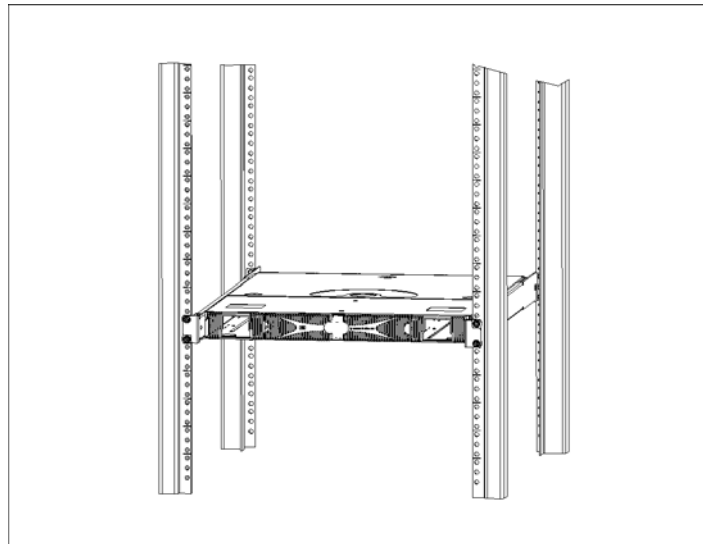
Figure 2-1. FC 16B Rack-Mounted Switch

The following items are required to install the switch in a rack:

- FC 16B
- Power cables
- #2 Phillips and T25 Torx screwdrivers
- Rails and rail mounting hardware:

    (2) Rear mounting bracket
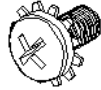
    (6) #8-32 x 5/16 Phillips pan-head screw with captive star lock washer

    (6) #8 Flat washer

    (6) M5 Torx head screw with captive lock washer

    (2) Rubber washer

    (4) M5 U-type Tinnerman clip (HP rack only)

    (4) #10-32 square Tinnerman nut (Compaq/Rittal rack only)

    (4) #10-32 x 5/8 Phillips pan-head screw with attached lock washer (Compaq/Rittal rack only)

    (6) Spacer (Compaq/Rittal rack only)

    (4) M5 flat washer (Compaq/Rittal rack only)

CAUTION   For proper airflow, the SFP media side of the FC 16B faces the rear of the rack. This mounting allows air to enter from the front of the rack and to exhaust at the rear of the rack, which is similar to other rack-mounted equipment.

To install the switch in a rack:

1. Check contents of the shipping carton to verify all the required parts and hardware are available.

2. Choose a mounting location in the rack for the switch.

3. Attach the rear rail-tray brackets to the rear rack uprights by completing one of the following steps:

   – For an HP rack, install each of the two mounting brackets with (1) M5 Torx head screw with captive lock washers as shown in Figure 2-2.
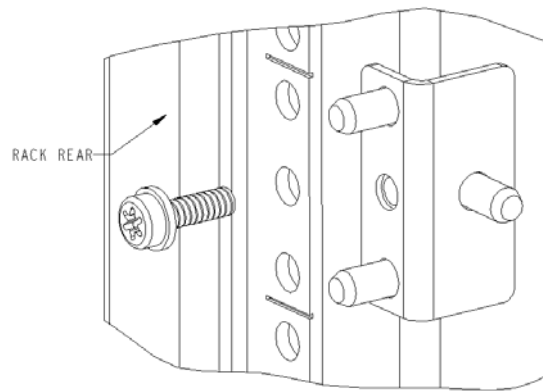
Figure 2-2. Installing the Rear Rail-Tray Brackets (HP Rack)

   – For a Compaq/Rittal rack, assemble each of the two brackets with (2) spacers, (2) M5 flat washers, and (1) M5 Torx head screw with captive lock washers as shown in Figure 2-3. Note that the alignment pins will be resting on the top surfaces of the spacers.
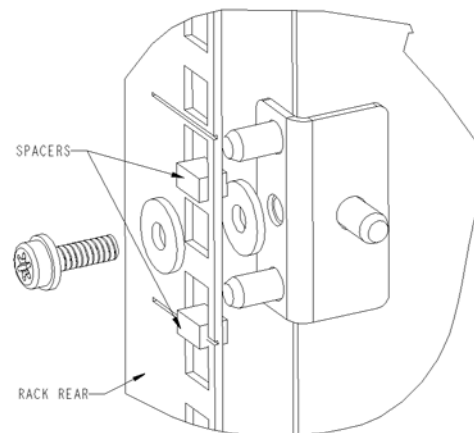
Figure 2-3. Installing the Rear Rail-Tray Brackets (Compaq/Rittal Rack)

4. Install the Tinnerman clips or nuts by completing one of the following steps:

   – For an HP rack, install (2) M5 U-type Tinnerman clips for each of the front columns of the rack in the top and bottom positions of the three-hole EIA pattern as shown in Figure 2-4.
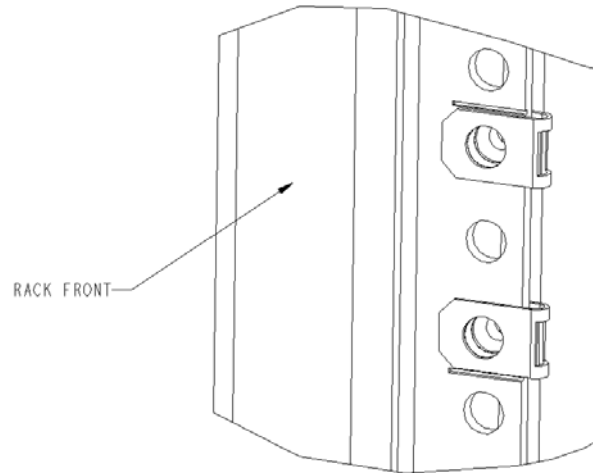
Figure 2-4. Installing the Tinnerman Clips (HP Rack)

– For a Compaq/Rittal rack, install (2) #10-32 square Tinnerman nuts for each of the front columns of the rack in the top and bottom positions of the three-hole EIA pattern. Also install (1) spacer in the center position for each column on the front of the rack. See Figure 2-5.
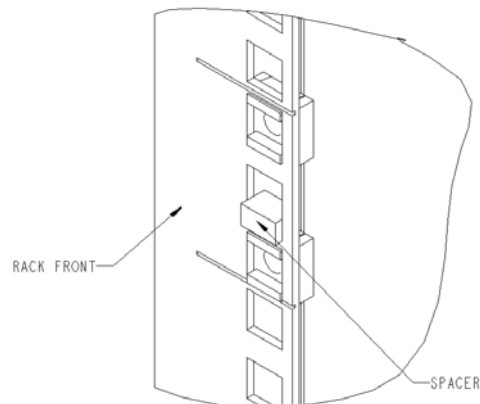
Figure 2-5. Installing the Tinnerman Nuts and Spacers (Compaq/Rittal Rack)

5. Assemble the outer rails by completing the following steps:

a. As an aid in assembly, two rubber washers have been included to help keep the rear slotted portion of the outer rail flush against the rear rail-tray brackets. Install them as shown in Figure 2-6.
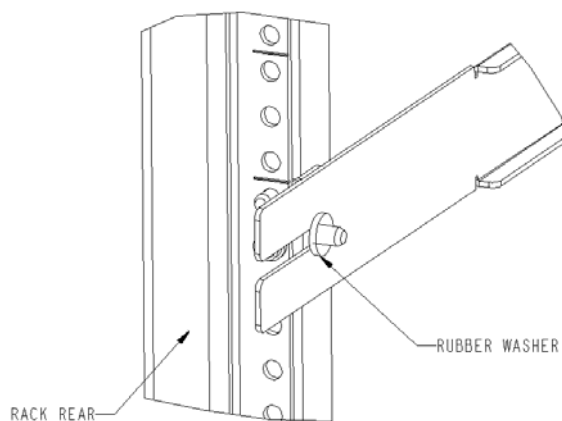
Figure 2-6. Installing the Rubber Washers

b. Insert the alignment pins attached to the outer rail front flange into the center opening in the rack.

Note   For the Compaq/Rittal rack, the alignment pins will be resting on the top surfaces of the spacers.

c. Depending on the rack you are using, complete one of the following tasks:

– For an HP rack, install one M5 Torx screw in the upper hole location of the right rail. Then, install one M5 Torx screw in the lower location of the left rail. See Figure 2-7.
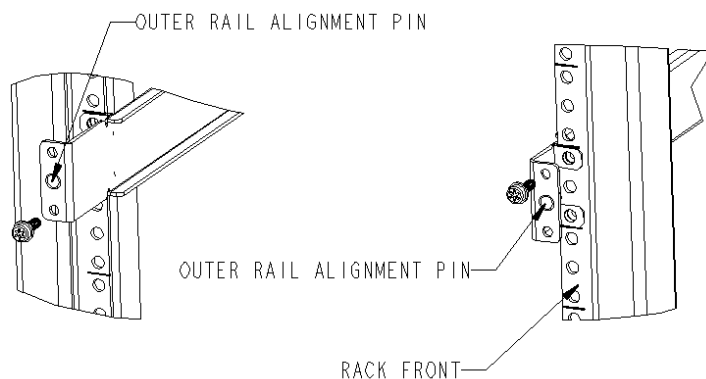
Figure 2-7. Assembling the Outer Rails (HP Rack)

– For a Compaq/Rittal rack, install one #10-32 x 5/8 Phillips pan-head screw in the upper hole location of the right rail. Then, install one #10-32 x 5/8 Phillips pan-head screw in the lower location of the left rail.

6. Assemble the two inner rails (one on each side) to the switch using (6) #8-32 x 5/16 Phillips pan-head screws, and #8 flat washer as shown in Figure 2-8.
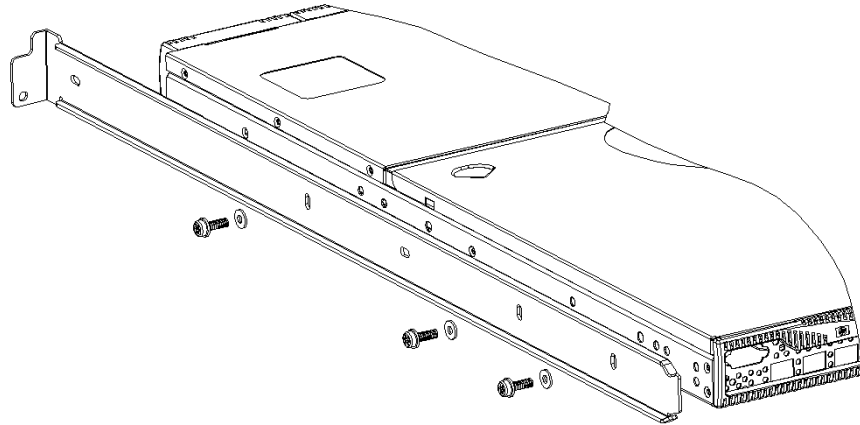
Figure 2-8. Assembling the Inner Rails

CAUTION   Do not use any other screws other than the six that are provided. Use of any longer lengths can cause damage to internal components of the switch. Before tightening screws, make sure that the rails are centered to the overall height of the switch.

7. Insert the switch with the attached inner rails into the outer rails. Assemble (2) remaining M5 Torx screws to complete the installation. See Figure 2-9.

RACK FRONT
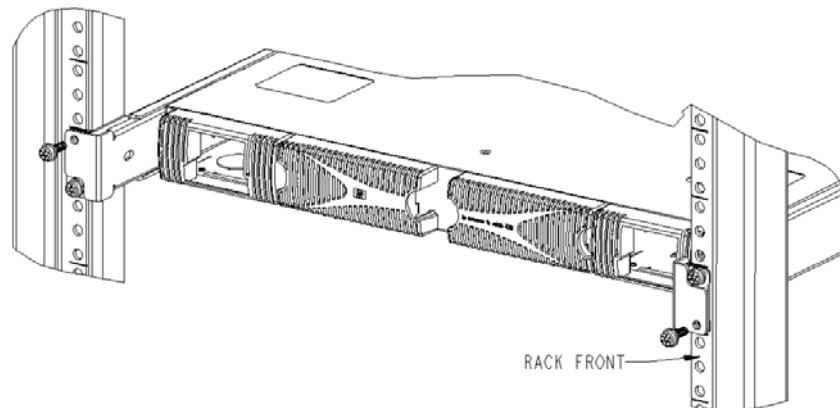
Figure 2-9. Installing Switch into the Rack

8. For the Compaq/Rittal rack only, install the remaining #10-32 x 5/8 Phillips pan-head screws.

9. Provide power to the switch by completing the following steps:

CAUTION   Ensure the power cable or cables are routed so that they are not exposed to stress when the switch is moved on the slides.

Note   Allow for 1U space in the rack for every five switches to facilitate cable management.

    a. Connect the power cable to the FC 16B power supply and to a power outlet.

    b. Turn on the power supply (flip the AC switch to "I") when ready to supply power to the switch. The switch automatically runs POST (power on self-test) each time it is turned on.

    c. If the FC 16B includes a second power supply, repeat Steps 9a and 9b for the remaining power supply.

Note   Do not connect the switch to the network until the IP address is correctly set. For instructions on how to set the IP address, see *Configuring and Connecting the Switch* on page 2-9.

Configuring and Connecting the Switch

The following items are required to configure and connect the FC 16B for use in a network and fabric:

- The FC 16B installed and connected to a power source
- Workstation that has a terminal emulator application (such as HyperTerminal)
- Serial cable provided with the switch, for connecting the switch to the workstation
- An unused IP address
- Ethernet cable for connecting the switch to the workstation or to a network containing the workstation
- SFPs and FC cables, as required to connect the switch to the fabric

To configure the FC 16B and connect it to a fabric:

1. Replace the factory IP address and related information with the IP information provided by your network administrator by completing the following steps:

    a. Remove the shipping plug from the serial port and insert the serial cable provided with the FC 16B.

    b. 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, the adapter on the end of the serial cable can be removed to use the RJ-45 connector to create a serial connection.

    c. Verify that the switch power is on and POST is completed.

    d. Disable any serial communication programs running on the workstation.

    e. Open a terminal emulator application (such as HyperTerminal on a PC, or TERM in a UNIX environment), and configure as follows:

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

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

– In a UNIX environment, enter the following string at the prompt: `tip /dev/ttyb -9600`

f. From the terminal emulator application, log on to the switch with administrative privileges through the serial connection. The default administrative logon is `admin` and the default password is `password`.

CAUTION   Do not change the default password unless local administration policy requires it.

---

g. Enter the following at the prompt: `ipAddrSet`

h. Enter the following information at the corresponding prompts, listed below:

– `Ethernet IP Address` [10.77.77.77]: Enter the new Ethernet IP address.

– `Ethernet Subnetmask` [0.0.0.0]: Enter the new Ethernet subnetmask.

– `Fibre Channel IP Address [none]`: Enter the new Fibre Channel IP address if desired.

– `Fibre Channel Subnetmask [none]`: Enter the new Fibre Channel subnet mask if desired.

– `Gateway Address` [172.17.1.1]: Enter the new gateway address.

– `Set IP address now? [y = set now, n = next reboot]`: Enter "y" to set now.

i. You can verify the address was correctly set by entering the following: `ipAddrShow`

j. Record the IP address on the label provided for this purpose on the FC 16B.

k. Once the IP address is verified as correct, remove the serial cable and replace the shipping plug in the serial port.

Note   The serial port is intended only for use during the initial setting of the IP address and for service purposes. Using the serial port during normal switch operation or for regular maintenance is not recommended.

---

2. Record the IP address for future reference.

3. Connect the switch to the workstation computer by Ethernet cable (can be a direct connection or through a network) by completing the following steps:

   a. Remove the shipping plug from the Ethernet port.

   b. Insert one end of an Ethernet cable in the Ethernet port.

   c. Connect the other end of the Ethernet cable to the workstation or to an Ethernet network containing the workstation.

   Note   The switch can now be accessed remotely and from multiple connections using telnet or Web Tools. Ensure that the switch is not being modified from any other connections during the remaining steps.

   ---

4. Log on to the switch with administrative privileges by telnet. The default administrative logon is `admin` and the default password is `password`.

   CAUTION   Do not change the default password unless local administration policy requires it.

   ---

5. Modify the domain IDs if desired by completing the following steps:

   Note   The default domain ID is 1. If the default 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. The domain IDs that are currently in use can be determined using the telnet command `fabricShow`.

   ---

   a. Disable the switch by entering the following: `switchDisable`

   b. Enter the following: `configure`

   c. Enter the following at the `Fabric parameters` prompt: `y`

   d. Enter a unique domain ID: `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. Re-enable the switch by entering the following: `switchEnable`

6. Optional: Specify any custom status policies for the fabric by completing the following steps:

   a. Enter the following at the prompt: `switchStatusPolicySet`

   b. Specify the desired status policies. To completely deactivate the alarm for a particular condition, enter "0" at the prompt for that condition.

7. Add the SFPs (small form factor pluggable media) and cables to the ports as required by completing the following steps:

Note   The ports and FC cables used in trunking groups must meet specific requirements. For a list of these requirements, refer to the *ISL Trunking User's Guide*.

CAUTION   Configure each port to match the topology of each host or target before connecting to the device. The default port configuration is fabric, not private loop. The switch does not auto-sense topology.

---

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, and insert the SFP into the port until it is firmly seated and the latching mechanism clicks. For more specific instructions, refer to the SFP manufacturer's documentation.

Note   The SFP is keyed so that it can only be inserted with the correct orientation into the port. If the SFP does not slide in easily, ensure it is correctly oriented.

---

c. Connect the 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. Then, insert the cable into the SFP until it is firmly seated and the latching mechanism clicks.

Note   The cable is keyed so that it can only be inserted correctly into the SFP. If the cable does not slide in easily, ensure it is correctly oriented.

---

8. Optional: Verify the correct operation of the FC 16B by entering the following command from a workstation: `switchShow`. This command provides information about the status of the switch and the ports. For more information about this and other commands, refer to the *Fabric OS Procedures Guide*.

Saving the System Configuration Files

Upload the switch configuration file for disaster recovery and keep it in a safe place where it can be easily found. Backing up the configuration after the initial configuration changes and periodically thereafter is **strongly recommended**.

Backing up the Switch Configuration Settings

FTP must be used on Windows workstations to backup the system configuration. The FTP server must be running before an upload can occur. Use the RSHD service on a UNIX machine.

> Note   The two supplied utilities, RSHD.EXE and CAT.EXE currently do not support uploads for Windows, only downloads. FTP must be used on Windows machines.

1. Verify that the RSHD service (on a UNIX machine) or the FTP service (on a Windows machine) is running on the host workstation.

2. Login to the switch as the admin user.

3. At the command line enter the following command:

   ```
   configUpload "hostIPaddr", "user", "path_filename","password"
   ```

   where `hostIPaddr` is the IP address of the host computer, `user` is the User ID used to log into this computer, `path_filename` is the path location and filename of the configuration file, and `password` is the password for the user ID specified. If only `configUpload` is entered the system prompts you for each parameter.

   Example:

   ```
   switch:admin> configupload
   Server Name or IP Address [host]: 123.45.678.901
   User Name [user]: kelev
   File Name [config.txt]: switch1
   Protocol (RSHD or FTP) [rshd]: ftp
   Password:
   upload complete
   ```

Restoring the System Configuration Settings

To restore the system configuration settings from a backup:

1. Verify that the RSHD service (on a UNIX machine) or the FTP service (on a Windows machine) is running on the host workstation.

2. Login to the switch as the admin user.

3. Shut down the switch by entering the following command:

   ```
   switchDisable
   ```

4. At the command line enter the following command:

   ```
   configDownload "hostIPaddr", "user", "path_filename","password"
   ```

   where `hostIPaddr` is the IP address of the host computer, `user` is the User ID used to log into this computer, `path_filename` is the path location and filename of the system configuration file, and `password` is the password for the user ID specified.

Note   The password operand is only required if you are using FTP.

---

5. Reboot the switch by entering the following command:

   `fastBoot`

Next Steps

Specific tasks remain to be completed before the switch is fully operational and manageable in your network with your equipment. These tasks and the associated tools are described in the remaining documents shipped with the product on the documentation CD-ROM. This section provides specific guidance for completing tasks that many users may need to do.

Setting QuickLoop Mode on Ports

The default configuration for a port is fabric mode. QuickLoop is used to connect private hosts to private storage using the Fibre Channel network. A QuickLoop zone, connecting two switches, may be used to expand the number of private hosts and storage connected. An entire switch can be set to operate in QuickLoop mode using the `qlEnable` telnet command. A port on a switch operating in Mixed mode can be set to or removed from QuickLoop using the telnet commands `qlPortEnable` and `qlPortDisable`. See the *QuickLoop User's Guide* for more details.

Setting Up Speed Negotiation

The FC 16B ports can operate at three different speed levels: auto-sensing mode, 1 Gbps mode, or 2 Gbps mode. Use the telnet command `switchCfgSpeed` to set the speed level for all ports in a switch. Use the `portCfgSpeed` to set the speed level for a single port. Depending on your environment you may need to force a port to use a specific speed level. Check the configuration information for your network components for specific requirements. See the *Fabric OS Reference Manual* for a detailed command description.

Configuring Supported Devices

HP Surestore Director FC-64 Switch

The FC 16B switch can be used with the HP Surestore Director FC-64 switch. Specific configurations must be set on both devices to make this work.

On the FC 16B, logon to the switch with administrative privileges and enter the following telnet commands:

1. `switchDisable`

2. `interopMode 1`

3. `switchEnable`

On the Director FC-64 switch, the following steps must be completed to configure the switch for interoperability:

Step 1: Verify Unique Domain IDs
Step 2: Select a Single Surestore FC-64 Director as Principal Switch
Step 3: Verify Unique Zone Names
Step 4: Verify Brocade Product Zoning Configurations
Step 5: Verify Zone Naming Conventions
Step 6: Verify Operating Mode
Step 7: Verify Surestore FC-64 Director Switches' Operating Parameters
Step 8: Verify Firmware Version
Step 9: Verify EFC Manager Version
Step 10: Verify Private Loop Targets on Brocade Products are Translated to Fabric
Step 11: Add Switches to Fabric
Step 12: Complete Zoning Activities
Step 13: Save Active Zone Set

For complete instructions on configuring the HP Director FC-64 switch see "Checklist for Merging Fabrics" in the *Merging Heterogeneous Fabrics Instructions* white paper on the FC 16B documentation CD-ROM.

HP Surestore VA 7400

The FC 16B also can support a 2Gb connection to an HP Surestore Virtual Array 7400. Set the port speed to 2Gb using the telnet command `portCfgSpeed`.

Use the Virtual Front Panel (VFP) on the VA 7400 and configure the device as follows:

1. Change the controller port data rate to 2 Gbits/s

   a. To change the port data rate to 2 gigabits/second for controller 1, enter:

   ```
   vfpmgr -S 2 -c 1
   ```

   When prompted to reset, enter `no`.

   b. To change the port data rate for controller 2, enter:

   ```
   vfpmgr -S 2 -c 2
   ```

   When prompted to reset, enter `no` if additional settings must be changed. If all changes have been made, enter `yes` to reset the array.

2. Change the controller port topology.

a. To change the port topology for controller 1 enter the following command, selecting 4 for Direct Fabric Attach:

    ```
    vfpmgr -t 4 -c 1
    ```

    When prompted to reset, enter no.

b. To change the port topology for controller 2 enter the following command, using the same topology value used for controller 1:

    ```
    vfpmgr -t 4 -c 2
    ```

    When prompted to reset, enter no if additional settings must be changed. If all changes have been made, enter yes to reset the array.

Private Loop Devices

To work with private loop devices such as the FC 60, the FC 10, or the SCSI bridge FC 4/2, set the FC 16B switch port as an L_PORT. See the telnet command portCfgLport.

Operating the HP Surestore FC 1Gb/2Gb Switch 16B

This chapter provides the following information:

- *Turning the FC 16B On and Off* on page 3-1
- *Interpreting LED Activity* on page 3-1
- *Interpreting POST Results* on page 3-5
- *Maintaining the Switch* on page 3-6

Turning the FC 16B On and Off

To turn the FC 16B on, connect one or both power supplies to a power source, then flip the AC power switch to "I".

To turn the switch off, turn off both power supplies (if both are installed) by flipping each AC power switch to "O".

Note: Removing all power from the switch triggers a system reset. When power is restored, all devices are returned to the initial state and the switch runs POST, a one-minute system check.

Interpreting LED Activity

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

Note: The LEDs may flash yellow during diagnostic tests, and green, yellow, or orange during POST. This is normal, and does not indicate a problem unless the LEDS do not return to a normal pattern after POST or the other diagnostic tests are complete. The orange light may be referred to as "amber" in other documentation.

The FC 16B includes the following LEDs:

- 16 port status LEDs on the SFP media side (above and to the left of each port) to indicate the status of each port.

- 16 port speed LEDs on the SFP media side (above and to the right of each port) to indicate the current link speed of each port.

- One switch power LED below the serial port on the SFP media side, to indicate whether the switch is on and has successfully booted.

- Two power supply LEDs on the power supply side (one on each power supply) to indicate the status of each power supply.

- One switch status LED in the center of the power supply side to indicate whether the switch is on and has successfully booted, and whether any of the ports are faulty.

LEDs On the SFP Media Side

Figure 3-1 shows the SFP media side of the FC 16B with the LEDs identified.
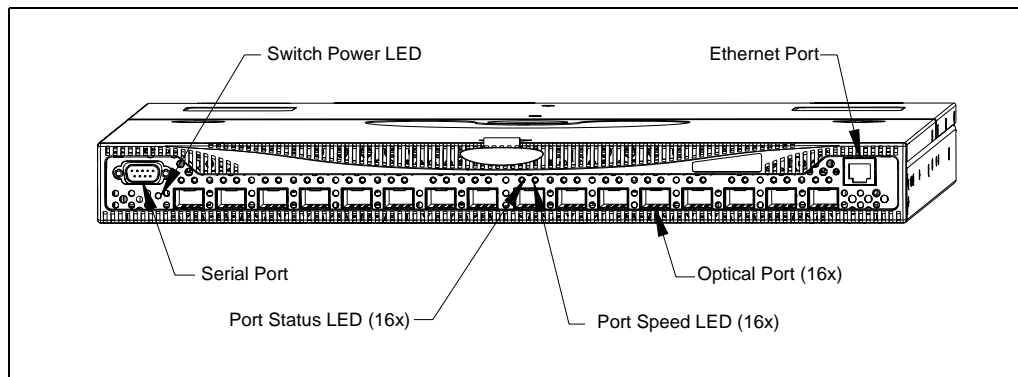
Figure 3-1   The SFP media side of the FC 16B

Table 3-1 describes the LEDs on the SFP media side of the switch.

Table 3-1   SFP Media Side LED Patterns During Normal Operation

Location of LED	Purpose of LED	Color of LED	Status of Hardware	Recommended Action
Above Each Port, on Left	Indicates port status	No light	No light or signal carrier (media or cable) is detected.	Check media and cable.
		Steady green	Port is online (connected to an external device) but has no traffic.	No action required.
		Slow-flashing green (on 1 second; off 1 second)	The port is online but segmented, indicating a loopback cable or incompatible switch.	Verify correct device is connected to port.
		Fast-flashing green (on 1/4 second; off 1/4 second)	The port is in internal loopback (diagnostic).	No action required.
		Flickering green	Port is online, with traffic flowing through port.	No action required.
		Steady orange	Port is receiving light or signal carrier, but is not yet online.	No action required.
		Slow-flashing orange (on 1 second; off 1 second)	The port is disabled (result of diagnostics or portDisable 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	Port is bypassed.	Reset the port from a management station.
Above Each Port, on Right	Indicates port speed	No light	The port is transmitting/ receiving at 1 Gbps.	No action required.

Table 3-1   SFP Media Side LED Patterns During Normal Operation

Location of LED	Purpose of LED	Color of LED	Status of Hardware	Recommended Action
		Steady green	The port is transmitting/ receiving at 2 Gbps.	No action required.
Below Serial Port	Indicates switch power	No light	Either the switch is off, or boot is not complete, or boot has failed.	Verify that the switch is on and boot has had time to complete. If there is still no light, contact your HP account representative.
		Steady green	Switch is on and boot has successfully completed.	No action required.
		Slow-flashing green	Diagnostic failure on one or more ports.	Errors may be listed in the error log. Refer to the *Fabric OS Procedures Guide* for more information.

LEDs On the Power Supply Side

Figure 3-2 shows the power supply side of the switch with the LEDs identified.
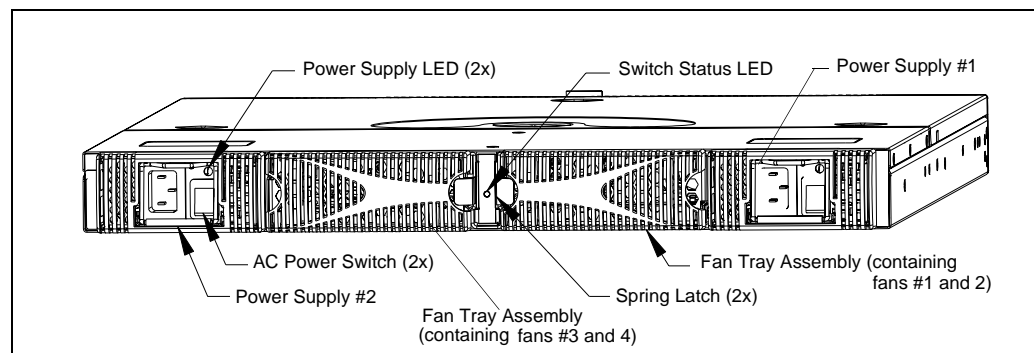

Figure 3-2   The power supply side of the FC 16B

Table 3-2 describes the LEDs on the power supply side of the switch.

Table 3-2   Power Supply Side LED Patterns During Normal Operation

Location of LED	Purpose of LED	Color of LED	Status of Hardware	Recommended Action
On each power supply	Indicates status of related power supply	No light	Power supply is not providing power.	Verify power supply is on and power cable is connected to a valid power source.
		Steady green	Power supply is providing power.	No action required.
Center of power supply side	Indicates switch status	No light	Either the switch is off, or boot is not complete, or boot has failed.	Verify that the switch is on and boot has had time to complete. If there is still no light, contact your HP account representative.
		Steady green	Switch is on and boot has successfully completed.	No action required.
		Steady yellow	Diagnostic command is in progress, or one or more ports are faulty.	If no diagnostic tests are running, check the Port Status LEDs for fault indicators.
		Slow-flashing yellow	Diagnostic failure on one or more ports.	Errors may be listed in the error log. Refer to the *Fabric OS Procedures Guide* for more information.

Interpreting POST Results

Each time the switch is powered on or reset, the switch automatically performs POST, a one minute system check during which the port status LEDs flash different colors.

To determine whether POST completed without errors, verify that all LEDs return to a normal state after POST is complete. If one or more LEDs do not return to a normal state, and this is not due to the switch being set to beacon, see *Interpreting LED Activity* on page 3-1 (for more information about beaconing, refer to the *Fabric OS Procedures Guide)*.

Note: If the switch prompt does not display when POST completes, POST was not successfully completed and the switch should be returned to your HP account representative for repair.

Any errors detected during POST are written to the system log, accessible through the errShow command. For more information about error messages, refer to the *Fabric OS Reference*.

Maintaining the Switch

The FC 16B does not require any regular physical maintenance, and is designed to minimize the chance of failure, including diagnostic tests and field-replaceable units.

Diagnostic Tests

Diagnostic tests are provided to help troubleshoot the hardware and the firmware. The diagnostic tests provided on the switch include tests of internal connections and circuitry, fixed media, and any SFP modules and fiber optic cables in use. The tests are implemented by command, either through a telnet session or through a terminal set up for a serial connection to the switch. Some tests require the ports to be connected by external cables, to allow diagnostics to verify the serializer/deserializer interface, as well as the attached SFP and cable.

All diagnostic tests are run at link speeds of both 1 Gbps and 2 Gbps. For information about the specific diagnostic tests and how to run them, refer to the *Fabric OS Procedures Guide*.

Note: The transmit and receive speed of the links may be temporarily locked to a specific speed during diagnostic testing.

Field-Replaceable Units (FRUs)

⚠	**Warning**	This switch may have more than one power cable. To reduce the risk of electric shock, disconnect both power cables before servicing.

The power supplies, fan trays, and the entire switch can all be replaced in the field, without the use of special tools. The switch can continue operating during the replacement of a fan tray or power supply, if they are replaced one at a time. To simplify replacement, the switch has a minimum of internal cables and no jumpers or hardware settings. Replacement instructions are provided with all replacement units ordered.

The right and left power supplies are identical and fit into either power supply slot. Once they are installed, they are identified by the Fabric OS as power supply #1, which is on the right when viewing the switch from the power supply side, and power supply #2, on the left (see Figure 3-2 on page 3-4). The right and left fan trays are also identical and fit into either fan tray slot. Each fan tray contains two fans: the fans in the fan tray on the right when viewing the switch from the power supply side are identified by the Fabric OS as fans #1 and #2, and the fans in the fan tray on the left are identified as fans #3 and #4 (see Figure 3-2 on page 3-4).

Product Specifications

This appendix provides the following information:

- *Switch Components* on page A-1
- *Weight and Physical Dimensions* on page A-2
- *Facility Requirements* on page A-2
- *Power Supply Specifications* on page A-3
- *Environmental Requirements* on page A-3
- *General Specifications* on page A-4
- *Memory Specifications* on page A-5
- *Optical Port Specifications* on page A-5
- *Serial Port Specifications* on page A-5
- *POST Specifications* on page A-6
- *Regulatory Compliance* on page A-7

Switch Components

The FC 16B switch consists of the following components:

- A 1U chassis, designed to be mounted in a 19-inch rack, with forced-air cooling that flows from the power supply side of the switch to the SFP media side.
- 16 optical ports, compatible with SFPs (small form factor pluggable media).
- One RS-232 serial port (DB9 connector) on the SFP media side.
- One IEEE compliant RJ-45 connector on the SFP media side for use with 10/100 Mbps Ethernet or in-band.
- Human-readable labels and bar code labels on the front and back.
- A total of 36 LEDs
  - Two LEDs for each of the 16 ports to indicate port status and link speed information.
  - One LED on each power supply to indicate the status of that power supply.
  - One LED on the left of the SFP media side to indicate whether the switch has power.
  - One LED in the center of the power supply side to indicate the overall switch status.
- Two universal input and redundant power supplies with AC switches and built-in fans. The power supplies plug into internal blind-mate connectors when installed in the chassis.

- Two fan trays, each containing two fans. Air is pulled in through the rear intake and pushed out through the vents in the SFP media side. The fans provide adequate cooling for the maximum switch power rating of 102 Watts.

- Three digital thermometers, capable of sensing a temperature range from -55 °C to +125°C, in 0.5°C increments.

- A motherboard that is completely enclosed in an EMI (electromagnetic interference) enclosure tray. The logic and chassis ground are connected to the chassis by screws. The embedded processor can process frames up to 1024 bytes.

- A real-time clock (RTC) with a 10-year, non-customer replaceable, battery and 56 bytes of NVRAM.

Weight and Physical Dimensions

The dimensions of the FC 16B are listed in the following table.

Table A-1   Physical Specifications

Dimension	Value
Height	1U
Depth	24 inches (61.0 cm)
Width	17 inches (43.2 cm)
Weight (with both power supplies installed)	28.5 lbs (12.9 kg)

Facility Requirements

To ensure correct operation of the switch, the facility where the switch is in use must meet the following requirements:

- Adequate supply circuit, line fusing, and wire size, as specified by the electrical rating on the switch nameplate.

- An air flow of at least 300 cubic feet per minute, available in the immediate vicinity of the switch.

- The power specifications listed in Table A-2 on page A-3.

- The environmental specifications listed in Table A-3 on page A-3.

- The electrical interference must be less than the levels stated in the standards listed in Table A-4, under "Immunity" (on page A-5).

- If the switch will be installed in an EIA rack:

  - All equipment installed in the rack should have a reliable branch circuit ground connection, and should not rely on a connection to a branch circuit, such as a power strip.

  - The rack should be balanced and the installed equipment within the rack's weight limits. Ensure the rack is mechanically secured to insure stability in the event of an earthquake.

Power Supply Specifications

The power supplies are universal and capable of functioning worldwide without using voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has its own built-in fan for cooling, pushing the air towards the front of the switch.

Table A-2   Power Supply Specifications

Specification	Value
Outlet	Correctly wired and earth-grounded
Total power available from each power supply	126 Watts, with fans operating
Max. switch power	90 - 102 Watts (depending on SFP media vendor)
Input voltage	100 - 240 VAC
Input line frequency	47 - 63 Hz
Harmonic distortion	Active power factor correction per IEC1000-3-2
BTU rating	108 Watts x 3.412 BTU/Hr/Watts = 368.5 BTU/hr
Inrush current	10 Amps Peak, > 300 usec - hot/cold start
Input line protection	Fused in both hot & neutral lines
Maximum dimensions	3.5" wide, 1.5" high, 13.5" long

Environmental Requirements

The following table lists the environmental ranges that are acceptable when the FC 16B is operating, and the ranges that are acceptable when the switch is not operating.

Table A-3   Environmental Requirements

Condition	Acceptable Range
Temperature (operating)	10°C to 40 °C
Temperature (non-operating)	-35°C to 65 °C
Humidity (operating)	5% to 85% RH non condensing, at 40°C
Humidity (non-operating)	0% to 90% RH non-conducting, at 40°C
Altitude (operating)	0 to 3 kilometers above sea level
Altitude (non-operating)	0 to 12 kilometers above sea level

Table A-3   Environmental Requirements (Continued)

Shock (operating)	4G, 11MS duration, half sine
Shock (non-operating)	20G, 11MS duration, sq.wave
Vibration (operating)	5G, 0-3 kHz at 1.0 octave/minute
Vibration (non-operating)	10G, 0-5kHz at 1.0 octave/minute

General Specifications

The FC 16B supports F_Port, FL_Port, and E_Port connections and DNS (Distributed Name Server). It is EMC (Electromagnetic Compatibility) compliant.

The following table lists the general specifications for the FC 16B.

Table A-4   General Specifications

Specification	Description
Configurable port types	The FC 16B supports F_Port, FL_Port, and E_Port connections.
EMI rating	An operating FC 16B conforms to the EMI (electromagnetic interference) radiation levels specified by the following regulations: • FCC Rules & Regulations, Part 15B, Class A level • CISPR22 Class A • EN55022 Class A • VCCI Class A ITE • AS/NZS 3548 Class A
System architecture	Non-blocking shared-memory switch
System processor	Intel 80960VH, 100MHz CPU
ANSI Fibre Channel protocol	FC-PH (Fibre Channel Physical and Signalling Interface standard)
Modes of operation	Fibre Channel Class 2 and Class 3
Fabric initialization	Complies with FC-SW 5.0
FC-IP (IP over Fibre Channel)	Complies with FC-IP 2.3 of the FCA profile
Aggregate switch I/O bandwidth	64 Gbps if all 16 ports running at 2Gbps, full duplex
Frame buffers	27 buffers per E_Port and 16 buffers per F_Port at 2112 bytes per frame

Table A-4   General Specifications (Continued)

Port to port latency	Less than 2 microseconds with no contention (destination port is free)
Data transmission range	Up to 500 m (1,625 ft.) for short-wavelength optical link Up to 10 km (32,820 ft.) for long-wavelength optical link
Immunity	IEC 61000-4-2 Severity Level 3 for Electrostatic Discharge IEC 61000-4-3 Severity Level 3 for Radiated Fields IEC 61000-4-4 Severity Level 3 for Fast Transients IEC 61000-4-5 Severity Level 3 for Surge Voltage IEC 61000-4-6 Conducted Emissions IEC 61000-4-11 Voltage Variations

Memory Specifications

The FC 16B has the following memory:

- Main Memory: 16 MB per switch

- Flash Memory: 16MB of 16-bit wide memory, stored in 2 banks of 8M-bytes each

- Boot Flash: 512K bytes of 8-bit for system boot

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

Optical Port Specifications

The optical ports in the FC 16B are compatible with SWL (short wave-length) and LWL (long wave-length) SFPs (small form factor pluggable media) and SFP-compatible cables. The strength of the signal is determined by the type of SFP in use.

The ports meet all required safety standards. For more information about these standards, see *Regulatory Compliance* on page A-7.

The ports are capable of operating at 2.125 Gbps or 1.0625 Gbps. Each port has a SerDes (serializer/de-serializer) which accepts 10-bit wide parallel data and serializes it into a high-speed serial stream. The parallel data is expected to be "8B/10B" encoded data or equivalent.

Serial Port Specifications

The serial port has an RS-232 connector, and is located in the SFP media side of the switch.

Note: For dust and ESD (electrostatic discharge) protection, a cover is provided for the serial port and should be kept on the port whenever the serial port is not in use.

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

The port requires a straight serial cable with a female 9-pin subminiature-D connector. Only pins 2, 3, and 5 are supported; if pin 7 is used, the signal must always be driven high, using the pinouts listed in the following table.

Table A-5   Cabling Pinouts if Pin 7 is Used

PIN	Signal	Description
1		
2	TxData	Transmit Data
3	RxData	Receive Data
4		
5	GND	Logic Ground
6		
7	CTS	Clear to Send
8		
9		

POST Specifications

The switch automatically performs POST when the switch is turned on, rebooted, or the system is reset. POST includes a number of diagnostic tests: the success/fail test results can be monitored through the LED activity, the error log, or command-line interface.

POST completes in 60 seconds. A slightly longer version of the memory portion of the test is performed after cold boots. A cold boot occurs after a complete power cycle, when the switch is turned off then on. A warm boot is any other type of boot, such as an operating system reboot or switch panic.

POST includes the following steps:

1. Preliminary POST diagnostics are run.
2. Operating system is initialized.
3. Hardware is initialized.
4. Diagnostic tests are run on a number of functions, including 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. Universal Port configuration is performed.
6. Links are initialized.
7. Fabric is analyzed. If ports are connected to other fabric elements, the principal switch in the fabric is identified.
8. Port addresses are assigned. The switch attempts to retain any previously assigned port addresses.
9. Unicast routing tables are constructed.
10. Normal port operation is enabled.

Regulatory Compliance

FCC EMC Statement (USA)

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. The end user of this product should be aware that any changes or modifications made to this equipment without the approval of Hewlett-Packard could result in the product not meeting the Class A limits, in which case the FCC could void the user's authority to operate the equipment.

EMC Statement (Canada)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

EMC Statement (European Union)

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.

Spécification ATI Classe A (France)

DECLARATION D'INSTALLATION ET DE MISE EN EXPLOITATION d'un matériel de traitement de l'information (ATI), classé A en fonction des niveaux de perturbations radioélectriques émis, définis dans la norme européenne EN 55022 concernant la Compatibilité Electromagnétique.

Germany Noise Declaration

Schalldruckpegel Lp = 46.1 dB(A)
Am Arbeitsplatz (operator position)
Normaler Betrieb (normal operation)
Nach ISO 7779:1999 (Typprüfung)

VCCI EMC Statement (Japan)

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Harmonics Conformance (Japan)

高調波ガイドライン適合品

BSMI EMC Statement (Taiwan)

警告使用者：這是甲類的資訊產品，在居住的
環境中使用時，可能會造成射頻干擾，在這種
情況下，使用者會被要求採取某些適當的對策。

RRL EMC Statement (Korea)

사용자 안내문 : A 급기기

이기기는 업무용으로 전자파 적합등록을 받은 기기
이오니, 판매자 또는 사용자는 이점을 주의하시기
바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에
서 비업무용으로 교환하시기 바랍니다.

Laser Safety

A. Certification and Classification Information

When equipped with native Fibre Channel adapters, this product contains a laser internal to the small form factor pluggable (SFP) transceiver modules.

In the USA, the SFP module is certified as a Class 1 Laser product, conforming to the requirements contained in Department Of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. The certification is indicated by a label on the metal SFP housing.

Outside the USA, the SFP is certified as a Class 1 Laser product conforming to requirements contained in IEC 825-1:1993 and EN60825-1:1994, including Amendment 11:1996.

The SFP includes the following certifications:

- UL Recognized Component (USA)
- CSA Certified Component (Canada)
- TUV Certified Component (European Union)
- CB Certificate (Worldwide)

The following figure shows the Class 1 information label that appears on the metal housing of the SFP.

CLASS 1 LASER PRODUCT 21 CFR(J)

B. Product Information

Each communications port consists of a transmitter and receiver optical subassembly. The transmitter subassembly contains internally a semiconductor laser diode in the wavelength of either 850 nanometers (shortwave laser) or 1310 nanometers (longwave laser).

Class 1 Laser products are not considered hazardous.

⚠ **Warning**   There are no user maintenance operations, service operations, or adjustments to be performed on the SFP module.

C. Usage Restrictions

Failure to comply with these usage restrictions may result in incorrect operation of the system and points of access may emit laser radiation above the Class 1 limits established by the IEC and U.S. DHHS.

Declaration of Conformity

<div style="border:1px solid">

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company
Network Storage Solutions Organization

Manufacturer's Address: 8000 Foothills Blvd.
Roseville, CA 95747
USA

declares, that the product

Product Name: hp surestore fc 1Gb/2Gb switch 16B

Model Number(s): A7340A, A7340AZ

Product Options: All

conforms to the following Product Specifications:

Safety: IEC 60950:1991 + A1, A2, A3, A4 / EN 60950:1992 + A1, A2, A3, A4, A11
GB 4943-1995
IEC 60825-1:1993 / EN 60825-1:1994 + A11, Class 1 (Laser/LED)

EMC: CISPR 22:1997 / EN 55022:1998 Class A[1]
GB 9254-1988
CISPR 24:1997 / EN 55024:1998
IEC 61000-3-2:1995 / EN 61000-3-2:1995 +A14
IEC 61000-3-3:1994 / EN 61000-3-3:1995

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE marking accordingly.

1) The Product was tested in a worst-case test configuration which maximizes RFI emissions.

Roseville, CA
October 15, 2001

Frank L. Sindelar, NSSO Regulatory Mgr.

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Straße 130, D-71034 Böblingen (FAX: + 49-7031-14-3143)

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Glossary

8b/10b Encoding	An encoding scheme that converts each 8-bit byte into 10 bits. Used to balance ones and zeros in high-speed transports.
Address Identifier	A 24-bit or 8-bit value used to identify the source or destination of a frame.
Advanced Performance Monitoring	A software product that provides error and performance information to the administrator and end user for use in storage management.
AL_PA	Arbitrated Loop Physical Address; a unique 8-bit value assigned during loop initialization to a port in an arbitrated loop.
Alias Address Identifier	An address identifier recognized by a port in addition to its standard identifier. An alias address identifier may be shared by multiple ports.
Alias AL_PA	An AL_PA value recognized by an L_Port in addition to the AL_PA assigned to the port. See also *AL_PA*.
Alias Server	A fabric software facility that supports multicast group management.
ANSI	American National Standards Institute; the governing body for Fibre Channel standards in the U.S.A.
API	Application Programming Interface; defined protocol that allows applications to interface with a set of services.
Arbitrated Loop	A shared 100 MBps Fibre Channel transport structured as a loop. Can support up to 126 devices and one fabric attachment. See also *Topology*.
ASIC	Application Specific Integrated Circuit.
ATM	Asynchronous Transfer Mode; a transport used for transmitting data over LANs or WANs that transmit fixed-length units of data. Provides any-to-any connectivity, and allows nodes to transmit simultaneously.
AW_TOV	Arbitration Wait Time-out Value; the minimum time an arbitrating L_Port waits for a response before beginning loop initialization.
Bandwidth	The total transmission capacity of a cable, link, or system. Usually measured in bps (bits per second). May also refer to the range of transmission frequencies available to a network. See also *Throughput*.
BB_Credit	Buffer-to-buffer credit; the number of frames that can be transmitted to a directly connected recipient or within an arbitrated loop. Determined by the number of receive buffers available. See also *Buffer-to-buffer Flow Control*, *EE_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	Bit Error Rate; the rate at which bits are expected to be received in error. Expressed as the ratio of error bits to total bits transmitted. See also *Error*.
Block	As applies to Fibre Channel, upper-level application data that is transferred in a single sequence.
Broadcast	The transmission of data from a single source to all devices in the fabric, regardless of zoning. See also *Multicast*, *Unicast*.
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 *BB_Credit*.
Cascade	Two or more interconnected Fibre Channel switches. For HP switches, a maximum of seven hops is recommended (no path longer than eight switches). See also *Fabric*, *ISL*.
Chassis	The metal frame in which the switch and switch components are mounted.
Circuit	An established communication path between two ports. Consists of two virtual circuits capable of transmitting in opposite directions. See also *Link*.
Class 1	Service that provides a dedicated connection between two ports (also called connection-oriented service), with notification of delivery or nondelivery.
Class 2	Service that provides multiplex and connectionless frame switching service between two ports, with notification of delivery or nondelivery.
Class 3	Service that provides a connectionless frame switching service between two ports, without notification of delivery or nondelivery of data. Can also be used to provide a multicast connection between the originator and recipients, with notification of delivery or nondelivery.
Class F	Connectionless service for control traffic between switches, with notification of delivery or nondelivery of data between the E_Ports.
Class of Service	A specified set of delivery characteristics and attributes for frame delivery.
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 (SNMP)	A relationship between a group of SNMP managers and an SNMP agent, in which authentication, access control, and proxy characteristics are defined. See also *SNMP*.
CRC	Cyclic Redundancy Check; a check for transmission errors included in every data frame.
Credit	As applies to Fibre Channel, the number of receive buffers available for transmission of frames between ports. See also *BB_Credit*, *EE_Credit*.
Cut-through	A switching technique that allows the route for a frame to be selected as soon as the destination address is received. See also *Route*.
Data Word	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*, *Transmission Word*.
Defined Zone Configuration	The set of all zone objects defined in the fabric. May include multiple zone configurations. See also *Enabled Configuration*, *Zone Configuration*.

Disparity	The relationship of ones and zeros in an encoded character. "Neutral disparity" means an equal number of each, "positive disparity" means a majority of ones, and "negative disparity" means a majority of zeros.
Distributed Fabrics	The combined user's guides for the software products Extended Fabrics and Remote Switch. "Distributed Fabrics" is not a software product. See also *Extended Fabrics*, *Remote Switch*.
DLS	Dynamic Load Sharing; dynamic distribution of traffic over available paths. Allows for recomputing of routes when an Fx_Port or E_Port changes status.
Domain ID	Unique identifier for the switch in a fabric. Usually automatically assigned by the switch, but can also be assigned manually. Can be any value between 1 and 239.
E_D_TOV	Error Detect Time-out Value; the minimum amount of time a target waits for a sequence to complete before initiating recovery. Can also be defined as the maximum time allowed for a round-trip transmission before an error condition is declared. See also *R_A_TOV*, *RR_TOV*.
E_Port	Expansion Port; a type of switch port that can be connected to an E_Port on another switch to create an ISL. See also *ISL*.
EE_Credit	End-to-end Credit; the number of receive buffers allocated by a recipient port to an originating port. Used by Class 1 and 2 services to manage the exchange of frames across the fabric between source and destination. See also *End-to-end Flow Control*, *BB_Credit*.
EIA Rack	A storage rack that meets the standards set by the Electronics Industry Association.
Enabled Zone Configuration	The currently enabled configuration of zones. Only one configuration can be enabled at a time. See also *Defined Configuration*, *Zone Configuration*.
End-to-end Flow Control	Governs flow of class 1 and 2 frames between N_Ports. See also *EE_Credit*.
Error	As applies to Fibre Channel, a missing or corrupted frame, time-out, loss of synchronization, or loss of signal (link errors). See also *Loop Failure*.
Exchange	The highest level Fibre Channel mechanism used for communication between N_Ports. Composed of one or more related sequences, and can work in either one or both directions.
Extended Fabrics	Software product that runs on Fabric OS and allows creation of a Fibre Channel fabric interconnected over distances of up to 100 kilometers. See also *Distributed Fabrics*.
F_Port	Fabric Port; a port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch. See also *FL_Port*, *Fx_Port*.
Fabric	A Fibre Channel network containing two or more switches in addition to hosts and devices. May also be referred to as a switched fabric. See also *Topology*, *SAN*, *Cascade*.
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 Manager	A software product that works in conjunction with Web Tools to provide a graphical user interface for managing switch groups as a single unit, instead of as separate switches. Fabric Manager is installed on and run from a computer workstation.
Fabric Name	The unique identifier assigned to a fabric and communicated during login and port discovery.
Fabric OS	Operating system on HP Brocade switches.
Fabric Watch	A software product that runs on Fabric OS and allows monitoring and configuration of fabric and switch elements.
FC-AL-3	The Fibre Channel Arbitrated Loop standard defined by ANSI. Defined on top of the FC-PH standards.
FC-FLA	The Fibre Channel Fabric Loop Attach standard defined by ANSI.
FCP	Fibre Channel Protocol; mapping of protocols onto the Fibre Channel standard protocols. For example, SCSI FCP maps SCSI-3 onto Fibre Channel.
FC-PH-1, 2, 3	The Fibre Channel Physical and Signalling Interface standards defined by ANSI.
FC-PI	The Fibre Channel Physical Interface standard defined by ANSI.
FC-PLDA	The Fibre Channel Private Loop Direct Attach standard defined by ANSI. Applies to the operation of peripheral devices on a private loop.
FC-SW-2	The second generation of the Fibre Channel Switch Fabric standard defined by ANSI. Specifies tools and algorithms for the interconnection and initialization of Fibre Channel switches in order to create a multi-switch Fibre Channel fabric.
Fibre Channel Transport	A protocol service that supports communication between Fibre Channel service providers. See also *FSP*.
Fill Word	An IDLE or ARB ordered set that is transmitted during breaks between data frames to keep the Fibre Channel link active.
Firmware	The basic operating system provided with the hardware.
FL_Port	Fabric Loop Port; a port that is able to transmit under fabric protocol and also has arbitrated loop capabilities. Can be used to connect an NL_Port to a switch. See also *F_Port*, *Fx_Port*.
FLOGI	Fabric Login; the process by which an N_Port determines whether a fabric is present, and if so, exchanges service parameters with it. See also *PLOGI*.
Frame	The Fibre Channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, any optional headers, the data payload, a cyclic redundancy check (CRC), and an end-of-frame delimiter. There are two types of frames: Link control frames (transmission acknowledgements, etc.) and data frames.
FRU	Field-replaceable Unit; a component that can be replaced on site.
FS	Fibre Channel Service; 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 *FSP*.
FSP	Fibre Channel Service Protocol; the common protocol for all fabric services, transparent to the fabric type or topology. See also *FS*.

FSPF	Fabric Shortest Path First. Routing protocol for Fibre Channel switches.
Full-duplex	A mode of communication that allows the same port to simultaneously transmit and receive frames. See also *Half-duplex*.
Fx_Port	A fabric port that can operate as either an F_Port or FL_Port. See also *F_Port*, *FL_Port*.
G_Port	Generic Port; a port that can operate as either an E_Port or F_Port. A port is defined as a G_Port when it is not yet connected or has not yet assumed a specific function in the fabric.
GBIC	Gigabit Interface Converter; a removable serial transceiver module that allows gigabaud physical-level transport for Fibre Channel and gigabit Ethernet. See also *SFP*.
Gbps	Gigabits per second (1,062,500,000 bits/second).
GBps	GigaBytes per second (1,062,500,000 bytes/second).
Half-duplex	A mode of communication that allows a port to either transmit or receive frames at any time, but not simultaneously (with the exception of link control frames, which can be transmitted at any time). See also *Full-duplex*.
Hard Address	The AL_PA that an NL_Port attempts to acquire during loop initialization.
HBA	Host Bus Adapter; the interface card between a server or workstation bus and the Fibre Channel network.
Hub	A Fibre Channel wiring concentrator that collapses a loop topology into a physical star topology. Nodes are automatically added to the loop when active and removed when inactive.
Idle	Continuous transmission of an ordered set over a Fibre Channel link when no data is being transmitted, to keep the link active and maintain bit, byte, and word synchronization.
Initiator	A server or workstation on a Fibre Channel network that initiates communications with storage devices. See also *Target*.
Integrated Fabric	The fabric created by the HP FC 6164, consisting of six Silkworm 2250 switches cabled together and configured to handle traffic as a seamless group.
IOD	In-order Delivery; a parameter that, when set, guarantees that frames are either delivered in order or dropped.
ISL	Interswitch Link; a Fibre Channel link from the E_Port of one switch to the E_Port of another. See also *E_Port*, *Cascade*.
ISL Trunking	An HP Brocade switch feature that enables distribution of traffic over the combined bandwidth of up to four 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 due to overlapping domain IDs or nonidentical parameters (such as E_D_TOVs). See also *E_Port*.
IU	Information Unit; a set of information as defined by either upper-level process protocol definition or upper-level protocol mapping.

JBOD	Just a Bunch Of Disks; indicates a number of disks connected in a single chassis to one or more controllers. See also *RAID*.
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*.
L_Port	Loop Port; a node port (NL_Port) or fabric port (FL_Port) that has arbitrated loop capabilities. An L_Port can be in one of two modes:

- *Fabric mode* Connected to a port that is not loop capable, and using fabric protocol.
- *Loop mode* In an arbitrated loop and using loop protocol. An L_Port in loop mode can also be in participating mode or non-participating mode.

See also *Non-participating Mode*, *Participating Mode*.

Latency	The period of time required to transmit a frame, from the time it is sent until it arrives.
Link	As applies to Fibre Channel, a physical connection between two ports, consisting of both transmit and receive fibres. See also *Circuit*.
Link Services	A protocol for link-related actions.
LIP	Loop Initialization Primitive; the signal used to begin initialization in a loop. Indicates either loop failure or resetting of a node.
LM_TOV	Loop Master Time-out Value; the minimum time that the loop master waits for a loop initialization sequence to return.
Loop Failure	Loss of signal within a loop for any period of time, or loss of synchronization for longer than the time-out value.
Loop Initialization	The logical procedure used by an L_Port to discover its environment. Can be used to assign AL_PA addresses, detect loop failure, or reset a node.
Loop_ID	A hex value representing one of the 127 possible AL_PA values in an arbitrated loop.
Looplet	A set of devices connected in a loop to a port that is a member of another loop.
LPSM	Loop Port State Machine; the logical entity that performs arbitrated loop protocols and defines the behavior of L_Ports when they require access to an arbitrated loop.
LWL	Long Wavelength; a type of fiber optic cabling that is based on 1300mm lasers and supports link speeds of 1.0625 Gbps. May also refer to the type of GBIC or SFP. See also *SWL*.
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*.
MIB	Management Information Base; an SNMP structure to help with device management, providing configuration and device information. The MIB types provided with HP Brocade switches are described in the *MIB Reference Manual*.
Multicast	The transmission of data from a single source to multiple specified N_Ports (as opposed to all the ports on the network). See also *Broadcast*, *Unicast*.

Multimode	A fiber optic cabling specification that allows up to 500 meters between devices.
N_Port	Node Port; a port on a node that can connect to a Fibre Channel port or to another N_Port in a point-to-point connection. See also *NL_Port*, *Nx_Port*.
Name Server	Frequently used to indicate Simple Name Server. See also *SNS*.
NL_Port	Node Loop Port; a node port that has arbitrated loop capabilities. Used to connect an equipment port to the fabric in a loop configuration through an FL_Port. See also *N_Port*, *Nx_Port*.
Node	A Fibre Channel device that contains an N_Port or NL_Port.
Node Name	The unique identifier for a node, communicated during login and port discovery.
Non-participating Mode	A mode in which an 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 AL_PA cannot be acquired. See also *L_Port*, *Participating Mode*.
Nx_Port	A node port that can operate as either an N_Port or NL_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 the following items: • *Frame delimiters* Mark frame boundaries and describe frame contents. • *Primitive signals* Indicate events. • *Primitive sequences* 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	A set of information transmitted across a network. See also *Frame*.
Participating Mode	A mode in which an L_Port in a loop has a valid AL_PA and can arbitrate, send frames, and retransmit received transmissions. See also *L_Port*, *Non-participating Mode*.
Path Selection	The selection of a transmission path through the fabric.
Phantom Address	An AL_PA value that is assigned to an 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.
PLOGI	Port Login; the port-to-port login process by which initiators establish sessions with targets. See also *FLOGI*.
Point-to-point	A Fibre Channel topology that employs direct links between each pair of communicating entities. See also *Topology*.
Port_Name	The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.
POST	Power On Self-Test; a series of tests run by a switch after it is turned on.
Private NL_Port	An NL_Port that communicates only with other private NL_Ports in the same loop and does not log into the fabric.

Private Device	A device that supports arbitrated loop protocol and can interpret 8-bit addresses, but cannot log into the fabric.
Private Loop	An arbitrated loop that does not include a participating FL_Port.
Protocol	A defined method and a set of standards for communication.
Public NL_Port	An 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.
Public Device	A device that supports arbitrated loop protocol, can interpret 8-bit addresses, and can log into the fabric.
Public Loop	An arbitrated loop that includes a participating FL_Port, and may contain both public and private NL_Ports.
QuickLoop	A software product 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.
	May also refer to 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 AL_PA space.
R_A_TOV	Resource Allocation Time-out Value; the maximum time a frame can be delayed in the fabric and still be delivered. See also *E_D_TOV, RR_TOV*.
RAID	Redundant Array of Independent Disks; a collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking. See also *JBOD*.
Remote Switch	A software product that runs on Fabric OS and enables two switches to be connected over an ATM (asynchronous transfer mode) connection. This requires a compatible Fibre Channel to ATM gateway, and can have a distance of up to 10 kilometers between each switch and the respective ATM gateway. See also *Distributed Fabrics*.
Request Rate	The rate at which requests arrive at a servicing entity. See also *Service Rate*.
Route	As applies to a fabric, the communication path between two switches. May also apply to the specific path taken by an individual frame, from source to destination. See also *FSPF*.
Routing	The assignment of frames to specific switch ports, according to frame destination.
RR_TOV	Resource Recovery Time-out Value; the minimum time a target device in a loop waits after a LIP before logging out a SCSI initiator. See also *E_D_TOV, R_A_TOV*.
RSCN	Registered State Change Notification; a switch function that allows notification of fabric changes to be sent from the switch to specified nodes.
SAN	Storage Area Network; a network of systems and storage devices that communicate using Fibre Channel protocols. See also *Fabric*.
Sequence	A group of related frames transmitted in the same direction between two N_Ports.
Service Rate	The rate at which an entity can service requests. See also *Request Rate*.
SFP	Small Form Factor Pluggable; optical transceiver used to convert signals between optical fiber cables and switches.

SI	Sequence Initiative.
Single Mode	The fiber optic cabling standard that corresponds to distances of up to 10 km between devices.
SNMP	Simple Network Management Protocol. An internet management protocol that uses either IP for network-level functions and UDP for transport-level functions, or TCP/IP for both. Can be made available over other protocols, such as UDP/IP, because it does not rely on the underlying communication protocols. See also *Community (SNMP)*.
SNS	Simple Name Server; 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. May also be referred to as directory service. See also *FS*.
Switch	Hardware that routes frames according to Fibre Channel protocol and is controlled by software.
Switch Name	The arbitrary name assigned to a switch.
Switch Port	A port on a switch. Switch ports can be E_Ports, F_Ports, or FL_Ports.
SWL	Short Wavelength; a type of fiber optic cabling that is based on 850mm lasers and supports 1.0625 Gbps link speeds. May also refer to the type of GBIC or SFP. See also *LWL*.
Target	A storage device on a Fibre Channel network. See also *Initiator*.
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	The rate of data flow achieved within a cable, link, or system. Usually measured in bps (bits per second). See also *Bandwidth*.
Topology	As applies to Fibre Channel, the configuration of the Fibre Channel network and the resulting communication paths allowed. There are three possible topologies: • Point to point - A direct link between two communication ports. • Switched fabric - Multiple N_Ports linked to a switch by F_Ports. • Arbitrated loop - Multiple NL_Ports 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 Word	A group of four transmission characters.
Trap (SNMP)	The message sent by an SNMP agent to inform the SNMP management station of a critical error. See also *SNMP*.
Trunking	See *ISL Trunking*.
Tunneling	A technique for enabling two networks to communicate when the source and destination hosts are both on the same type of network, but are connected by a different type of network.

U_Port	Universal Port; a switch port that can operate as a G_Port, E_Port, F_Port, or 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.
UDP	User Datagram Protocol; a protocol that runs on top of IP and provides port multiplexing for upper-level protocols.
ULP	Upper-level Protocol; the protocol that runs on top of Fibre Channel. Typical upper-level protocols are SCSI, IP, HIPPI, and IPI.
ULP_TOV	Upper-level Time-out Value; the minimum time that a SCSI ULP process waits for SCSI status before initiating ULP recovery.
Unicast	The transmission of data from a single source to a single destination. See also *Broadcast*, *Multicast*.
Web Tools	A software product that runs on Fabric OS and provides a graphical interface to allow monitoring and management of individual switches or entire fabrics from a standard workstation.
Well-known Address	As pertaining to Fibre Channel, a logical address defined by the Fibre Channel standards as assigned to a specific function, and stored on the switch.
Workstation	A computer used to access and manage the fabric. May also be referred to as a management station or host.
WWN	Worldwide Name; an identifier that is unique worldwide. Each entity in a fabric has a separate WWN.
Zone	A set of devices and hosts attached to the same fabric and configured as being in the same zone. See also *Zoning*. Devices and hosts within the same zone have access permission to others in the zone, but are not visible to any outside the zone.
Zone Configuration	A specified set of zones. Enabling a configuration enables all zones in that configuration. See also *Defined Configuration*, *Enabled Configuration*.
Zoning	A software product that runs on Fabric OS and allows partitioning of the fabric into logical groupings of devices. Devices in a zone can only access and be accessed by devices in the same zone. See also *Zone*.

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