

IBM Storage Networking SAN32C-6



# Installation, Service, and User Guide



IBM Storage Networking SAN32C-6



# Installation, Service, and User Guide

**Read Before Using**

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Before you use the information in this publication, be sure to read the general information under “Notices” on page 47.

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## Read this first

### Summary of changes

This is the first edition of the IBM® Storage Networking SAN32C-6 Installation, Service, and User Guide.

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## Getting help

For the latest version of your product documentation, visit the web at <http://www.elink.ibm.link.ibm.com/public/applications/publications/cgibin/pbi.cgi>.

For more information about IBM SAN products, see the following Web site: <http://www.ibm.com/servers/storage/san/>

For support information for this product and other SAN products, see the following Web site: <http://www.ibm.com/servers/storage/support/san>

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at: [www.fibrechannel.org/](http://www.fibrechannel.org/)

Visit [www.ibm.com/contact](http://www.ibm.com/contact) for the contact information for your country or region.

You can also contact IBM within the United States at 1-800-IBMSERV (1-800-426-7378). For support outside the United States, you can find the service number at: <http://www.ibm.com/planetwide/>.

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## Accessibility features

Accessibility features help users who have a disability, such as restricted mobility or limited vision, to use information technology products successfully.

### Accessibility features

The following list includes the major accessibility features in this product:

- This product follows WCAG 2.0 Guidelines but has limited accessibility support.

### Keyboard navigation

This product does not have an attached or integrated keyboard. Any keyboard navigation is provided through the Data Center Network Manager (DCNM) software and GUI.

### Interface information

You can view the publications for this product in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. The PDFs are provided on a product documentation CD-ROM that is packaged with the product. The CD-ROM also includes an accessible HTML version of this document.

## Vendor software

This product includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for the accessibility information about its products.

## Related accessibility information

In addition to standard IBM help desk and support websites, IBM has a TTY telephone service for use by deaf or hard of hearing customers to access sales and support services:

TTY service  
800-IBM-3383 (800-426-3383)  
(within North America)

## IBM and accessibility

For more information about the commitment that IBM has to accessibility, see IBM Accessibility([www.ibm.com/able](http://www.ibm.com/able)).

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## How to send your comments

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## Safety and environmental notices

This section contains information about:

- “Safety notices and labels”
- “Rack safety” on page xviii
- “Product recycling and disposal” on page xx

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### Safety notices and labels

When using this product, observe the danger, caution, and attention notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition. The danger and caution notices are listed in numerical order based on their IDs, which are displayed in parentheses, for example (D004), at the end of each notice. Use this ID to locate the translation of these danger and caution notices in the Safety Notices publication that is shipped with this product.



The following notices and statements are used in IBM documents. They are listed below in order of increasing severity of potential hazards. Follow the links for more detailed descriptions and examples of the danger, caution, and attention notices in the sections that follow.





- **Note:** These notices provide important tips, guidance, or advice.
- **“Attention notices” on page xvii:** These notices indicate potential damage to programs, devices, or data.
- **“Caution notices”:** These statements indicate situations that can be potentially hazardous to you.
- **“Danger notices” on page xiii:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these situations.
- In addition to these notices, “Safety labels” on page xvi may be attached to the product to warn of potential hazards.

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### Caution notices

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

Example symbol	Symbol meaning
	A hazardous electrical condition with less severity than electrical danger.
	A generally hazardous condition not represented by other safety symbols.

Example symbol	Symbol meaning
	A specification of product weight that requires safe lifting practices. The weight range of the product is listed below the graphic, and the wording of the caution varies, depending on the weight of the device.
	A potential hazard of pinching the hand or other body parts between parts.
	A hazardous condition due to moving parts nearby.
	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).

Read and comply with the following caution notices before installing or servicing this device.



**CAUTION:**

Energy hazard present. Shorting may result in system outage and possible physical injury. Remove all metallic jewelry before servicing. (C001)



**CAUTION:**

The weight of this part or unit is more than 55 kg (121.2 lb). It takes specially trained persons, a lifting device, or both to safely lift this part or unit. (C011)



**CAUTION:**

The system contains circuit cards, assemblies, or both that may contain lead solder. To avoid the release of lead (Pb) into the environment, do not burn. Discard the circuit card as instructed by local regulations. (C014)



**CAUTION:**

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



Class I

**CAUTION:**

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)



**CAUTION:**

The power-control button on the device does not turn off the electrical current supplied to the device. The device might also have more than one connection to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals. (C031)



**CAUTION:**

Servicing of this product or unit is to be performed by trained service personnel only. (C032)

**CAUTION:**

For CA residents only: IBM recommends installing this product in a room size of 62 cubic meters (2190 cubic feet) or larger at 0.4 ACH ventilation rate to reduce the concentrations of any chemicals emitted by the product.

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## Danger notices

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol accompanies a danger notice to represent a dangerous electrical condition. Read and comply with these danger notices before installing or servicing this device.



**DANGER**

To prevent a possible shock from touching two surfaces with different protective ground (earth), use one hand, when possible, to connect or disconnect signal cables. (D001)



**DANGER**

Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device or the power rating label for electrical specifications. (D002)



**DANGER**

If the receptacle has a metal shell, do not touch the shell until you have completed the voltage and grounding checks. Improper wiring or grounding could place dangerous voltage on the metal shell. If any of the conditions are not as described, *STOP*. Ensure the improper voltage or impedance conditions are corrected before proceeding. (D003)



**DANGER**

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

A general electrical danger notice provides instructions on how to avoid shock hazards when servicing equipment. Unless instructed otherwise, follow the procedures in this danger notice.





## DANGER

When working on or around the system, observe the precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

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

To disconnect:

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

To connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

(D005)

## Delivery and subsequent transportation of the equipment

The customer should prepare his environment to accept the new product based on the installation planning information provided, with assistance from an IBM

Installation Planning Representative (IPR) or IBM authorized service provider. In anticipation of the equipment delivery, the final installation site should be prepared in advance such that professional movers/riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, the customer will need to make arrangements to have professional movers/riggers return to finish the transportation at a later date. Only professional movers/riggers should transport the equipment. The IBM authorized service provider will only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. The customer is also responsible for using professional movers/riggers in the case of equipment relocation or disposal.



**DANGER**

Heavy equipment—personal injury or equipment damage might result if mishandled. (D006)

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## Safety labels

As an added precaution, safety labels are often installed directly on products or product components to warn of potential hazards. These can be either danger or caution notices, depending upon the level of the hazard.

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



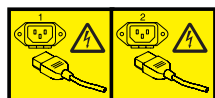
**DANGER**

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)



**DANGER**

Rack-mounted devices are not to be used as a shelf or work space. (L002)



**DANGER**

Multiple power cords. The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. (L003)

**DANGER**

Hazardous voltage present. Voltages present constitute a shock hazard, which can cause severe injury or death. (L004)

**CAUTION:**

Hazardous moving parts nearby. (L008)

---

## Attention notices

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

**Attention:** Do not bend a fibre cable to a radius less than 5 cm (2 in.); you can damage the cable. Tie wraps are not recommended for optical cables because they can be easily overtightened, causing damage to the cable.

---

## ESD precautions

**Attention:** Many of the field replaceable units (FRUs) are sensitive to electrostatic discharge (ESD), and can potentially be damaged by improper handling. When working with any FRU, use correct ESD precautions:

- Attach ground to the indicated area on the chassis
- Wear a wrist grounding strap connected to chassis ground (if the switch is plugged in) or a bench ground.

**Note:** For safety reasons, the ESD wrist strap should contain a series 1 megaohm resistor.

- Store ESD-sensitive components in antistatic packaging

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## Rack safety

### Rack installation

#### DANGER

Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices.



- Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

(R001 part 1 of 2)

**CAUTION:**

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

(R001 part 2 of 2)

## Rack relocation (19" rack)

### CAUTION:

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

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must complete these steps:
  - Remove all devices in the 32U position and above.
  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
  - Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.
  - If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
  - Inspect the route that you plan to take when moving the rack to eliminate potential hazards.
  - Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that came with your rack cabinet for the weight of a loaded rack cabinet.
  - Verify that all door openings are at least 760 x 2030 mm (30 x 80 in.).
  - Ensure that all devices, shelves, drawers, doors, and cables are secure.
  - Ensure that the four leveling pads are raised to their highest position.
  - Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
  - Do not use a ramp inclined at more than 10 degrees.
  - Once the rack cabinet is in the new location, do the following:
    - Lower the four leveling pads.
    - Install stabilizer brackets on the rack cabinet.
    - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
  - If a long distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also, lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.

(R002)

---

## Product recycling and disposal

Refer to the *IBM Systems Environmental Notices and User Guide* (Z125-5823) for translated environmental statements and information regarding product recycling and disposal. This document may be provided either in printed version or on the product documentation CD. A more current version may be available through this link [ftp://public.dhe.ibm.com/systems/support/warranty/envnotices/environmental\\_notices\\_and\\_user\\_guide.pdf](ftp://public.dhe.ibm.com/systems/support/warranty/envnotices/environmental_notices_and_user_guide.pdf).

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## About this document

This document is intended for use by systems administrators and technicians experienced with networking, Fibre Channel, and storage area network (SAN) technologies. It describes how to install, service, and use the IBM Storage Networking SAN32C-6 Switch. Throughout this document, the product is referred to as the *IBM SAN32C-6*, or simply the *switch*.

This document has been created to include information specific to IBM SAN32C-6 switches running on NX-OS version 8.1(1b) or later. This document does not support all Fabric OS versions. It is specific to NX-OS version 8.1(1b) or later. Refer to the NX-OS version 8.1(1b) Release Notes for more information.

---

## IBM and Cisco product matrix

The product matrix provides a cross-reference between the comparable IBM and Cisco product models.

When you use any of the Cisco documents, such as the Fabric Configuration Guide, you will notice that the model numbers reflect the corresponding Cisco products. Table 1 provides a product matrix to correlate the Cisco products and models to the IBM product names and machine types and model numbers. Products withdrawn from marketing are not listed.

*Table 1. Cisco and IBM product and model number matrix*

Cisco product name	IBM product name	IBM machine type and model number
9132T Fabric Switch	SAN32C-6	8977 Model T32
9250i Multiservice Switch	SAN50C-R	8977 Model R50
9706 Multilayer Director	SAN192C-6	8978 Model E04
9710 Multilayer Director	SAN384C-6	8978 Model E08
9718 Multilayer Director	SAN768C-6	8978 Model E16

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## Product documentation

The following documents contain information related to this product:

- *IBM SAN32C-6 Installation, Service and User Guide, SC27-9275-00*
- *IBM SAN50C-R Installation, Service and User Guide, SC27-9274-00*
- *IBM SAN192C6, 384C-6, 768C-6 Installation, Service and User Guide, SC27-9276-00*





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## Chapter 1. Introducing the SAN32C-6

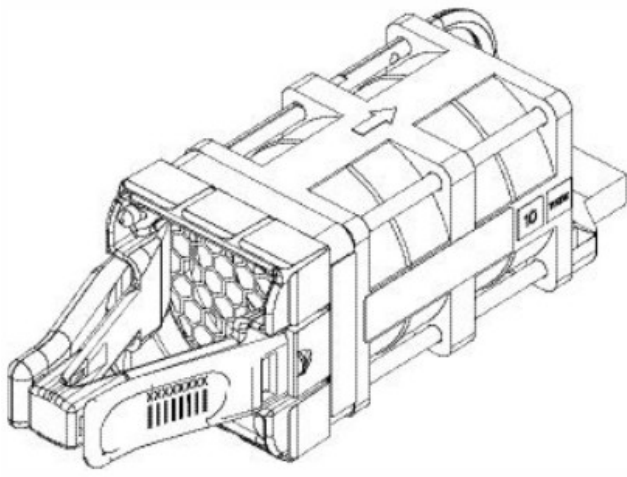
This topic provides the following information:

- “Fan Modules”
- “Power Supplies” on page 2
- “Linecard Expansion Module” on page 3
- “Switch LEDs” on page 5
- “Supported SFP+ Transceivers” on page 8

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### Fan Modules

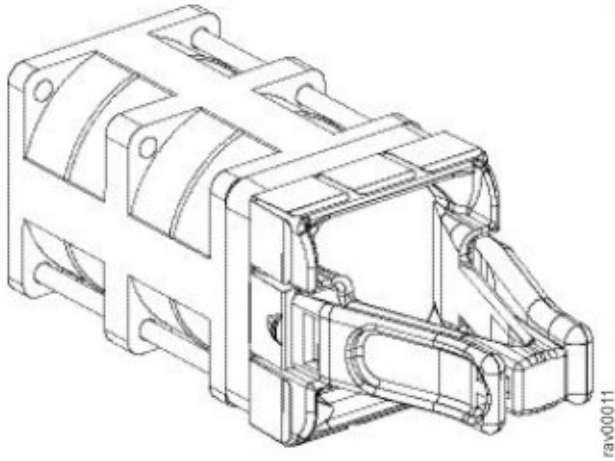
The IBM SAN32C-6 Switch fan modules have a fixed handle for inserting and removing from the chassis. The IBM SAN32C-6 Switch requires a minimum of two operating fan modules to prevent automatic shutdown. It supports installation of up to four fan modules. This provides redundancy for uninterrupted operation in the event of fan module failure. The IBM SAN32C-6 Switch fan modules are hot-swappable to allow swapping out of a fan module during operation for uninterrupted operation. Fan blank modules must be installed in empty fan bays when operating for longer than several minutes to provide correct airflow. If the airflow is inadequate the preset temperature thresholds will be exceeded and the system will automatically shut down to prevent permanent damage.



*Figure 1. IBM SAN32C-6 Fan Module*

The switch comes with fan modules and power-supply modules that support port-side exhaust and front-to-rear air flow for cooling the switch. All fan modules and power-supply modules must have the same direction of airflow.

The following figure shows a fan blank module:

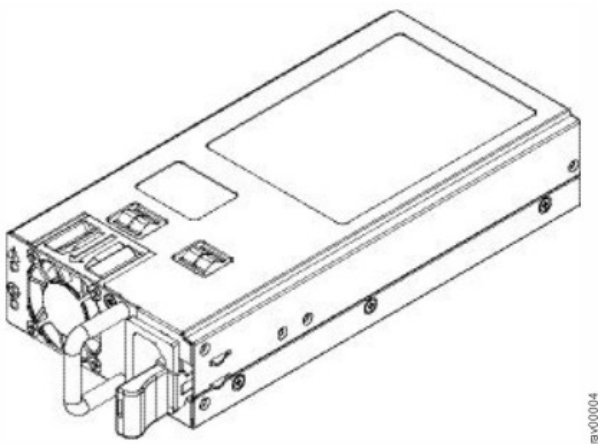


*Figure 2. Fan Blank Module*

For more information on installing and removing fan modules, see [Installing and Removing Fan Modules](#).

## Power Supplies

The IBM SAN32C-6 Switch PSUs have an unswitched power receptacle, a PSU status LED and a handle for inserting and removing the PSU from the chassis. The PSU is 650-W AC with port-side exhaust. The IBM SAN32C-6 Switch requires a minimum of one operating power supply unit. It supports installation of up to two PSUs. This provides redundancy for uninterrupted operation in the event of PSU failure. The PSUs are hot-swappable to allow swapping out of a PSU during operation for uninterrupted operation. A PSU blank module must be installed if there is an empty PSU bay when operating for longer than several minutes to provide correct airflow. If the airflow is inadequate the preset temperature thresholds will be exceeded and the system will automatically shut down to prevent permanent damage.



*Figure 3. IBM SAN32C-6 PSU*

**Note:**

The following figure shows a power supply blank module:

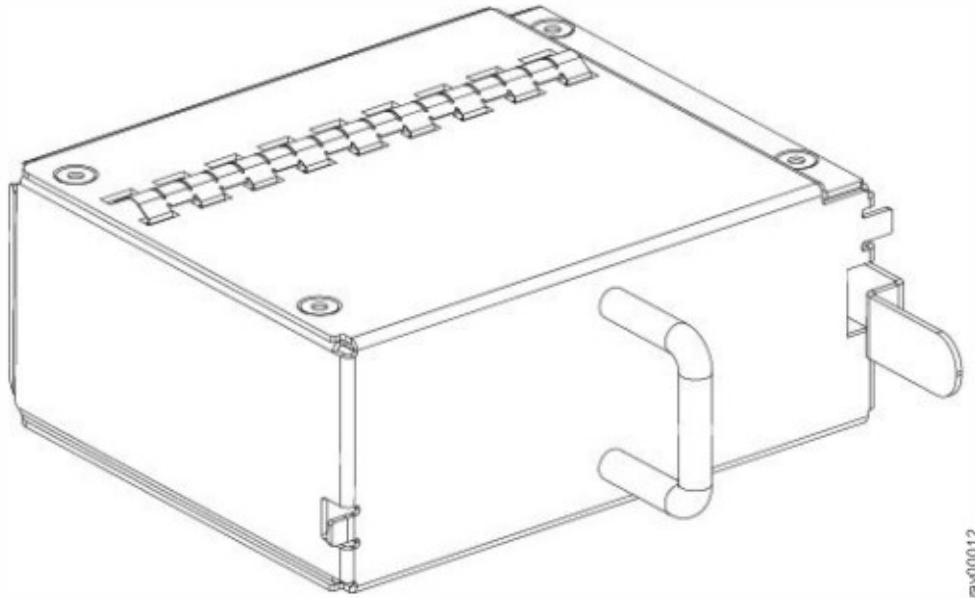


Figure 4. Power Supply Blank Module

For more information on installing and removing PSUs, see *Installing and Removing Power Supplies*.

## Jumper Power Cord

The following figure shows the C14 and C15 connectors on the optional jumper power cord for the IBM SAN32C-6 switch. The C15 connector connects into the C14 inlet on the IBM SAN32C-6 switch power supply, while the C14 connector connects into the C13 receptacle of a power distribution unit for a cabinet.

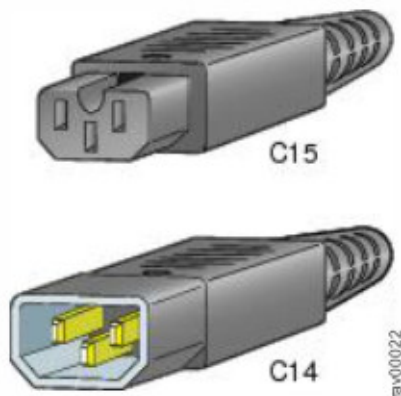


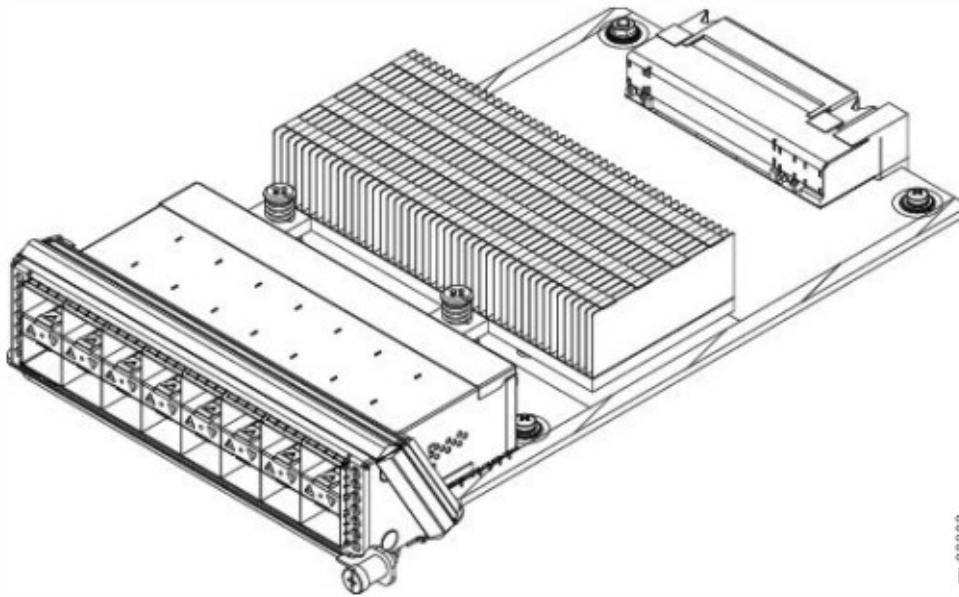
Figure 5. Connectors on Jumper Power Cord for IBM SAN32C-6 Switch

---

## Linecard Expansion Module

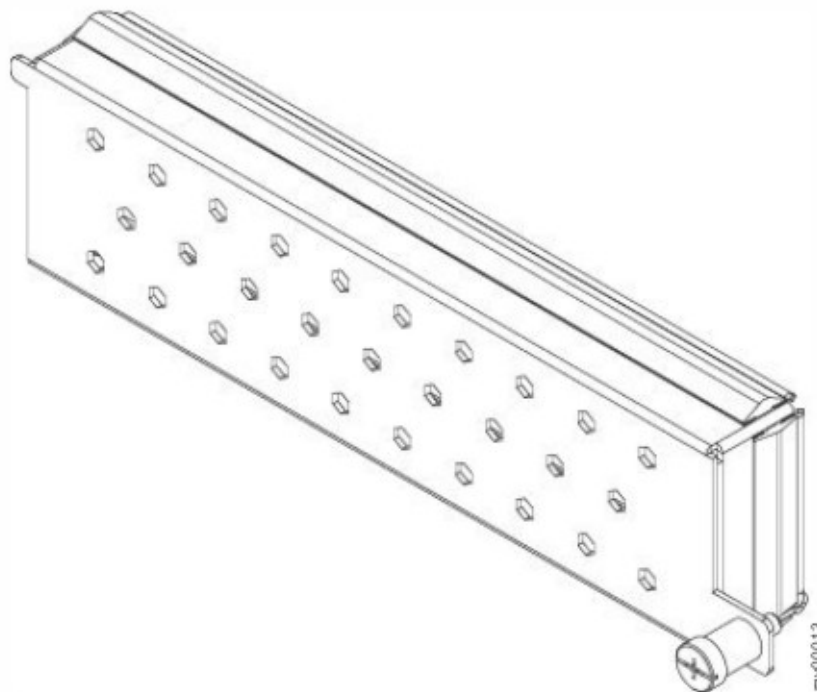
The LEM is a pluggable expansion module for the IBM SAN32C-6 Switch. The LEM has 16 32-Gbps ports that are automatically detected and enabled by the switch. The ports may then be used when the correct port licenses are installed.

The LEM blank module must be installed if the LEM bay is empty when operating for longer than several minutes to provide correct airflow. If the airflow is inadequate the preset temperature thresholds will be exceeded and the system will automatically shut down to prevent permanent damage.



*Figure 6. IBM SAN32C-6 LEM*

The following figure shows a linecard expansion blank module:



*Figure 7. Linecard Expansion Blank Module*

For more information on installing and removing the LEM, see the chapter "Installing the Fibre Channel Switch."

## Switch LEDs

The following table describes the chassis activity LEDs for an IBM SAN32C-6 switch.

*Table 2. Chassis Activity LEDs for an IBM SAN32C-6 Switch*



Indicator	Location	Function	Color	Status	State
Power LED	Front panel of the chassis	Chassis Power/Health	Off	Off	Either of the following conditions exists: <ul style="list-style-type: none"><li>• The system is not receiving sufficient power from the PSUs.</li><li>• The operating system is not running.</li></ul>
			Green	Solid On 	Both PSUs are installed and operational.
			Red	Solid On 	Either of the following conditions exists: <ul style="list-style-type: none"><li>• A PSU has failed.</li><li>• A PSU has been removed.</li></ul>

Table 2. Chassis Activity LEDs for an IBM SAN32C-6 Switch (continued)









Indicator	Location	Function	Color	Status	State
Status LED	Front panel of the chassis	System Status	Green	Solid On 	All diagnostics have passed, NX-OS is running and the system is operational.
			Orange	Solid On 	Any of the following conditions exists: <ul style="list-style-type: none"> <li>• The system is running bootup diagnostics.</li> <li>• The system is booting.</li> <li>• A minor temperature threshold is exceeded.</li> </ul>
			Red	Blinking 	Mismatched airflow direction observed in one of the following modules: <ul style="list-style-type: none"> <li>• Fan modules—The switch will go down in 10-15 seconds.</li> <li>• PSUs—The switch will go down after 10 minutes.</li> <li>• Fan modules and PSUs—The switch will go down after 10 minutes.</li> </ul>
				Solid On 	One of the following conditions exists: <ul style="list-style-type: none"> <li>• A diagnostic test failed or another fault occurred during bootup.</li> <li>• A major temperature threshold is exceeded.</li> </ul>
Fan status	Front panel of the chassis	Fan health	Green	Solid on 	All fan modules are operational.
			Red	Solid on 	Fan failure.






Table 2. Chassis Activity LEDs for an IBM SAN32C-6 Switch (continued)

Indicator	Location	Function	Color	Status	State
PSU Status Indicators	Faceplate of each PSU	PSU input/output	Green	Off	No input to the PSU.
				Solid on 	PSU output is OK.
				Blinking 	PSU output is not OK, but input is OK.
		PSU operation	Amber	Off	PSU is operating normally.
				Solid on 	One of the following conditions exists in the PSU: <ul style="list-style-type: none"> <li>• Over voltage</li> <li>• Over current</li> <li>• Over temperature</li> <li>• Fan failure.</li> </ul>
				Blinking 	PSU has a fault, but is still operational.
Fan Status	Faceplate of each fan module	Fan module	Green	Solid on 	Fan module is operating normally.
			Amber	Solid on 	All fans in the fan module have failed.

The following table describes the Ethernet port LEDs for a IBM SAN32C-6 switch.

LED Position	Status	State
Left	Off	There is no link.
	Solid Green 	Indicates a physical link.
Right	Off	There is no activity.
	Blinking Green 	Indicates activity.

The following table describes the Fibre Channel port LEDs for a IBM SAN32C-6 switch.

Status	State
Solid Green 	The link is up.
Regular Blinking Green 	The link is up and the port beacon is active.
Intermittent Blinking Green 	The link is up (indicates traffic on the port).
Solid Orange 	The link is disabled by the software.
Blinking Orange 	A faulty condition exists.
Off	No link.

---

## Supported SFP+ Transceivers

SFP+ transceivers are field-replaceable. You can use any combination of SFP+ transceivers that are supported by the switch. The only restrictions are that SWL transceivers must be paired with SWL transceivers on the peer device, and LWL transceivers with LWL transceivers on the peer device, and the cable must not exceed the stipulated cable length for reliable communications.

For a list of SFP+ transceivers supported on the IBM SAN32C-6 Switch, see SFP Transceiver Specifications. SFP+ transceivers can be ordered either separately or with the IBM SAN32C-6 Switch.

### Note:

Use only Cisco SFP+ transceivers in the IBM SAN32C-6 switches. Each Cisco SFP+ transceiver is encoded with model information that enables the switch to verify that the SFP+ transceiver meets the requirements for the switch.



---

## Chapter 2. Installing Cabinets and Racks

This topic provides the following information:

- “Cabinet and Rack Requirements”
- “General Requirements for Cabinets and Racks”
- “Requirements Specific to Perforated Cabinets” on page 10
- “Reference Perforated Cabinet” on page 10
- “Requirements Specific to Solid-Walled Cabinets” on page 10

---

### Cabinet and Rack Requirements

This section provides the IBM Storage Networking SAN c-type Family requirements for the following types of cabinets and racks in an external ambient air temperature range of 0 to 40°C. If you are selecting an enclosed cabinet, we recommend that you choose one of these thermally validated types:

- Standard perforated cabinets
- Solid-walled cabinets with a roof fan tray (bottom-to-top cooling)

### General Requirements for Cabinets and Racks

A cabinet or rack must belong to one of the following types:

- Standard 19-in. four-post EIA cabinet or rack, with mounting posts that conform to English universal hole spacing per section 1 of ANSI/EIA-310-D-1992. See Requirements Specific to Perforated Cabinets and Requirements Specific to Solid-Walled Cabinets.
- Standard two-post telco rack, with mounting posts that conform to English universal hole spacing per section 1 of ANSI/EIA-310-D-1992.

The cabinet or rack must also meet the following requirements:

- The minimum vertical rack space per chassis should be 1 RU, equal to 1.75 in. (4.4 cm).
- The width between the inside edges of the mounting posts must be at least 17.75 in. (45.1 cm). This is the distance between the two front posts of the four-post EIA racks.
- The minimum rack-load ratings per RU are listed in the following table:

Rack Type	IBM SAN32C-6
EIA (4 post)	7.5 lb (3.4 kg)
Telco (2 post)	15 lb (6.8 kg)

- For four-post EIA cabinets (perforated or solid-walled):
  - The minimum spacing for bend radius for fiber-optic cables should have the front mounting posts of the cabinet offset from the front door by a minimum of 3 in. (7.6 cm).
  - The distance between the outside face of the front mounting post and the outside face of the back mounting post should be 26 to 32 in. (66 to 81 cm) to allow for rear-bracket installation.

- The distance between the rear of the chassis and the perforated rear door of the cabinet (required for airflow in the cabinet, if used) should be 3.0 in. (7.6 cm).
- No clearance is required between the chassis and the sides of the rack or cabinet (no side airflow).

**Note:** Optional jumper power cords are available for use in a cabinet. See Jumper Power Cord.

## Requirements Specific to Perforated Cabinets

In addition to the requirements listed in the “General Requirements for Cabinets and Racks” section, perforated cabinets must meet the following requirements:

- The front and rear doors must have at least a 60 percent open area perforation pattern, with at least 15 sq. in. (96.7 sq cm) of open area per rack unit of door height.
- We recommend that the roof be perforated with at least 20 percent open area, unless the cabinet only contains IBM SAN32C-6 switch, in which case the roof does not have to be perforated.
- We recommend an open or perforated cabinet floor to enhance cooling but it is not required.

### Reference Perforated Cabinet

A perforated cabinet that conforms to the above requirements is available from Rittal Corporation:

Rittal Corporation  
One Rittal Place  
Springfield, OH 45504  
Phone: (800) 477-4000  
Cabinet P/N: Rittal 9969427  
Cabinet description: PS-DK/OEM Cabinet Assembly, 1998 x 600 x 1000 (H x W x D) (42U)

## Requirements Specific to Solid-Walled Cabinets

In addition to the requirements listed in the “General Requirements for Cabinets and Racks” section, solid-walled cabinets must meet the following requirements:

- A roof-mounted fan tray and an air-cooling scheme in which the fan tray pulls air in at the bottom of the cabinet and sends it out from the top, with a minimum of 849.5 m<sup>3</sup>/h of airflow exiting the cabinet roof through the fan tray, should be available.
- Nonperforated (solid and sealed) front and back doors and side panels should be present so that air travels predictably from bottom to top.
- The overall cabinet depth should be 36 to 42 in. (91.4 to 106.7 cm) to allow the doors to close and to facilitate adequate airflow.
- A minimum of 150 sq. in. (968 sq. cm) of open area should be available at the floor air intake of the cabinet.
- The lowest piece of equipment should be installed at a minimum of 1.75 in. (4.4 cm) above the floor openings to prevent blockage of the floor intake.

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## Chapter 3. Mounting the Device

This topic provides the following information:

- “Installation Options”
- “IBM Storage Networking SAN c-type Family Telco and EIA Shelf Bracket”
- “Shelf-Installation Guidelines” on page 12
- “Before Installing the Shelf Brackets” on page 12
- “Required Equipment” on page 12
- “Installing the Shelf Bracket Kit into a Two-Post Telco Rack” on page 14
- “Installing the Shelf Bracket Kit into a Four-Post EIA Rack” on page 15

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### Installation Options

A IBM SAN32C-6 Switch can be installed using the following methods:

- In an open EIA rack
- In a perforated EIA cabinet

The rack-mount kit enables you to install the switch into racks of varying depths. You can use the rack-mount kit parts to position the switch with easy access to either the port connections end of the chassis or the end of the chassis with the fan and power supply modules. For instructions on how to install the rack-mount kit, see the Installing the Switch section.

---

### IBM Storage Networking SAN c-type Family Telco and EIA Shelf Bracket

The optional Telco and EIA Shelf Bracket Kit can temporarily or permanently support the IBM SAN32C-6 switch during installation. After the front rack-mount brackets are securely attached to the rack-mounting rails, the shelf bracket can be removed.

The Telco and EIA Shelf Bracket kit supports the following configurations:

- A IBM SAN32C-6 Switch in a two-post Telco rack
- A IBM SAN32C-6 Switch in a four-post EIA rack

#### **Note:**

Telco and EIA Shelf Bracket optional kit is not provided with the switch; to order the kit, contact your switch supplier.

This section describes the procedure for installing a IBM SAN32C-6 switch in a rack or cabinet using the optional Telco and EIA Shelf Bracket Kit.

## Shelf-Installation Guidelines

### CAUTION:

- If the rack is on wheels, ensure that the brakes are engaged or the rack is otherwise stabilized.
- If you are installing this kit in an EIA rack, attach the shelf to all four rack-mounting posts; the EIA posts may not be thick enough to prevent flexing of shelf brackets if only two posts are used.

## Before Installing the Shelf Brackets

Before installing the shelf brackets, inspect the contents of your kit. The following table lists the contents of the shelf bracket kit:

Quantity	Part Description
2	Slider brackets
2	Shelf brackets
1	Crossbar
2	10-32 x 3/8-in. Phillips pan-head screws
16	12-24 x 3/4-in. Phillips screws
16	10-24 x 3/4-in. Phillips screws

## Required Equipment

You need the following equipment for this installation:

- Number 2 Phillips screwdriver
- Tape measure and level (to ensure that shelf brackets are at level with each other)
- NEBS plate - If the airflow is port-side intake

## Installing the Switch into a 2-Post Rack

### Procedure

1. Install two rack-mount brackets onto the switch as follows:
  - a. Determine which end of the chassis is to be located in the cold aisle as follows:
    - If the switch has port-side intake modules (fan modules with red coloring), position the switch so that its ports is in the cold aisle.
    - If the switch has port-side exhaust modules (fan modules with blue coloring), position the switch so that its fan and power supply modules is in the cold aisle.
  - b. Position a rack-mount bracket so that four of its screw holes are aligned to the screw holes on the side of the chassis. Then, secure the front-mount bracket to the chassis using four M4 screws.

**Note:** You can align four of the holes in the front rack-mount bracket to four of the screw holes on the front side of chassis or four of the screw holes on the rear side of the chassis. The holes that you use depend on which side of your chassis needs to be put in the cold aisle.

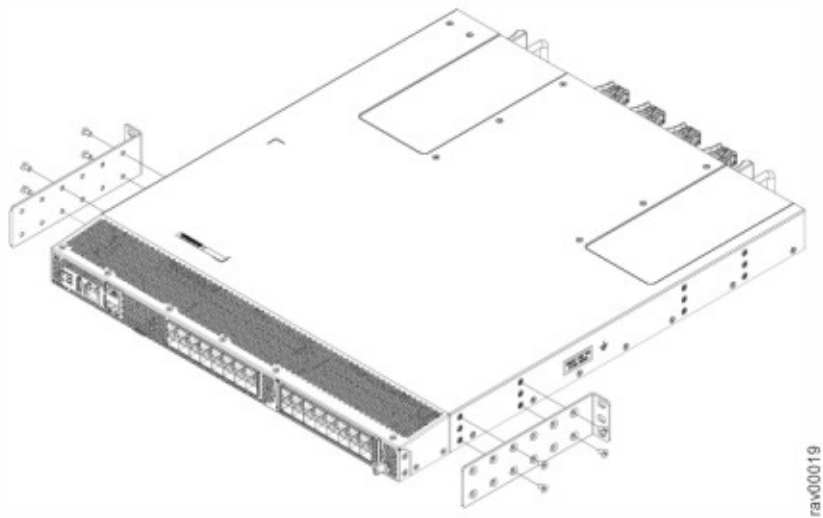


Figure 8. Installing Rack-mount Brackets on the Front Side of the Chassis

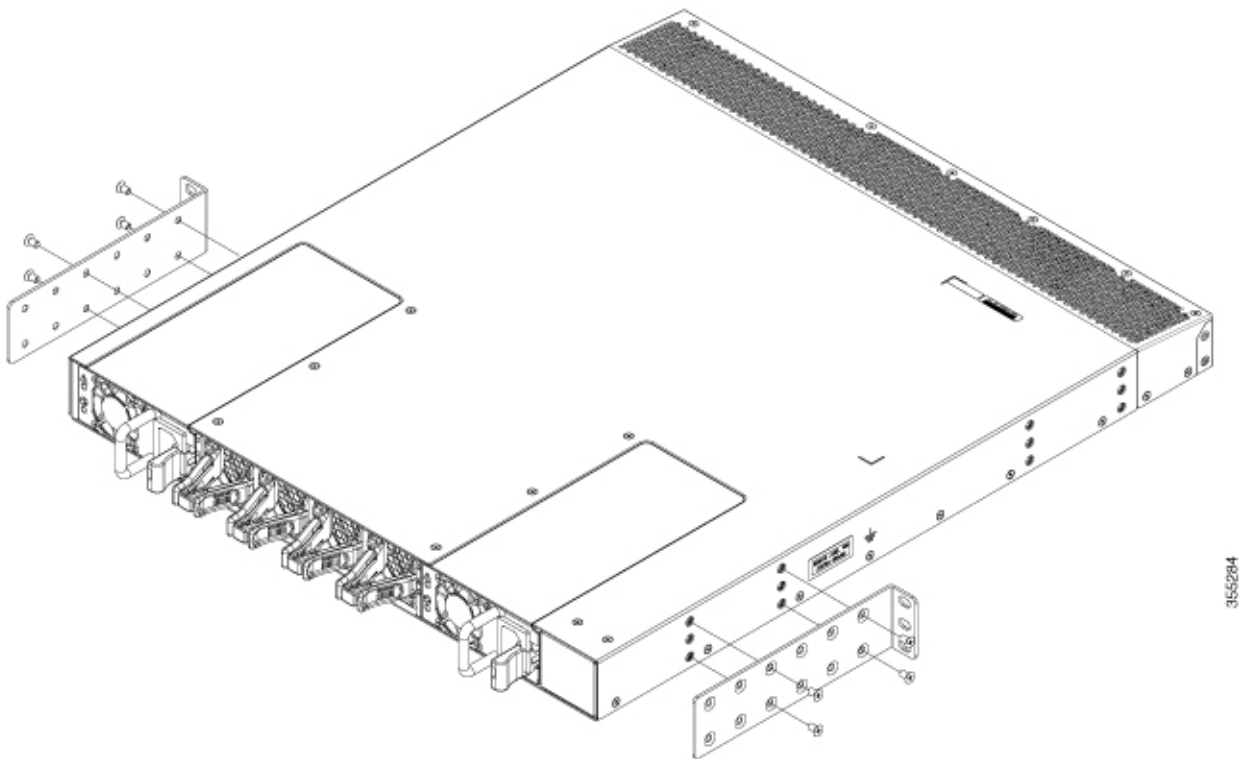


Figure 9. Installing Rack-mount Brackets on the Rear Side of the Chassis

- c. Repeat Step 1b, for the other front rack-mount bracket on the other side of the switch and be sure to position that bracket the same distance from the front of the switch.
2. Install the switch onto the 2-post rack:
  - a. Holding the switch with both hands, position the back of the switch between the two posts of the rack. Then gently move the switch until the front rack-mount brackets come in contact with two rack posts.

- b. Holding the chassis level, insert two screws (12-24 or 10-32, depending on the rack type) into each of the two front rack-mount brackets (using a total of four screws) and into the cage nuts or threaded holes in the vertical rack-mounting posts.

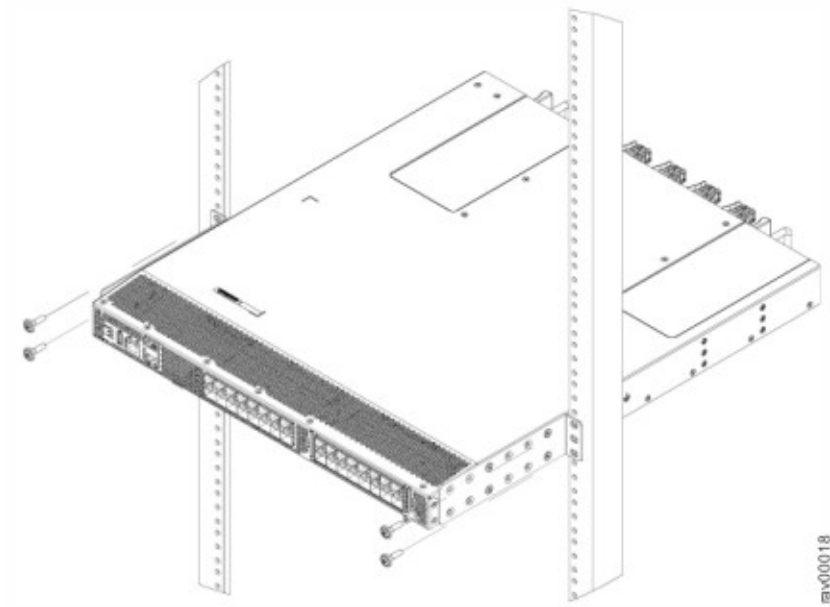


Figure 10. Installing the Switch onto the 2-post Rack

- c. Tighten the 10-32 screws to 20 in-lb (2.26 N.m) or tighten the 12-24 screws to 30 in-lb (3.39 N.m).

### **Installing the Shelf Bracket Kit into a Two-Post Telco Rack**

#### **About this task**

The following figure shows the installation of the shelf bracket kit into a two-post Telco rack:

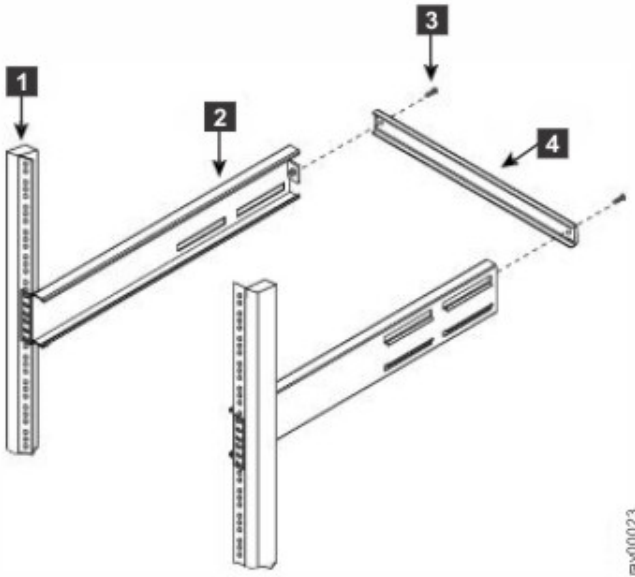


Figure 11. Installing the Shelf Bracket Kit into a Telco Rack

1	Rack-mounting post	3	10-32 screws
2	Shelf bracket	4	Crossbar

To install the shelf brackets in a Telco rack, follow these steps:

### Procedure

1. Position a shelf bracket inside a rack-mounting post as shown in Figure 11 and align the screw holes at the front of the shelf bracket with the holes in the rack-mounting post. Then, attach the shelf bracket to the rack-mounting post using a minimum of four 12-24 or 10-24 screws.

### Note:

The bottom hole of the shelf bracket should align with the bottom hole (the hole immediately above the 1/2 in. spacing) of a rack unit on the rack-mounting post.

2. Repeat Step 1 with the other shelf brackets.
3. Verify that the shelf brackets are at the same height (using the level or tape measure, as desired).
4. Attach the crossbar to the rear of the shelf brackets, as shown in Figure 11, using the 10-32 screws.

### Installing the Shelf Bracket Kit into a Four-Post EIA Rack

#### About this task

The following figure shows the installation of the shelf bracket kit into a four-post EIA rack:

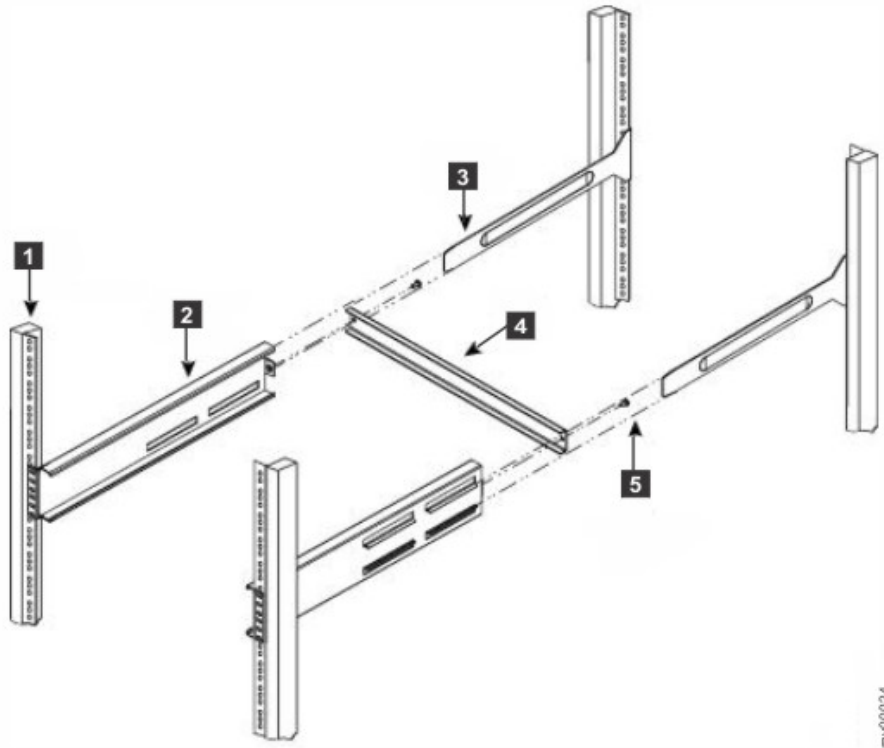


Figure 12. Installing the Shelf Bracket Kit into an EIA Rack

1	Rack-mounting post	4	Crossbar
2	Shelf bracket	5	10-32 screws
3	Slider post		

To install the shelf brackets in an EIA rack, follow these steps:

### Procedure

1. Position a shelf bracket inside the rack-mounting posts, as shown in Figure 12. Align the screw holes at the front of the shelf bracket with the holes in the front rack-mounting post. Then, attach the shelf bracket to the front rack-mounting post using a minimum of four 12-24 or 10-24 screws.

### Note:

The bottom hole of the shelf bracket should align with the bottom hole (the hole immediately above the 1/2 in. spacing) of a rack unit on the rack-mounting post.

2. Repeat Step 1 with the other shelf brackets.
3. Verify that the shelf brackets are at the same height (using the level or tape measure, as desired).
4. Attach the crossbar to the shelf brackets, as shown in Figure 12, using the 10-32 screws.
5. Insert the slider posts into the shelf brackets, as shown in Figure 12. Attach them to the rear rack-mounting posts, using a minimum of four 12-24 or 10-24 screws.



---

## Preinstallation Guidelines

### Airflow Considerations

The switch comes with fan modules and power-supply modules that have port-side exhaust and front to rear airflow for cooling the switch. All fan modules and power-supply modules must have the same direction of airflow.

### Connection Guidelines for AC-Powered Systems

To connect to the IBM SAN32C-6 switch AC power supplies to the site power source, follow these guidelines:

- Each power supply should have its own dedicated branch circuit.
- Circuits should be sized according to local and national codes.
- The AC power receptacles that are used to plug in the chassis must be the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth ground in the service equipment.

### Installation Guidelines

Follow these guidelines when installing the IBM SAN32C-6 switch:

- Plan your site configuration and prepare the site before installing the switch. The recommended site planning tasks are listed in the Site Planning and Maintenance Records section.
- Ensure that there is adequate space around the switch to allow for servicing the switch and for adequate airflow. The airflow requirements are listed in the “Airflow Considerations” section.
- Ensure that you are positioning the switch in a rack so that it takes in cold air from the cold aisle and sends out air to the hot aisle. For more information, see the Airflow Considerations section.
- Ensure that the air-conditioning meets the heat-dissipation requirements listed in the “Airflow Considerations” section.
- Ensure that the cabinet or rack meets the requirements listed in the “Cabinet and Rack Requirements” on page 9 section.
- Ensure that the chassis is adequately grounded. If the switch is not mounted on a grounded rack, we recommend that you connect both the system ground on the chassis and the site power ground to an earth ground.
- Ensure that the site power meets the power requirements listed in the Appendix A, “Switch Specifications,” on page 39. If available, you can use an uninterruptible power supply (UPS) to protect against power failures.

#### CAUTION:

**Avoid UPS types that use ferro-resonant technology. These UPS types can become unstable with systems such as the IBM Storage Networking SAN c-type Family, which can in turn have substantial current draw fluctuations because of fluctuating data traffic patterns.**

- Ensure that circuits are sized according to local and national codes.

For North America, the 650-W power supplies require a 15-A circuit. If you are using a 200 or 240 VAC power source in North America, the circuit must be protected by a two-pole circuit breaker.

**CAUTION:**

To prevent loss of input power, ensure that the total maximum loads on the circuits supplying power to the switch are within current ratings for wiring and breakers.

- As you install and configure the switch, record the information listed in the Site Planning and Maintenance Records section.

## Unpacking and Inspecting the Switch

**CAUTION:**

When handling switch components, wear an ESD strap and handle modules using only the carrier edges. An ESD socket is provided on the chassis. For an ESD socket to be effective, the chassis must be grounded through the power cable, the chassis ground, or the metal-to-metal connection with a grounded rack.

**Tip:**

Retain the shipping container in case the chassis has to be shipped in the future.

**Note:**

The switch is thoroughly inspected before shipment. If any damage occurs during transportation, or if any item is missing, contact your customer representative immediately.

To inspect the shipment, follow these steps:

1. Compare the shipment to the equipment list provided by your customer service representative and verify that you have received all items, including the following:
  - Grounding lug kit
  - Rack-mount kit
  - ESD wrist strap
  - Cables and connectors
  - Optional items, if any, ordered
2. Check for damage and report any discrepancies or damage, to your customer service representative. Have the following information ready:
  - Invoice number of shipper (see packing slip)
  - Model and serial number of the damaged unit
  - Description of damage
  - Effect of damage on the installation
3. Check to be sure that all the power supplies and the fan trays have the expected direction of airflow. Port-side intake airflow modules have a red coloring, and port-side exhaust airflow modules have blue coloring. For more information, see the Power Supplies and Fan Modules sections.

---

## Installing the Switch

This section describes how to use the rack-mount kit to install the IBM SAN32C-6 switch into a cabinet or rack that meets the requirements described in the Cabinet and Rack Requirements section.

### Installing the Switch on Shelf Brackets

#### About this task

This section provides general instructions for installing the switch on top of the shelf brackets. Note that this is an optional task.

#### Note:

Before you install, operate, or service the system, refer to *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family* for important safety information.

To install the switch on top of the shelf brackets, follow these steps:

#### Procedure

1. Verify that the shelf brackets are level and securely attached to the rack-mounting posts, the crossbar is securely attached to the shelf brackets, and the rack is stabilized.
2. Slide the switch onto the shelf brackets, ensuring that it is squarely positioned.
3. Attach the switch to the rack-mounting posts.

#### CAUTION:

**We recommend that you ground the chassis even if the rack is already grounded. A grounding pad with two threaded M4 holes is provided on the chassis for attaching a grounding lug.**

#### Note:

The grounding lug must be NRTL listed and compatible with copper conductors. Only copper conductors (wires) must be used and these conductors must comply with National Electrical Code (NEC) for ampacity.

### NEBS Compliance

In case of port-side intake airflow, the chassis has to be NEBS compliant. To be NEBS compliant, install the NEBS kit by following these steps:

1. Install two NEBS rack-mount brackets onto the switch.
2. Install the NEBS air-baffle onto the switch, and ensure that the direction is as shown in the following images.

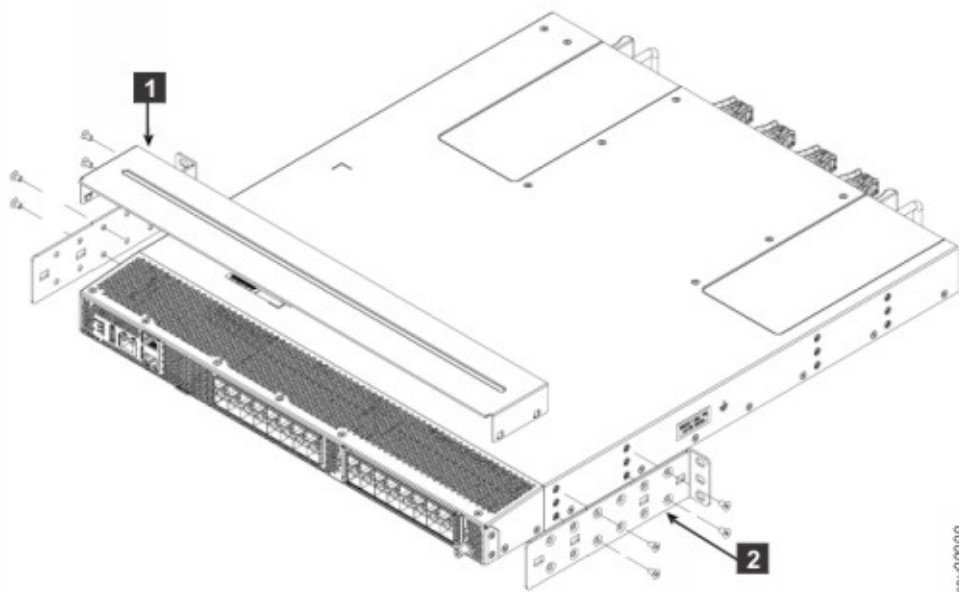


Figure 13. NEBS Kit for 2-post installation

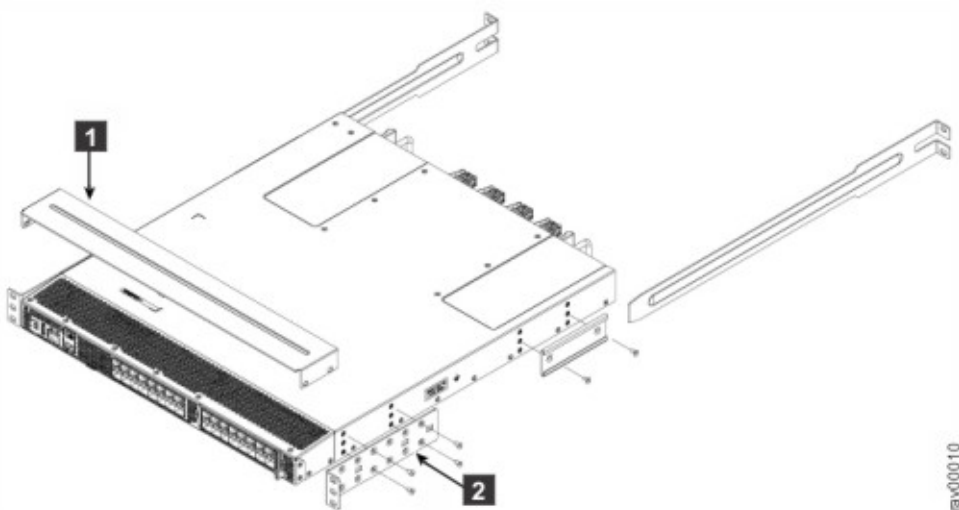


Figure 14. NEBS Kit for 4-post installation

#### 1. NEBS air-baffle

For more information on how to install the switch, see the Installing the Switch in a 4-post Rack and Installing the Switch in a 2-post Rack.

## Installing the Switch in a 4-Post Rack

### Before you begin

- Inspect the switch shipment to ensure that you have everything you ordered.
- Make sure that the switch rack-mount kit includes the following parts:
  - Front rack-mount brackets (2)
  - Rear rack-mount brackets (2)

- Slider rails (2)
- M4 x 0.7 x 8-mm Phillips countersink screws (12)
- The rack is installed and secured to its location.

## About this task

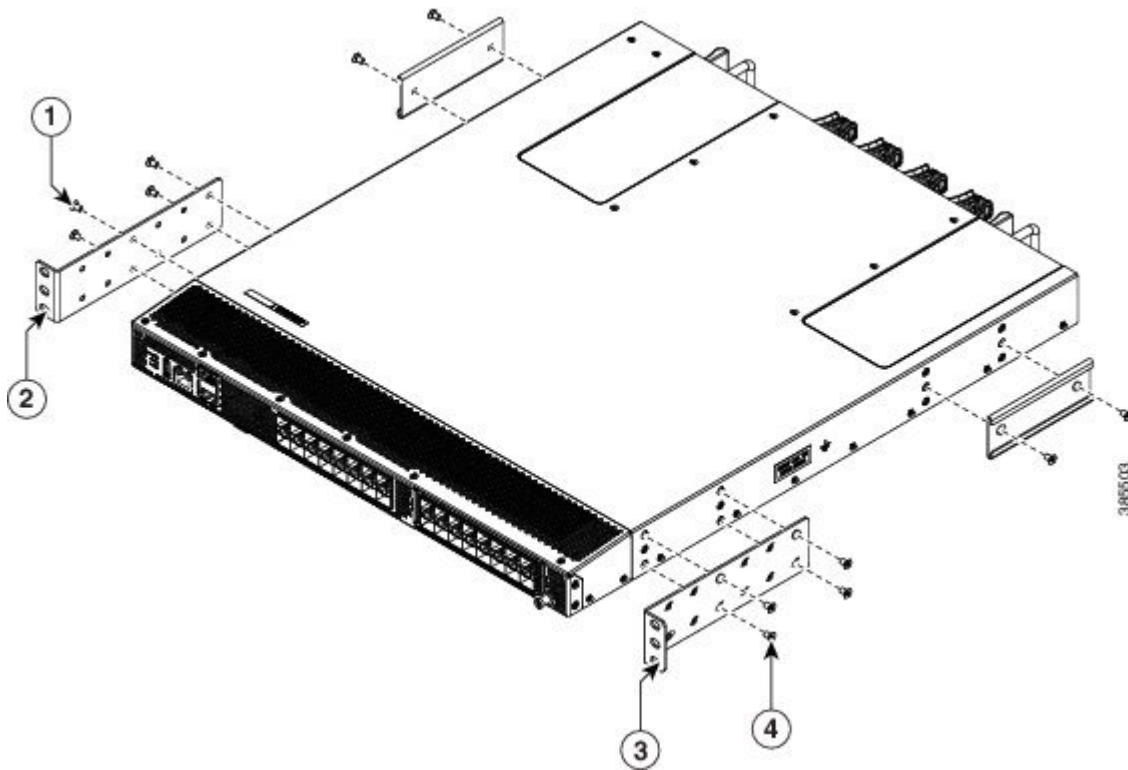
To install the switch, you must attach the front and rear mounting brackets to the switch, install the slider rails on the rear of the rack, slide the switch into the slider rails, and secure the switch to the front of the rack. Typically, the front of the rack is the side that is easiest to access for maintenance.

## Procedure

1. Install two front-mount brackets to the switch as follows:
  - a. Determine which end of the chassis is to be located in the cold aisle as follows:
    - If the switch has port-side intake modules (fan modules with red coloring), position the switch so that its ports are in the cold aisle.
    - If the switch has port-side exhaust modules (fan modules with blue coloring), position the switch so that its fan and power-supply modules are in the cold aisle.
  - b. Position a front-mount bracket so that four of its screw holes are aligned to the screw holes on the side of the chassis.

### Note:

You can align any four of the holes in the front rack-mount bracket to four of the six screw holes on the side of the chassis. The holes that you use depend on the requirements of your rack and the amount of clearance required for interface cables (3 in. [76 mm] minimum) and module handles (1 in. [25 mm] minimum).



1 & 4. Four M4 screws

2 & 3. Front rack-mount bracket

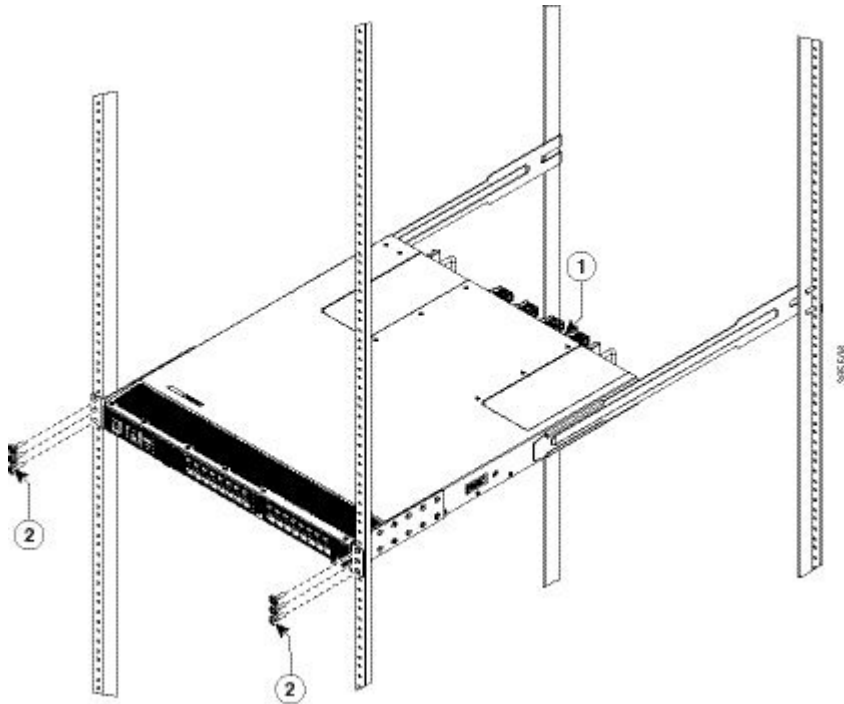
- c. Secure the front-mount bracket to the chassis using the four M4 screws and tighten each screw to 12 in-lb (1.36 N•m) of torque.
- d. Repeat Step 1 for the other front rack-mount bracket on the other side of the switch, and be sure to position that bracket the same distance from the front of the switch.
2. Install the two rear rack-mount brackets on the chassis, as follows:
  - a. Align the two screw holes on a rear rack-mount bracket to the middle two screw holes in the remaining six screw holes on a side of the chassis if you are aligning the guide to holes that are near the port connections end of the chassis.
  - b. Attach the guide to the chassis using two M4 screws. Tighten the screws to 12 in-lb (1.36 N•m) of torque.
  - c. Repeat Step 2 for the other rear rack-mount bracket on the other side of the switch.
3. If you are not installing the chassis into a grounded rack, you must attach a customer-supplied grounding wire to the chassis, as explained in Grounding the Switch. However, if you are installing the chassis into a grounded rack, you can skip this step.
4. Install the slider rails into the rack or cabinet, as follows:
  - a. Determine which two posts of the rack or cabinet you should use for the slider rails. Of the four vertical posts in the rack or cabinet, two will be used for the front-mount brackets attached to the easiest-accessed end of the chassis, and the other two posts will have the slider rails.
  - b. Position a slider rail at the desired level on the back side of the rack and use two 12-24 screws or two 10-32 screws, depending on the rack thread

type, to attach the posts to the rack. Tighten the 12-24 screws to 30 in-lb (3.39 N•m) of torque, and tighten the 10-32 screws to 20 in-lb (2.26 N•m) of torque.

- c. Repeat Step 3 to attach the other slider rail to the other side of the rack.

To make sure that the slider rails are at the same level, you should use a level tool or tape measure, or carefully count the screw holes in the vertical mounting posts.

5. Insert the switch into the rack and attach it as follows:



1. Fan-tray end of the chassis.
2. Customer-supplied rack-mount screw.
- a. Holding the switch with both hands, position the two rear rack-mount brackets on the switch between the rack or cabinet posts that do not have slider rails attached to them.
- b. Align the two rear rack-mount guides on either side of the switch with the slider rails installed in the rack. Slide the rack-mount guides onto the slider rails, and then gently slide the switch all the way into the rack until the front rack-mount brackets come in contact with two rack or cabinet posts.
- c. Holding the chassis level, insert two screws (12-24 or 10-32, depending on the rack type) into each of the two front rack-mount brackets (using a total of four screws), and into the cage nuts or threaded holes in the vertical rack-mounting posts.

**Note:**

If you attached a grounding cable to the chassis, you will need to bend one of the rack-mount posts slightly to allow the grounding lug to go behind the post.

- d. Tighten the 10-32 screws to 20 in-lb (2.26 N•m), or tighten the 12-24 screws to 30 in-lb (3.39 N•m).

6. If you have attached a grounding wire to the chassis grounding pad, connect the other end of the wire to the facility ground.

---

## Grounding the Switch

### About this task

The switch chassis is automatically grounded when you install the switch properly in a grounded rack with metal-to-metal connections between the switch and rack.

Alternatively, you can ground the chassis (this is required if the rack is not grounded) by attaching a customer-supplied grounding cable to the chassis grounding pad and the facility ground.

#### Note:

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

#### Note:

When installing or replacing the unit, the ground connection must always be made first and disconnected last.

To connect the switch chassis to the facility ground, you need the following tools and materials:

- Grounding lug—A two-holed standard barrel lug that supports up to 6 AWG wire. This lug is supplied with the accessory kit.
- Grounding screws—Two M4 x 8 mm (metric) pan-head screws. These screws are shipped with the accessory kit.
- Grounding wire—Not supplied with the accessory kit. This wire should be sized to meet local and national installation requirements. Depending on the power supply and system, a 12 AWG to 6 AWG copper conductor is required for U.S. installations. We recommend that you use commercially available 6 AWG wire. The length of the grounding wire depends on the proximity of the switch to proper grounding facilities.
- Number 1 manual Phillips-head torque screwdriver.
- Crimping tool to crimp the grounding wire to the grounding lug.
- Wire-stripping tool to remove the insulation from the grounding wire.

### Procedure

1. Use a wire-stripping tool to remove approximately 0.75 in. (19 mm) of the covering from the end of the grounding wire.
2. Insert the stripped end of the grounding wire into the open end of the grounding lug, and use a crimping tool to crimp the lug to the wire. Verify that the ground wire is securely attached to the grounding lug by attempting to pull the wire out of the crimped lug.
3. Secure the grounding lug to the chassis grounding pad with two M4 screws, and tighten each screw to 11.5 to 15 in-lb (1.3 to 1.7 N•m) of torque.
4. Prepare the other end of the grounding wire and connect it to an appropriate grounding point in your site to ensure an adequate earth ground for the switch.



If the rack is fully bonded and grounded, connect the grounding wire, as explained in the documentation provided by the vendor from whom you bought the rack.

---

## Installing and Removing Components

### Note:

Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.

### CAUTION:

During this procedure, wear grounding wrist straps to avoid ESD damage to the switch.

## Installing and Removing the Linecard Expansion Module

This section provides instructions for installing and removing the Linecard Expansion Module.

### Installing the Linecard Expansion Module

#### Before you begin

If the LEM blank module is installed, remove it as follows:

1. Unscrew the locking screw.
2. Gently pull the linecard expansion module ejector till the linecard expansion blank module is slightly ejected.
3. Remove the linecard expansion blank module.

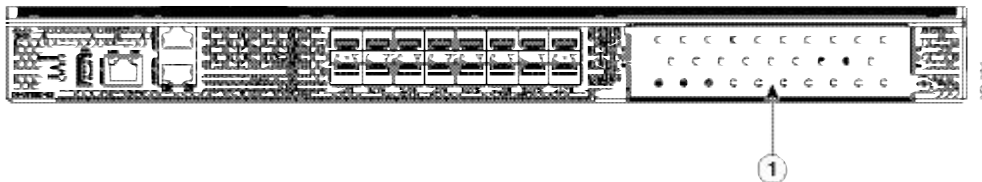


Figure 15. Inserted Linecard Expansion Blank Module

1. Linecard expansion blank module

#### About this task

To install a Linecard Expansion Module, follow the steps provided in this section:

#### Procedure

1. Power off the switch.
2. Gently pull the LEM ejector so as to insert the LEM.
3. Gently slide the LEM into the LEM bay till it clicks into place with the help of the Linecard Expansion Module ejector.
4. Secure the Linecard Expansion Module ejector with the locking screw.

## Removing the Linecard Expansion Module

### About this task

To remove a Linecard Expansion Module, follow these steps:

#### Procedure

1. Power off the switch.
2. Unscrew the locking screw.
3. Gently pull the LEM ejector till the LEM is slightly ejected.
4. Remove the LEM.
5. Physically insert the linecard expansion blank module, as shown in Figure 15 on page 25 to ensure proper system cooling.

## Installing and Removing Power Supplies

This section provides instructions for installing and removing the power supplies in the IBM SAN32C-6 Switch.

### Installing Power Supplies

#### Before you begin

If the PSU blank module is inserted, remove it as follows:

1. Unscrew the locking screw.
2. Gently pull the power supply blank module out of the bay.

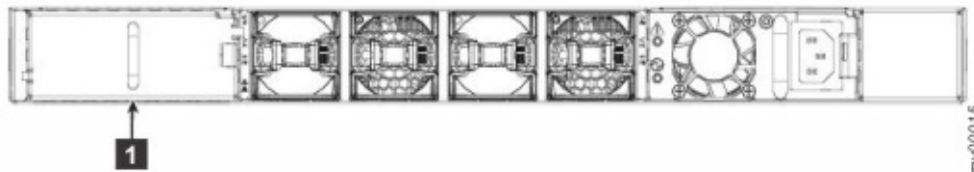


Figure 16. Inserted Power Supply Blank Module

1. Power supply blank module
  - HVAC/HVDC power supplies automatically use the same airflow direction as the installed fan modules.
  - To implement n+n redundancy, there must be two external power sources and two PSUs attached to each power source. Otherwise, only one power source is required.
  - There must be an earth ground connection to the chassis to which you are installing the replacement module. Typically, the chassis is grounded by its metal-to-metal connection with a grounded rack. If you need to ground the chassis, see Grounding the Switch.

### About this task

You can replace one power supply while the other one provides power to the switch.

## Procedure

1. Holding the power supply unit with one hand underneath it and the other hand holding the handle, turn the power supply so that its release latch is on the right side, and align the back end of the power supply (the end with the electrical connections) to the open power supply slot. Carefully slide the power supply unit all the way into the slot until it clicks into place.

### Note:

If the power supply unit does not fit into the slot opening, turn the unit over and try again.

2. Test the installation by trying to pull the power supply out of the slot without using the release latch.

If the power supply does not move out of place, it is secured in the slot. If the power supply moves, carefully press it all the way into the slot until it clicks in place and tighten the locking screw.

3. Attach the power cable to the electrical outlet on the front of the power supply.
4. Make sure that the other end of the power cable is attached to the appropriate power source for the power supply. If the power source has a switch, slide it to the On position.

### Note:

Depending on the outlet receptacle on your power distribution unit, you might need the optional jumper cable to connect the switch to your outlet receptacle.

5. Verify that the power supply is operational by making sure that the power supply LED is green. For information on what the power supply LEDs indicate, see the Switch LEDs section.

## Removing Power Supplies

### About this task

You can remove one faulty power supply, while the other one provides enough power to the switch. Install a new power supply or a power supply blank module in the open slot.

## Procedure

1. Holding the plug for the power cable, pull the plug out from the power receptacle on the power supply, and verify that both the power supply LEDs are off.

### Note:

If you need to remove an Anderson's Saf-D-Grid power cable connector from a high voltage power supply, press the tab at the top of the connector and pull the connector out of the power supply.

2. Grasp the power supply handle while pressing the release latch towards the power supply handle.
3. Place your other hand under the power supply to support it while you slide it out of the chassis.

**CAUTION:**

**Do not touch the electrical connectors on the back side of the module and prevent anything else from coming into contact with and damaging the connectors.**

4. Insert a power supply blank module, as shown in Power Supply Blank Module if you do not have a new power supply unit.

## Installing and Removing Fan Modules

This section provides instructions for installing and removing the fan modules for the IBM SAN32C-6 switch.

You can replace one of the four fan modules even when the switch is operating so long as you perform the replacement within one minute of removing the old fan module. If you cannot perform the replacement within one minute, leave the original fan module in the chassis to maintain the designed airflow until you have the replacement fan module on hand and can perform the replacement.

**CAUTION:**

**If you are replacing a module during operations, be sure that the replacement fan module has the correct direction of airflow, which means that it has the same airflow direction as the other modules in the chassis. Also, be sure that the airflow direction takes in air from a cold aisle and sends it out to a hot aisle. Otherwise, the switch can overheat and shut down.**

**If you are changing the airflow direction of all the modules in the chassis, you must shut down the switch before replacing all the fan and power supply modules with modules using the other airflow direction. During operations, all the modules must have the same direction of airflow.**

### Installing a Fan Module

#### Before you begin

If a fan blank module is installed, remove it as follows:

- Press the two sides of the fan blank module handle and pull on the handles enough to unseat it from its connectors.
- Holding the handle, pull the module out of the chassis.

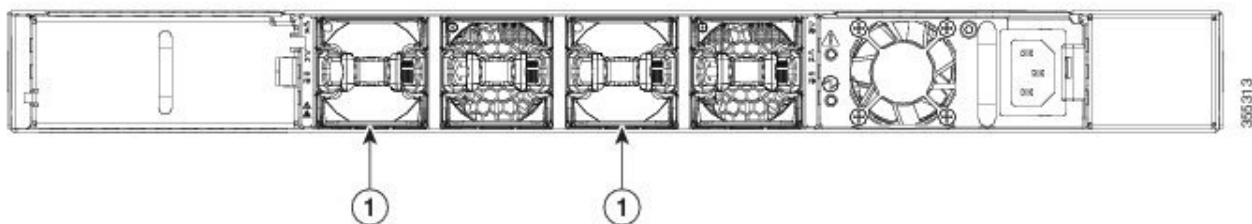


Figure 17. Inserted Fan Blank Modules

1. Fan blank modules
  - A fan slot must be open and ready for the new fan module to be installed.

- You must have a new fan module on hand and ready to install within one minute of removing the original fan module if the switch is operating.
- The new fan module must have the same airflow direction as the other fan and power supply modules installed in the switch. All of these modules must have either red coloring (port-side intake airflow) or they must all have blue coloring (port-side exhaust airflow).

### About this task

To install a new fan module, follow these steps:

#### Procedure

1. Holding the fan module by its handle, align the back of the fan module (the side with the electrical connectors) to the open fan slot in the chassis.
2. Slide the fan module into the fan module bay until it clicks into place and tighten the locking screw.
3. Verify that the Status LED turns on and becomes green.

### Removing a Fan Module

#### About this task

The fan module is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damaging the system.

#### CAUTION:

The IBM Storage Networking SAN c-type Family Switches have internal temperature sensors that can shut down the system if the temperature within the chassis exceed certain safety thresholds. To accurately monitor the system temperature, the temperature sensors require sufficient airflow through the chassis. In the event that a fan module is removed from the chassis and the airflow is reduced, the system will bypass the temperature sensor information and shut down after five minutes to prevent undetected overheating. However, the switches will shut down sooner if the major temperature threshold is exceeded.

#### Note:

While removing the fan module, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan module. Statement 258

To remove an existing fan module, follow these steps:

#### Procedure

1. On the fan module that you are removing, press the two sides of the fan module handle next to where it connects to the fan module and pull on the handles enough to unseat it from its connectors.
2. Holding the handle, pull the module out of the chassis.

#### CAUTION:

**Do not touch the electrical connectors on the back side of the module and prevent anything else from coming into contact with and damaging the connectors.**

3. Insert a fan blank module, as shown in Figure 17 on page 28 if you do not have a new fan module.

---

## Chapter 4. Initial Setup and Verification

This topic provides the following information:

- “Preparing for Network Connections”
- “Connecting the Console Port”
- “Connecting the Management Port” on page 33
- “Connecting to a Fibre Channel Port” on page 33
- “Removing and Installing Cables into SFP Transceivers” on page 33
- “Removing and Installing SFP Transceivers” on page 35
- “Maintaining SFP Transceivers and Fiber-Optic Cables” on page 36
- “Powering Up the Switch” on page 36

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### Preparing for Network Connections

When preparing your site for network connections to the IBM SAN32C-6 switch, consider the following for each type of interface:

- Cabling required for each interface type
- Distance limitations for each signal type
- Additional interface equipment needed

Before installing the component, have all the additional external equipment and cables available.

---

### Connecting the Console Port

This section describes how to connect the RS-232 console port to a PC. The console port allows you to perform the following functions:

- Configure the switch from the CLI.
- Monitor network statistics and errors.
- Configure SNMP agent parameters.
- Download software updates to the switch or distribute software images residing in flash memory to attached devices.
- Perform initial switch configuration
- Perform password recovery

#### Connecting the Console Port to a PC

##### About this task

You can connect the console port to a PC serial port for local administrative access to the IBM SAN32C-6 switch.

##### Note:

The PC must support VT100 terminal emulation. The terminal emulation software—frequently a PC application, such as HyperTerminal Plus—makes the communication between the IBM SAN32C-6 switch and your PC possible during setup and configuration.

To connect the console port to a PC, follow these steps:

### Procedure

1. Configure the baud rate and character format of the PC terminal emulation program to match the following management port default characteristics:
  - 9600 baud
  - 8 data bits
  - 1 stop bit
  - No parity
2. Attach the adapter required for your PC to its communication port. It must present an RJ-45 socket towards the switch.
  - For a DB-9 serial port, attach the supplied RJ-45-to-DB-9 female adapter.
  - For a DB-25 serial port, attach the supplied RJ-45-to-DB-25 female adapter.
  - For a USB port, attach a customer-supplied USB-to-serial dongle.
3. Connect one end of the supplied console cable (a rollover RJ-45-to-RJ-45 cable) to the console port. Connect the other end to the female RJ-45 adapter attached to the PC communication port.

## Connecting a Modem to a Console Port

### About this task

#### CAUTION:

**Do not connect the console port to a modem while the switch is booting. Connect the console port to a modem either before powering the switch on or after the switch has completed the boot process.**

To connect the console port to a modem before the switch is powered on, follow these steps:

### Procedure

1. Connect the supplied console cable (a rollover RJ-45-to-RJ-45 cable) to the console port.
2. Connect the other end of the console cable to the supplied RJ-45-to-DB-25 adapter.
3. Connect the RJ-45-to-DB-25 adapter to the DB-25 port on the modem.
4. Power on the switch. The switch boots automatically, and the following default console port characteristics are applied to the modem connection:
  - 9600 baud
  - 8 data bits
  - 1 stop bit
  - No parity
  - Default initialization string (ATE0Q1&D2&C1S0=1\015) if previously configured

#### Note:

For instructions on how to change these settings, see the *Cisco Fabric Manager Fundamentals Configuration Guide*.



---

## Connecting the Management Port

The auto-sensing 10/100/1000 Mbps Ethernet management ports are located on the left side of the front panel (labeled MGMT ETH0 and MGMT ETH1), below the console port. MGMT ETH0 is the default Ethernet management port (interface mgmt0). This port is used for out-of-band management of the IBM SAN32C-6 switch. It can also be used for upstream data transferring.

**Note:**

MGMT ETH1 is disabled in the IBM NX-OS version 8.1(1b) software.

Use a modular, RJ-45, straight-through UTP cable to connect the 10/100/1000 Mbps Ethernet management ports to external hubs and switches.

---

## Connecting to a Fibre Channel Port

The Fibre Channel ports are compatible with FC LC-type fiber-optic SFP transceivers and cables (see the Removing and Installing Cables into SFP Transceivers section). You can use these ports to connect to the SAN or for in-band management. For information about configuring the switch for in-band management, see the *IBM NX-OS version 8.1(1b) Configuration Guide*.

Each transceiver must match the transceiver at the other end of the cable, and the cable must not exceed the stipulated cable length for reliable communications. SFP transceivers can be ordered either separately or with the IBM SAN32C-6 switch.

**Note:**

**Class 1 laser product.**

**Note:**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.**

**Note:**

Wear an ESD wrist strap connected to the chassis when handling transceivers. Keep optical connectors covered when not in use, and do not touch connector ends. The fiber-optic connectors must be free of dust, oil, and other contaminants.

## Removing and Installing Cables into SFP Transceivers

**CAUTION:**

**To prevent damage to the fiber-optic cables, do not place more tension on them than the rated limit and do not bend to a radius of less than one inch (2.5 cm) if there is no tension in the cable, or two inches (5 cm) if there is tension in the cable.**

## Installing a Cable into an SFP Transceiver

### About this task

#### CAUTION:

To prevent possible damage to the cable or transceiver, install the transceiver in the port before installing the cable in the transceiver.

To install a cable into a transceiver, follow these steps:

#### Procedure

1. Attach an ESD-preventive wrist strap and follow its instructions for use.
2. Remove the dust cover from the connector on the cable.
3. Remove the dust plug from the cable-end of the transceiver.
4. Align the cable connector with the transceiver and insert the connector into the transceiver until it clicks into place.

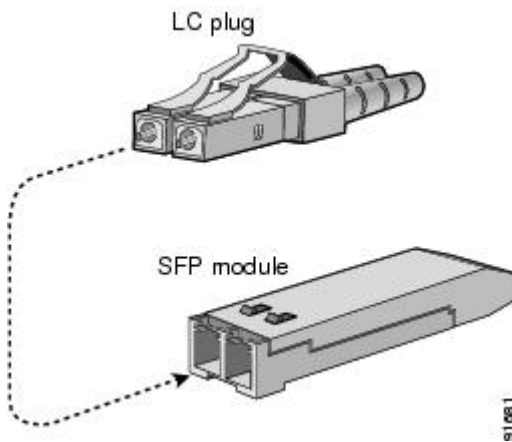


Figure 18. Connecting the LC-Type Cable to a Fibre Channel Port

#### CAUTION:

If the cable does not install easily, ensure that it is correctly oriented before continuing.

For instructions on verifying connectivity, see the *Cisco NX-OS Fundamentals Configuration Guide*.

## Removing a Cable from an SFP Transceiver

### About this task

#### CAUTION:

- When pulling a cable from a transceiver, grip the body of the connector. Do not pull on the jacket sleeve because this can compromise the fiber optic termination in the connector.
- If the cable does not remove easily, ensure that any latch present on the cable has been released before continuing.

To remove the cable, follow these steps:

### Procedure

1. Attach an ESD-preventive wrist strap and follow its instructions for use.
2. Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.
3. Insert a dust plug into the cable-end of the transceiver.
4. Insert a dust cover into the end of the cable.

## Removing and Installing SFP Transceivers

### Note:

Removing and installing an SFP transceiver can shorten its useful life. Do not remove and insert SFP transceivers more often than is absolutely necessary. We recommend that you disconnect the cables before installing or removing SFP transceivers to prevent damage to the cable or transceiver.

**Note:** Use only Cisco SFP transceivers on the IBM SAN32C-6 switch. Each SFP transceiver is encoded with model information that enables the switch to verify that the SFP transceiver meets the requirements for the switch.

The IBM SAN32C-6 switch supports SFP transceivers with the following types of latching devices:

- Mylar tab latch
- Bale-clasp latch

### Installing an SFP Transceiver

#### About this task

To install an SFP transceiver, follow these steps:

### Procedure

1. Attach an ESD-preventive wrist strap and follow its instructions for use.

#### CAUTION:

**If the transceiver does not install easily, ensure that it is correctly oriented and the tab or clasp are in the correct position before continuing.**

2. Remove the dust plug from the switch-port cage.
3. Remove the dust cover from the port-end of the transceiver.
4. Insert the transceiver into the port.
5. Insert or leave the dust plug in the cable-end of the transceiver if a cable is not being installed in the transceiver.

### Removing an SFP Transceiver

#### About this task

To remove an SFP transceiver, follow these steps:

### Procedure

1. Attach an ESD-preventive wrist strap and follow its instructions for use.
2. Remove attached fibre-optic cables, if any. For more information, see the Removing a Cable from an SFP Transceiver section.
3. Remove the transceiver from the port:

- If the transceiver has a mylar tab latch, gently pull the tab straight out (do not twist), and then pull the transceiver out of the port.
  - If the transceiver has a bale-clasp latch, open the clasp by pressing it downwards, and then pull the transceiver out of the port.
4. Insert a dust cover into the cable-end of the transceiver and place the transceiver on an antistatic mat or into a static shielding bag.
  5. Protect the switch port by inserting a clean dust plug if another transceiver is not being installed.

## Maintaining SFP Transceivers and Fiber-Optic Cables

SFP transceivers and fiber optic cables must be kept clean and dust-free to maintain high signal accuracy and prevent damage to the connectors. Attenuation (loss of light) is increased by contamination. Therefore, attenuation should be kept below 0.35 dB.

Follow these maintenance guidelines:

- SFP transceivers are static-sensitive. To prevent ESD damage, wear an ESD-preventive wrist strap that is connected to the chassis.
- Do not remove and reinsert a transceiver more often than necessary. Repeated removals and insertions can shorten its useful life.
- Keep all optical connections covered when not in use. If they become dusty, clean before using in order to prevent dust from scratching the fiber-optic cable ends.
- Do not touch the ends of connectors. This prevents fingerprints and other contamination of the connectors.
- Inspect cables before installation, for dust and damage. If damage is suspected, clean the ends and check for excessive light loss with a light meter.

---

## Powering Up the Switch

### About this task

This section provides instructions for powering up the switch and verifying component installation.

#### CAUTION:

**During this procedure, wear grounding wrist straps to avoid ESD damage to the switch.**

#### Note:

Do not connect the MGMT 10/100/1000 Ethernet port to the LAN until the initial switch configuration has been performed. For instructions on connecting to this port, see the Connecting the Management Port section.

To power up the switch and verify hardware operation, follow these steps:

### Procedure

1. Verify that the power supplies and fan modules are installed, and tighten loose captive screws, if any.

2. Plug the power cables into the power supplies and arrange the cables so that they cannot be accidentally pulled out.

**Note:**

Depending on the outlet receptacle on your power distribution unit, you may need the optional jumper power cord to connect the IBM SAN32C-6 Switch to your outlet receptacle. For more information about the jumper power cord, see the Jumper Power Cord section.

3. Connect the other end of the power cables to the site power outlets that have the required power voltages.
4. Ensure that the switch is adequately grounded, as described in the Grounding the Switch section.
5. Connect a terminal device to the serial console port. For more information, see the Connecting the Console Port section.
6. Turn the site power outlet switches to On. The switch boots automatically.
7. Listen for the fans; they should begin operating as soon as the switch is powered on.

**Note:**

Do not operate the switch without a functioning fan module, except briefly during the fan module-replacement procedure. IBM Storage Networking SAN c-type Family can operate for only a few minutes without any functioning fan modules before they begin to overheat.

8. Verify that the LED behavior is as follows when the switch has finished booting:
  - Fan status LED is green.
  - Each power supply LED is green.
  - The switch status LED is green. If this LED is orange or red, it indicates that one or more environmental monitors is reporting a problem.
  - The Ethernet port link LEDs should not be On unless the cable is connected.

**Note:**

The LEDs for the Fibre Channel ports remain orange until the ports are enabled, and the LED for a MGMT 10/100/1000 Ethernet port remains Off until the port is connected.

9. If a component is not operating properly, try removing and reinstalling it. If it still does not operate correctly, contact your customer service representative for a replacement.
10. Verify that the system software has booted and the switch has initialized without error messages. If any problems occur, see the *Cisco NX-OS Fundamentals Configuration Guide*. If you cannot resolve an issue, contact your customer service representative.
11. Complete the worksheets provided in Site Planning and Maintenance Records for future reference.

**Note:**

A setup utility is automatically launched the first time you access the switch, and guides you through the basic configuration. For instructions about how to configure the switch and check module connectivity, see the *Cisco NX-OS Fundamentals Configuration Guide*.

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## Appendix A. Switch Specifications

The following table lists the environmental specifications for the IBM SAN32C-6 switch:

*Table 3. Environmental Specifications for the IBM SAN32C-6 Switch*

Description	Specification
Temperature, ambient operating	32 to 104°F (0 to 40°C)
Temperature, ambient nonoperating and storage	-40 to 158°F (-40 to 70°C)
Humidity (RH), ambient (noncondensing) operating	10 to 90%
Humidity (RH), ambient (noncondensing) nonoperating and storage	10 to 95%
Altitude, operating	-197 to 6500 ft (-60 to 2000 m)

The following table lists the physical specifications for the IBM SAN32C-6 switch.

*Table 4. Physical Specifications for the IBM SAN32C-6 Switch*

Description	Specification
Dimensions (HxWxD)	1.72 x 17.3 x 20.11 in. (4.36 x 43.94 x 51.07 cm) excluding PSU and fan module handles
Rack Space	Chassis requires 1 RU (1.75 in. or 4.45 cm)
Weight	21.65 lb (9.82 kg)
Power Supply	<ul style="list-style-type: none"><li>• 650-W AC, port-side exhaust variant (up to 2 per switch)</li><li>• 650-W AC, port-side intake variant (up to 2 per switch)</li><li>• 1200-W HVAC/HVDC, Bidirectional air flow variant (up to 2 per switch)</li><li>• AC input—100 to 240 V AC (10% range)</li><li>• HVAC input—200 V to 277 V</li><li>• HVDC input—240 V to -380 V</li><li>• Frequency—50 to 60 Hz (nominal)</li></ul>
Airflow	<ul style="list-style-type: none"><li>• Back to front (toward ports) using port-side exhaust fans</li><li>• Front to back (into ports) using port-side intake fans</li><li>• 50 CFM (0.02 m<sup>3</sup>/s) through system fan assembly at 25°C</li><li>• 100 CFM (0.04 m<sup>3</sup>/s) maximum</li></ul> <p>We recommend that you maintain a minimum air space of 2.5 in. (6.4 cm) between walls and chassis air vents and a minimum horizontal separation of 6 in. (15.2 cm) between two chassis to prevent overheating.</p>





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## Appendix B. SFP Transceiver Specifications

The IBM SAN32C-6 switch is compatible with SFP transceivers and cables that have LC connectors. Each transceiver must match the transceiver at the other end of the cable in terms of wavelength. The cable must not exceed the stipulated cable length for reliable communications to take place.

The SFP+ transceivers support 850 to 1610 nm nominal wavelengths, depending upon the transceiver.

Use only SFP transceivers specified here on the IBM SAN32C-6 switch. Each SFP transceiver is encoded with model information that enables the switch to verify that the SFP transceiver meets the requirements for the switch. For the list of supported SFP transceivers, see the Cisco MDS 9000 Series Compatibility Matrix.

For details about SFP transceivers see the *Cisco MDS 9000 Family Pluggable Transceivers Data Sheet*.

For information about safety, regulatory, and standards compliance, see the *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*.

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### Fibre Channel SFP+ Transceivers

The following table lists the Fibre Channel SFP+ transceivers that are available with the IBM SAN32C-6 switch:

*Table 5. Fibre Channel SFP+ Transceivers for the IBM SAN32C-6 Switch*

SFP+	Description	Type
FC 32Gb SW SFP+	32-Gbps Fibre Channel SW SFP+	Short wavelength
FC 32Gb LW SFP+	32-Gbps Fibre Channel LW SFP+	Long wavelength
FC16Gb SW SFP+	16-Gbps Fibre Channel SW, SFP+	Short wavelength
FC 16Gb LW SFP+	16-Gbps Fibre Channel LW, SFP+	Long wavelength
FC 8Gb SW SFP+	8-Gbps Fibre Channel SW, SFP+	Short wavelength
FC 8Gb LW SFP+	8-Gbps Fibre Channel LW, SFP+	Long wavelength

## General Specifications for IBM Fibre Channel 32-Gbps SFP+ Transceivers

The following table summarizes cabling specifications for 32 Gbps.

Table 6. General Specifications for IBM 32-Gbps Fibre Channel SFP+ Transceivers

SFP+	Fibre Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
FC 32Gb SW SFP+	MMF 850	50.0	28.05	65 ft (20 m) (OM2)
		50.0	28.05	230 ft (70 m) (OM3)
		50.0	28.05	328 ft (100 m) (OM4)
		50.0	28.05	328 ft (100 m) (OM5)
		62.5	14.025	49 ft (15 m) (OM1)
		50.0	14.025	115 ft (35 m) (OM2)
		50.0	14.025	328 ft (100 m) (OM3)
		50.0	14.025	410 ft (125 m) (OM4)
		50.0	14.025	410 ft (125 m) (OM5)
		62.5	8.5	69 ft (21 m) (OM1)
		50.0	8.5	164 ft (50 m) (OM2)
		50.0	8.5	492 ft (150 m) (OM3)
		50.0	8.5	623 ft (190 m) (OM4)
		50.0	8.5	623 ft (190 m) (OM5)
FC 32Gb LW	SMF 1310	9.0	28.05	10 km (6.2 mi)
		9.0	14.025	10 km (6.2 mi)
		9.0	8.5	10 km (6.2 mi)

## Power Requirements and Environmental Conditions for 32-Gbps SFPs

The following table provides the optical parameters for 32-Gbps SFPs:

*Table 7. Optical Parameters for 32-Gbps SFPs*

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)			
	Min	Max	Min	Max	OM2	OM3	OM4	OM5
FC 32Gb SW	-6.2	2.0	-8.2	2.0	1.68 (8 Gbps)	2.04 (8 Gbps)	2.04 (8 Gbps)	2.04 (8 Gbps)
					1.63 (16 Gbps)	1.86 (16 Gbps)	1.95 (16 Gbps)	1.95 (16 Gbps)
					2.02 (32 Gbps)	1.86 (32 Gbps)	1.86 (32 Gbps)	1.86 (32 Gbps)
FC 32Gb LW	-5.0	2.0	-11.4	2.0	6.4 (8 Gbps)			
					6.4 (16 Gbps)			
					6.4 (32 Gbps)			

The following table provides information on operating and storage temperature ranges for 32-Gbps SFPs:

*Table 8. Operating and Storage Temperature Ranges for 32-Gbps SFPs*

SFP+	Operating		Storage	
	Min	Max	Min	Max
FC 32Gb SW	0°C	40°C	-40°C	70°C
FC 32Gb LW	0°C	40°C	-40°C	70°C

## General Specifications for Fibre Channel 16-Gbps SFP+ Transceivers

The following table summarizes cabling specifications for 16-Gbps SFP+ transceivers:

Table 9. General Specifications for 16-Gbps Fibre Channel SFP+ Transceivers

SFP+	Wavelength (nm)	Fibre Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
FC 16Gb SW	850	MMF	62.5	14.025	15 m (49 ft) (OM1)
			50.0	14.025	35 m (115 ft) (OM2)
			50.0	14.025	100 m (328 ft) (OM3)
			50.0	14.025	125 m (410 ft) (OM4)
			62.5	8.5	21 m (69 ft) (OM1)
			50.0	8.5	50 m (164 ft) (OM2)
			50.0	8.5	150 m (492 ft) (OM3)
			50.0	8.5	190 m (623 ft) (OM4)
			62.5	4.25	70 m (230 ft) (OM1)
			50.0	4.25	150 m (492 ft) (OM2)
			50.0	4.25	380 m (1247 ft) (OM3)
			50.0	4.25	400 m (1312 ft) (OM4)
			50.0	4.25	
			50.0	4.25	
FC 16Gb LW	1310	SMF	9.0	14.025	10 km (6.2 mile)
			9.0	8.5	10 km (6.2 mile)
			9.0	4.25	10 km (6.2 mile)

## Power Requirements and Environmental Conditions for 16-Gbps SFP+ Transceivers

The following table provides the optical parameters for 16-Gbps SFP+ transceivers:

Table 10. Optical Parameters for 16-Gbps SFP+ Transceivers

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)		
	Min	Max	Min	Max	(62.5 microns [OM1])	(50.0 microns [OM2])	(50.0 microns [OM3])

Table 10. Optical Parameters for 16-Gbps SFP+ Transceivers (continued)

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)		
FC 16Gb SW	-7.8	-1.3	-10.3	0	2.08 (4 Gbps)	2.08 (4 Gbps)	2.88 (4 Gbps)
					1.68 (8 Gbps)	1.68 (8 Gbps)	2.04 (8 Gbps)
					1.63 (16 Gbps)	1.63 (16 Gbps)	1.86 (16 Gbps)
FC 16Gb LW	-5.0	2.0	-12.0	2.0	7.8 (4 Gbps)		
					6.4 (8 Gbps)		
					6.4 (16 Gbps)		

The following table provides information on operating and storage temperature ranges:

Table 11. Operating and Storage Temperature Ranges for 16-Gbps SFP+ Transceivers

SFP+	Operating		Storage	
	Min	Max	Min	Max
FC 16Gb SW	0°C	40°C	-40°C	85°C
FC 16Gb LW	0°C	40°C	-40°C	85°C

## Power Requirements and Environmental Conditions for 8-Gbps SFP+ Transceivers

The following table provides the optical parameters for 8-Gbps SFP+ transceivers:

Table 12. Optical Parameters for 8 Gbps SFP+ Transceivers

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)		
	Min	Max	Min	Max	(62.5 microns [OM1])	(50.0 microns [OM2])	(50.0 microns [OM3])
FC 8Gb SW	-10 (2 Gbps)	-1.3	—	0	2.10 (2 Gbps)	2.08 (4 Gbps)	3.31 (2 Gbps)
	-9 (4 Gbps)				1.78 (4 Gbps)	1.68 (8 Gbps)	2.88 (4 Gbps)
	-8.2 (8 Gbps)				1.58 (8 Gbps)	1.63 (16 Gbps)	2.04 (8 Gbps)
FC 8Gb LW	-11.7 (2 Gbps)	-3 (2 Gbps)	—	-3 (2 Gbps)	—	-7.8 (2 Gbps)	—
	-8.4 (4 Gbps)	-1 (4 Gbps)		-1 (4 Gbps)		7.8 (4 Gbps)	
	-8.4 (8 Gbps)	0.5 (8 Gbps)		0.5 (8 Gbps)		6.4 (8 Gbps)	

The following table provides information on operating and storage temperature ranges:

*Table 13. Operating and Storage Temperature Ranges for 8-Gbps SFP+ Transceivers*

SFP+	Operating		Storage	
	Min	Max	Min	Max
FC 8Gb SW	0°C	40°C	-40°C	85°C
FC 8Gb LW	0°C	40°C	-40°C	85°C

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