IBM Storage Networking
MTM 8977-T96

SAN96C-6 Multilayer Fabric Switch Installation, Service, and User Guide

IBM

Contents

Figures

Tables

Read this first

Summary of changes

This is the first edition of the IBM® Storage Networking SAN96C-6 Installation, Service, and User Guide.

Getting help

For the latest version of your product documentation, visit the web at http://www.elink.ibmlink.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/

Visit 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/.

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).

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 xvii
- "Product recycling and disposal" on page xix

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 xvi:** 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 xv may be attached to the product to warn of potential hazards.

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.
 ≥55 kg (≥121.2 lbs) svc00169 >55kg (121.2 lb)	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.

xi

Example symbol	Symbol meaning
P/N:18P5850-B SJ000752	A potential hazard of pinching the hand or other body parts between parts.
	A hazardous condition due to moving parts nearby.
Class I	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).

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)

≥55 kg (≥121.2 lbs)
svc00169
>55kg (121.2 lb)

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.

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)

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)
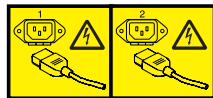
DANGER

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

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.

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 SAN96C-6 Switch. Throughout this document, the product is referred to as the *SAN96C-6*, or simply the *switch*.

This document has been created to include information specific to SAN96C-6 switches running on NX-OS version 8.4(1) or later. This document does not support all Fabric OS versions. It is specific to NX-OS version 8.4(1) or later. Refer to the NX-OS version 8.4(1) 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
9148T Fibre Channel Switch	SAN48C-6	8977 Model T48
9396T Multilayer Fabric Switch	SAN96C-6	8977 Model T96
9132T Fabric Switch	SAN32C-6	8977 Model T32
9250i Multi-service 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

Product documentation

The following documents contain information related to this product:

> **Draft comment**
> Do we want to include the documents from the last Raven release or just the current docs?

- *IBM SAN48C-6 Installation, Service and User Guide*, SC27-9572-00
- *IBM SAN96C-6 Installation, Service and User Guide*, SC27-9571-00
- *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
- *IBM Systems Environmental Notices and User Guide*, Z125-5823

Product Overview

The SAN96C-6 32 Gbps 96 Port two rack unit Fibre Channel switch provides high speed Fibre Channel connectivity in the SAN. This switch offers analytics and telemetry capability built into its Application-Specific Integrated Circuit (ASIC) platform. The Non-Volatile Memory express (NVMe)-ready switch allows seamless transition to Fibre Channel Non-Volatile Memory Express (FC-NVMe) workloads whenever available without any hardware upgrade in the SAN. This high density, highly reliable and scalable, enterprise class semi-modular switch is ideal for medium to large departmental SANs.

The SAN96C-6 switch has the following major features:

- 96x32 Gbps line rate Enhanced Small Form-Factor Pluggable (SFP+) ports provide an aggregate bandwidth of 3 Tbps per switch for highly scalable designs for hyperscale environments that drive several thousands of virtual machine instances within the rack. This switch provides at least six ports that can be configured with up to 8270 Buffer-To-Buffer (B2B) credits that can be connected to remote data centers as far as 612 km (380 miles) using native Fibre Channel connectivity at 32 Gbps speeds. These distances become even greater at lower speeds.
- Provides consistent 32 Gbps quality performance for every Fibre Channel port on the switch.
- Port-channel link members can be used across the six 16 port port groups providing additional high availability.
- Provides minimum configuration option of 48x32 Gbps Fibre Channel ports in the base variant, which can be enabled in increments of 16 ports to up to 96 ports. This allows four possible configurations of 48, 64, 80, and 96 ports.
- Supports enterprise-class features such as Slow Drain Detection and Isolation, Virtual SAN (VSAN) identifier, Access Control Lists (ACLs) for hardware-based intelligent frame processing, Smart Zoning, and migration from fabric wide Quality of Service (QoS) from SAN islands to enterprise wide storage networks. Traffic encryption is optionally available to meet stringent security requirements.
- Provides intelligent diagnostics tools such as Inter-Switch Link (ISL) diagnostics, HBA diagnostics with leading HBA vendors, read diagnostic parameters, protocol decoding, network analysis tools, and integrated Call Home.
- Supports the Virtual Machine Identifier (VMID) feature that provides visibility into virtual machines that are accessing the storage devices in the fabric.
- Supports Representational State Transfer (REST) and NX-API capabilities.
- Supports onboard hardware that protects the switch from malicious attacks by securing access to critical components such as the bootloader, system image loader, and Joint Test Action Group (JTAG) interface.

Chassis Components

Front View

The following figure shows the front view of a SAN96C-6 Switch:

> **Draft comment**
> Please provide the graphic file for the IBM front view of the switch and I'll replace the Cisco version.
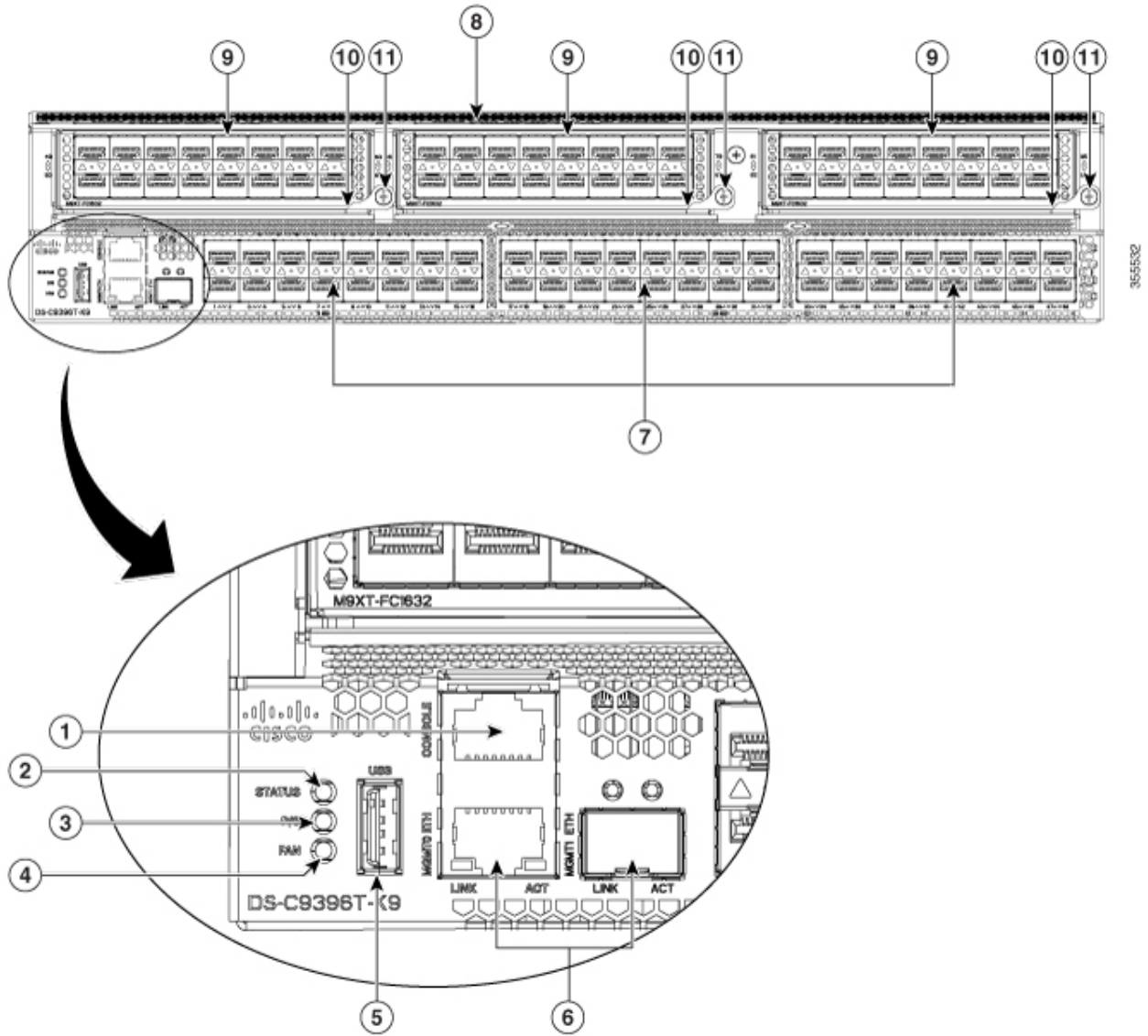
Figure 1. Front View of the SAN96C-6 Switch

1	Serial console port	7	Base Fibre Channel ports
2	System status LED	8	Airflow Grill
3	Power supply status LED	9	Linecard Expansion Module (LEM) (3)
4	Fan status LED	10	LEM ejector lever
5	USB port	11	LEM locking screw
6	Ethernet management ports (2)		

Rear View

The following figure shows the rear view of a SAN96C-6 Switch:.
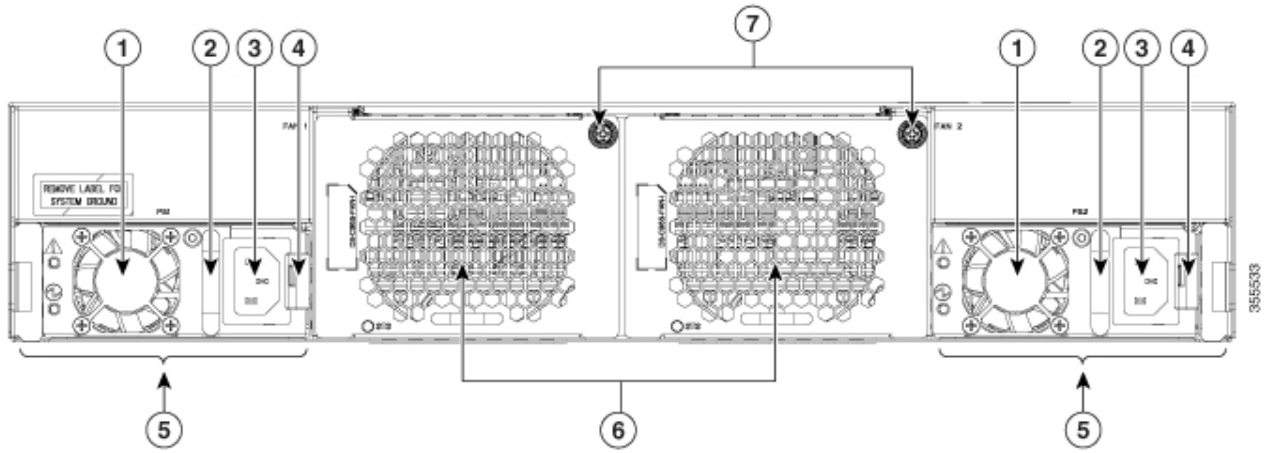
Figure 2. Rear view of the SAN96C-6 Switch

1	Power supply unit fan	5	Power supply units (2)
2	Power supply unit handle	6	Chassis fan modules (2)
3	Power receptacle	7	Fan module locking screw
4	Power supply unit locking latch		

Grounding Point

The rear of the SAN96C-6 switch also contains the grounding point which is located under a label.
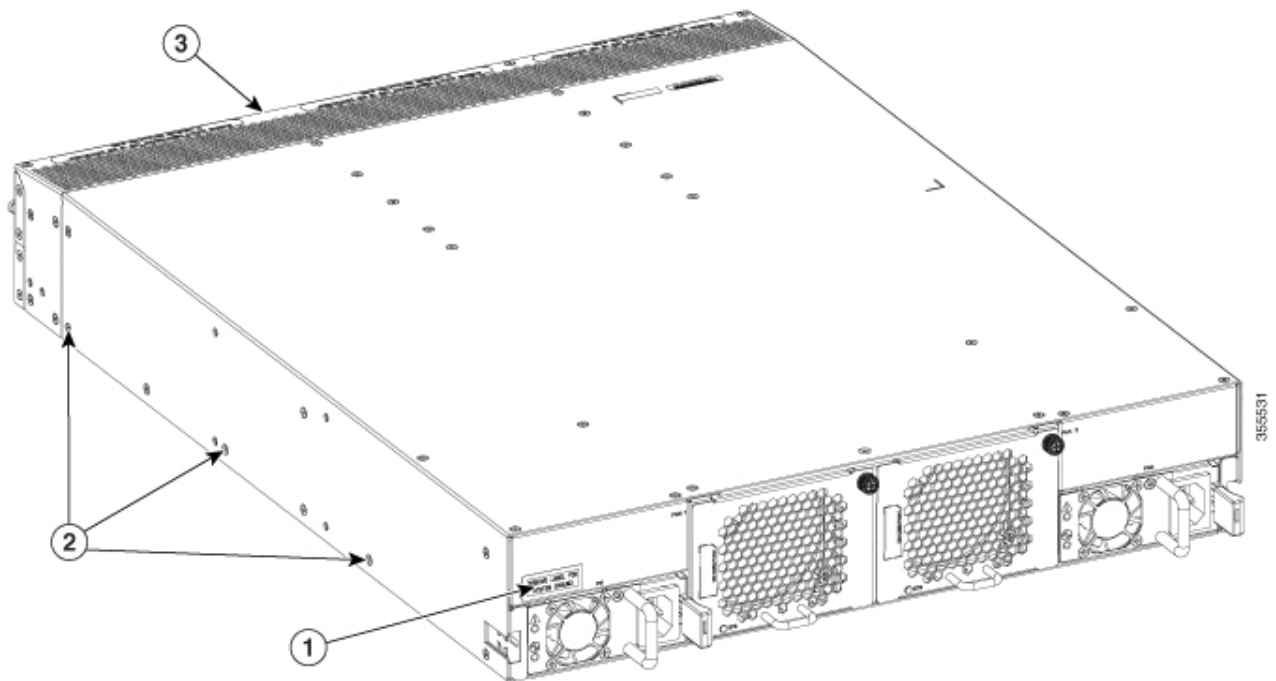
Figure 3. Grounding point

1	Grounding point	3	Port side of the switch

2	Rack mount holes		

Fan Modules

The SAN96C-6 Multilayer Fabric switch supports two hot-swappable fan modules that allow the switches to continue to run if a fan module is removed, provided that the preset temperature thresholds have not been exceeded. You can swap out a fan module without having to bring the system down. Each fan module on the SAN96C-6 switch has two fans.

The direction of the airflow through a fan module is denoted by colors on the module faceplate:
- Red—Port-side intake airflow (DS-C96S-FAN-I)
- Blue—Port-side exhaust airflow (DS-C96S-FAN-E)

If a chassis has two different fan modules, one supporting port-side exhaust airflow and the other supporting port-side intake airflow, the switch is immediately powered down.

Note:

To verify the current fan module on the switch, use the **show inventory fan** command.
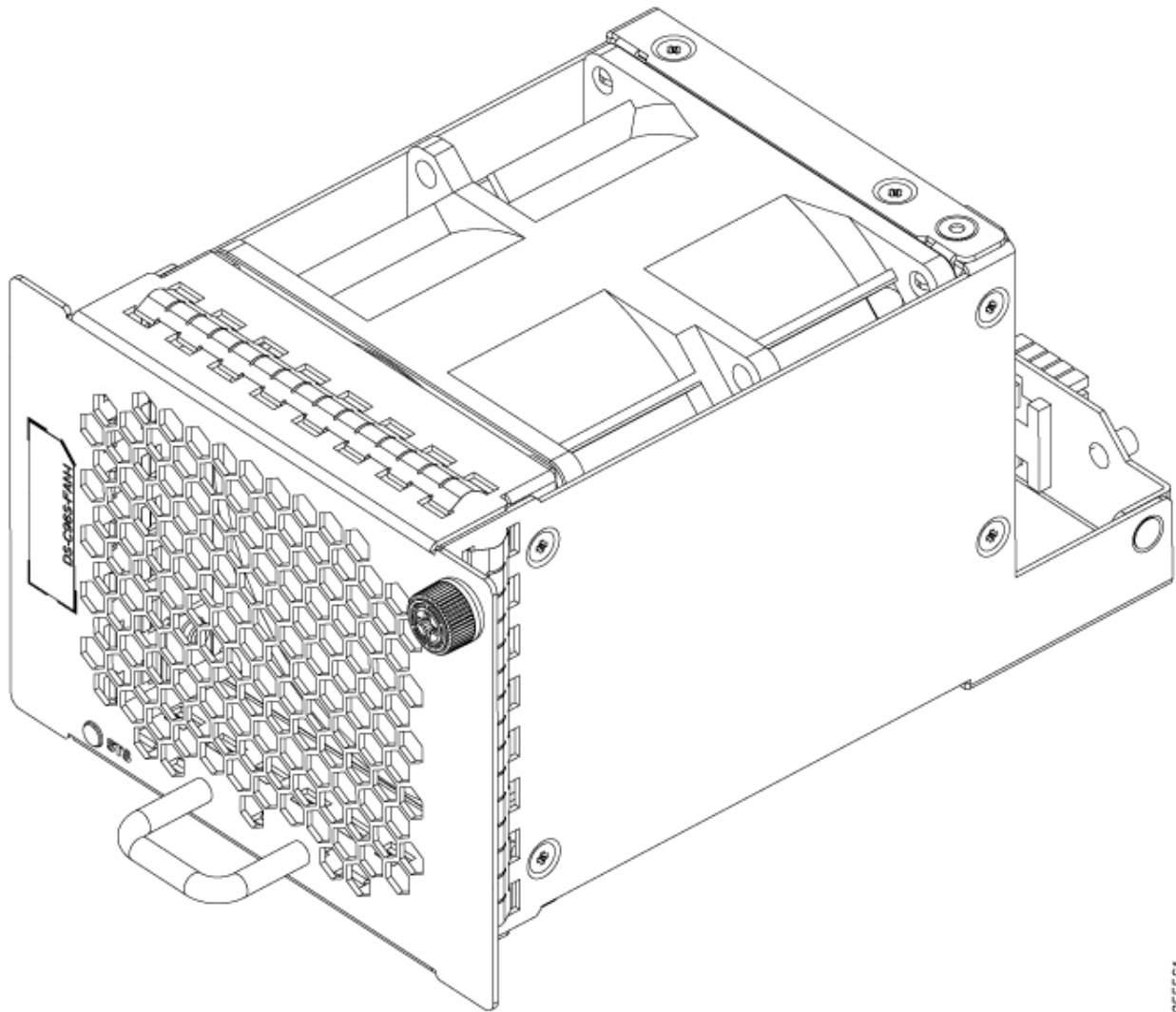
Figure 4. SAN96C-6 Fan Module

CAUTION:

The SAN96C-6 switch has internal temperature sensors that can shut down the system if the temperature at different points within the chassis exceeds certain safety thresholds. Temperature control within the chassis is dependent on airflow created by the fan modules; therefore, in the event a fan module is removed from the chassis, the SAN96C-6 switch will shut down after five minutes to prevent potentially undetectable overheating. However, the switch will shut down sooner if a higher-level temperature threshold is exceeded. For normal operation, the SAN96C-6 switch requires two fans. Fan module status is indicated on a front panel LED. To check temperature threshold values, use the show environment temperature command.

Procedures for replacing and installing the fan modules are available in the "Installing and Removing Components" on page 24 section.

Power Supplies

The IBM SAN96C-6 Multilayer Fabric switch supports two hot swappable AC/ HVAC/ HVDC Bidirectional airflow power supply units (PSUs). Each unit has a power receptacle and a status LED on the faceplate, and a handle for inserting and removing the unit from the chassis. The SAN96C-6 switch requires a minimum of 1 PSU for normal operation and 2 PSUs for normal operation with PSU redundancy. In the event of a PSU or AC supply (in grid redundant mode) failure, the system will continue to run. PSUs are hot swappable and can be individually replaced without shutting down the system. Procedures for installing and removing PSUs are detailed in the "Installing and Removing AC Power Supplies" on page 25 section.
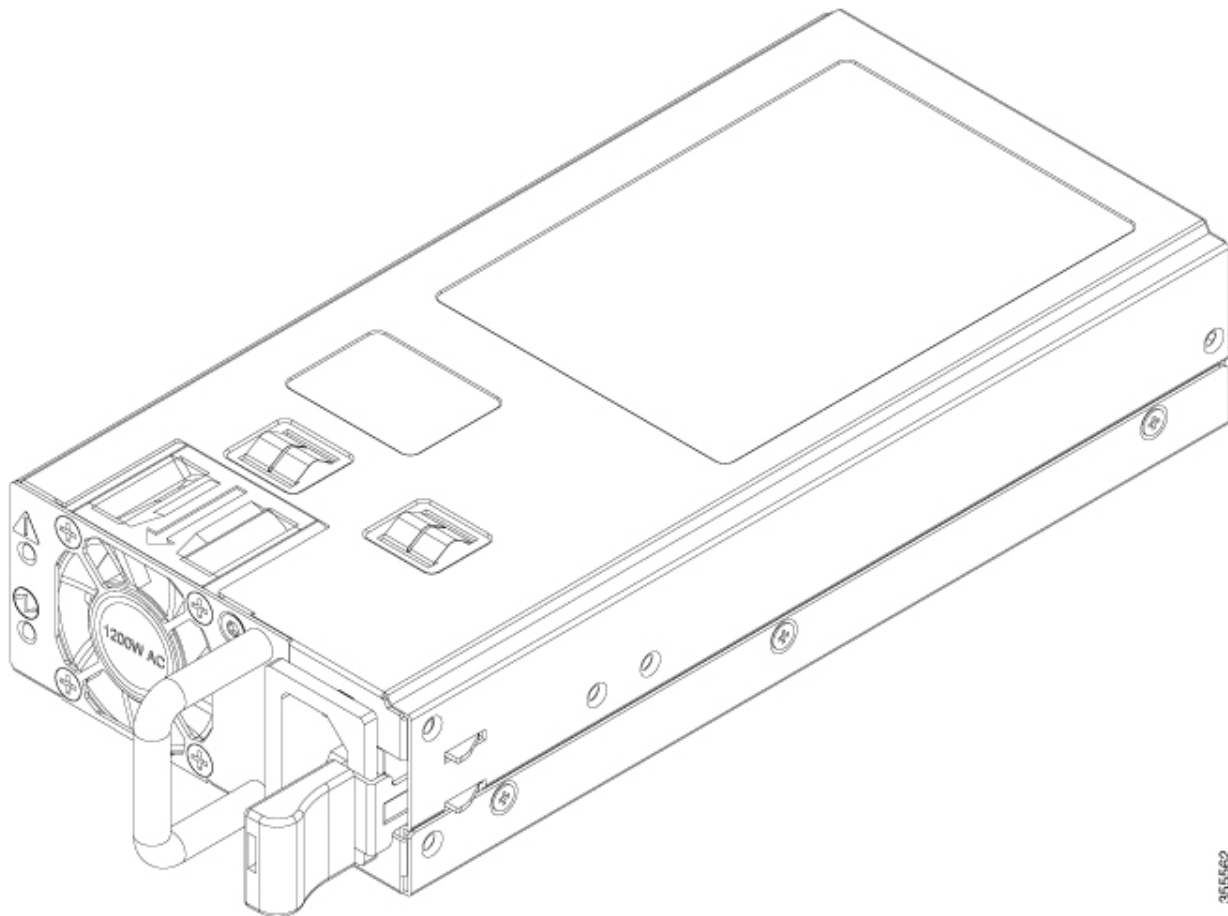
Figure 5. SAN96C-6 PSU

The PSUs support bidirectional airflow (DS-CAC-1200W), port-side exhaust airflow and port-side intake airflow, of fan modules. The PSUs automatically configure themselves to work in port-side exhaust airflow mode if the switch has Blue system fan modules installed. Similarly, the PSU automatically configures itself to work in port-side intake airflow mode if the switch has Red fan modules installed. For more information on the direction of airflow in fan modules, see the "Fan Modules" on page 4 section.

Switch LEDs

The following table describes the chassis activity LEDs for a SAN96C-6 switch:

Indicator	Location	Function	Color	Status	State
Power LED	Front panel of chassis	Chassis power/ Health	Off	Off	• The system is not receiving sufficient power from the PSUs. • The operating system is not running.
			Green	Solid On	Both PSUs are installed and operating
			Red	Solid On	Either of the following conditions exists: • A PSU has failed. • A PSU has been removed.
Status LED	Front panel of chassis	System Status	Green	Solid On	All diagnostics have passed, SAN96C-6 NX-OS is running and the system is operational.
			Orange	Solid On	Any of the following conditions exists: • The system is running bootup diagnostics. • The system is booting. • A minor temperature threshold is currently exceeded.
			Red	Blinking	Mismatched airflow direction observed in one of the following modules: • Fan modules—The switch will go down in 10-15 seconds. • PSUs—The switch will go down after 10 minutes. • Fan modules and PSUs—The switch will go down after 10 minutes.
				Solid On	One of the following conditions exists: • A diagnostic test failed or another fault occurred during bootup. • A major temperature threshold is currently exceeded.
Fan Status	On the front panel	Fan health	Green	Solid On	Fan is operating normally
			Red	Solid On	Fan failure

Indicator	Location	Function	Color	Status	State
Fan Status	Faceplate of each fan module	Fan tray health	Green	Solid on	Fan module is operating normally.
			Red	Solid on	The fan in the fan module has failed.
PSU Status	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	Solid on	One of the following conditions exists in the PSU: Over voltage Over current Over temperature Fan failure.
				Blinking	PSU has a fault, but is still operational.
				Off	PSU is operating normally.

The following table describes the Ethernet port LEDs for a SAN96C-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 SAN96C-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.

Linecard Expansion Module

The Linecard expansion module (LEM) is a pluggable expansion module for the SAN96C-6 Switch. The switch is shipped with three LEMs. Each 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.
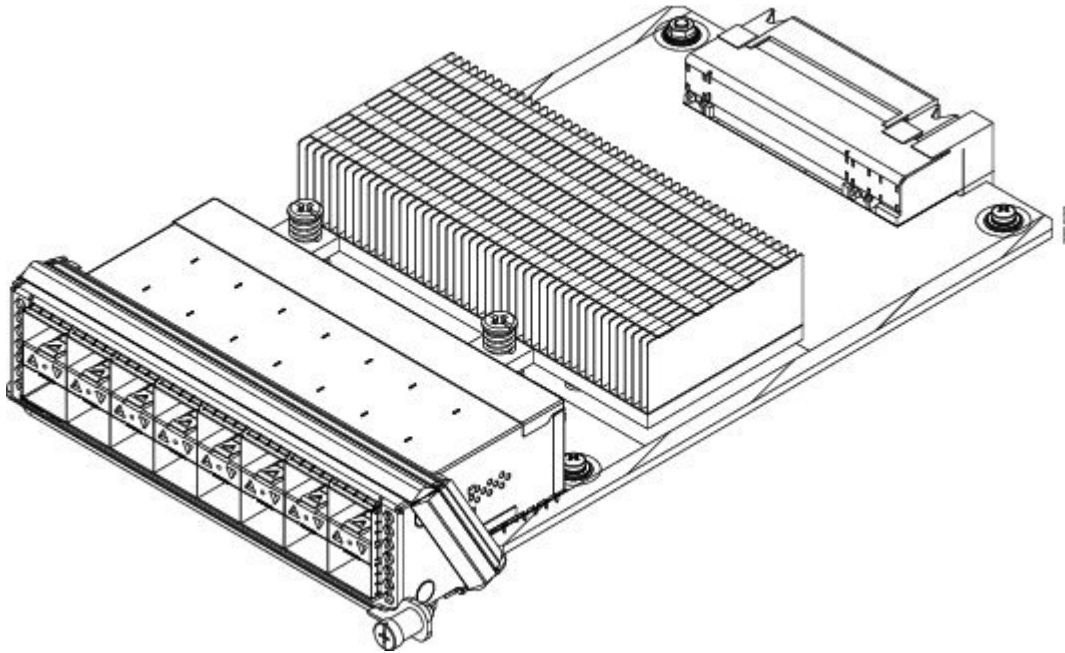
Figure 6. SAN96C-6 LEM

A LEM blank module must be installed if a LEM slot 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.

Note: If there is an empty LEM slot (with or without the blank module), then the LEM(s) present after this slot will not be detected.
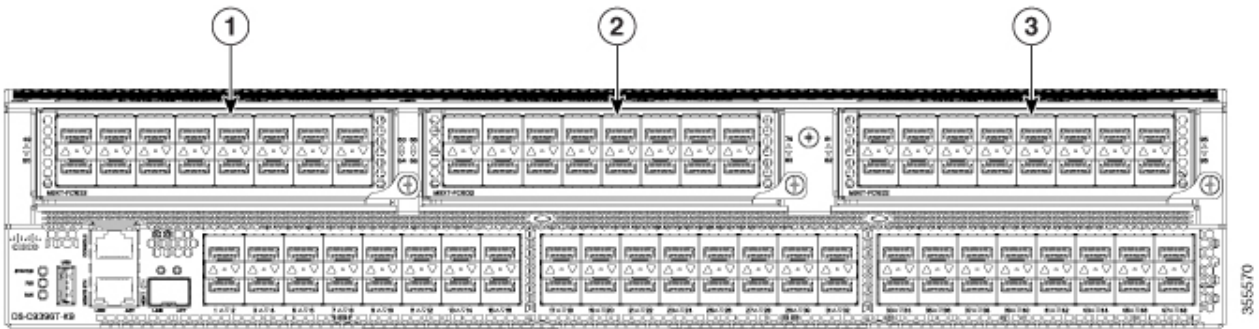
1	LEM 1	3	LEM 3
2	LEM 2		

Consider the following cases:
- If LEM 1 is absent, both LEM 2 and LEM 3 are not detected by the switch.
- If LEM 2 is absent, then only LEM 1 is detected by the switch. LEM 3 is ignored.
- If LEM 3 is absent, the switch detects both LEM 1 and LEM 2 because there are no LEMs after LEM 3.

A LEM should be removed only while replacing it with a new one in case of a fault condition. For more information on installing and removing the LEM, see "Installing and Removing the Linecard Expansion Module" on page 24.

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 Shortwave (SW) transceivers must be paired with SW transceivers on the peer device, and Longwave (LW) transceivers with LW transceivers on the peer device. Port path cabling must not exceed the stipulated total length or dB loss for reliable communications.

For a list of SFP+ transceivers supported on the SAN96C-6 Switch, see the "SFP Transceiver Specifications" on page 39 section. SFP+ transceivers can be ordered separately or with the SAN96C-6 Switch.

Note: Use only IBM provided transceivers on the SAN96C-6 switches. Each transceiver is encoded with model information that enables the switch to verify that the transceiver meets the requirements for the switch.

Cabinet and Rack Requirements

This section provides the IBM SAN c-type Family switches requirements for the following types of cabinets and racks in an external ambient air temperature range of 0 to 40°C:

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

Note: If you are selecting an enclosed cabinet, we recommend one of the thermally validated types listed above: standard perforated or solid-walled with a fan tray.

General Requirements for Cabinets and Racks

The cabinet or rack must be a 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 the Requirements Specific to Perforated Cabinets and Requirements Specific to Solid-Walled Cabinets sections.

The cabinet or rack must also meet the following requirements:

- The minimum vertical rack space per chassis should be 1 RU (rack unit), equal to 1.75 in. (4.4 cm).
- The width between the rack-mounting rails must be at least 17.75 in. (45.1 cm). This is the distance between the two front rails.
- For four-post EIA cabinets (perforated or solid-walled):
  - The distance between the front door and front mounting posts should be a minimum of 3 in. (7.6 cm) to allow for the bend radius of FC port fibre-optic patch cables.
  - The distance between the outside face of the front mounting rail and the outside face of the back mounting rail should be 23.5 to 34.0 in. (59.7 to 86.4 cm) to allow for installation with the Cisco rack mounting kit.
  - There should be a minimum of 2.5 in. (6.4 cm) of clear space between the side edge of the chassis and the side wall of the cabinet. No sizable flow obstructions should be immediately in the way of the chassis air intake or exhaust vents.
  - 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 a minimum of 3.0 in. (7.6 cm).
  - The airflow and cooling are adequate and there is sufficient clearance around the air vents on the switch, as described in Technical Specifications. This is particularly important to verify if you are installing the switch in an enclosed cabinet.
  - No clearance is required between the chassis and the sides of the rack or cabinet (no side airflow).
  - The rack meets the minimum rack load ratings per rack unit (RU) listed in the following table.

Rack Type	SAN96C-6
EIA (4-post)	7.5 lb

Note:
- SAN96C-6 switches are compatible with Cisco racks (such as Cisco R42612) and PDUs.
- Optional jumper power cords are available for use in a cabinet. See the Jumper Power Cord section.

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. 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 the SAN96C-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 Cabinet and Rack Requirements section, solid-walled cabinets must meet the following requirements:

- The rack must have 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 airflow of 849.5 m3/h exiting the cabinet roof through the fan tray, should be available.
- The front and rear doors, and side panels, must be installed and nonperforated so that air flows predicatably 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.
- The open area of the floor air intake must be a minimum of 150 sq. in. (968 sq. cm).
- The lowest piece of equipment should be installed at a minimum of 1.75 in. (4.4 cm) above the floor openings to prevent blocking the floor intake.

Installing the SAN96C-6 Switch

This chapter describes how to install the SAN96C-6 switch and its components.

Note: Before you install, operate, or service the system, see the Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family for important safety information.

warning: IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

warning: This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security. Statement 1017

warning: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

Preinstallation

Before installing the SAN96C-6 switch, be sure you understand and follow the guidelines outlined in this section.

Installing the ESD Grounding Strap

This section illustrates how to prepare yourself before removing the chassis from the sealed antistatic bag.

The figures show how to cuff the ESD strap around the wrist and the ground cord that connects the cuff to the ground. ESD wrist straps are the primary means of controlling static charge on personnel.

Note: These images are for only representation purposes. The chassis' actual appearance and size may vary.
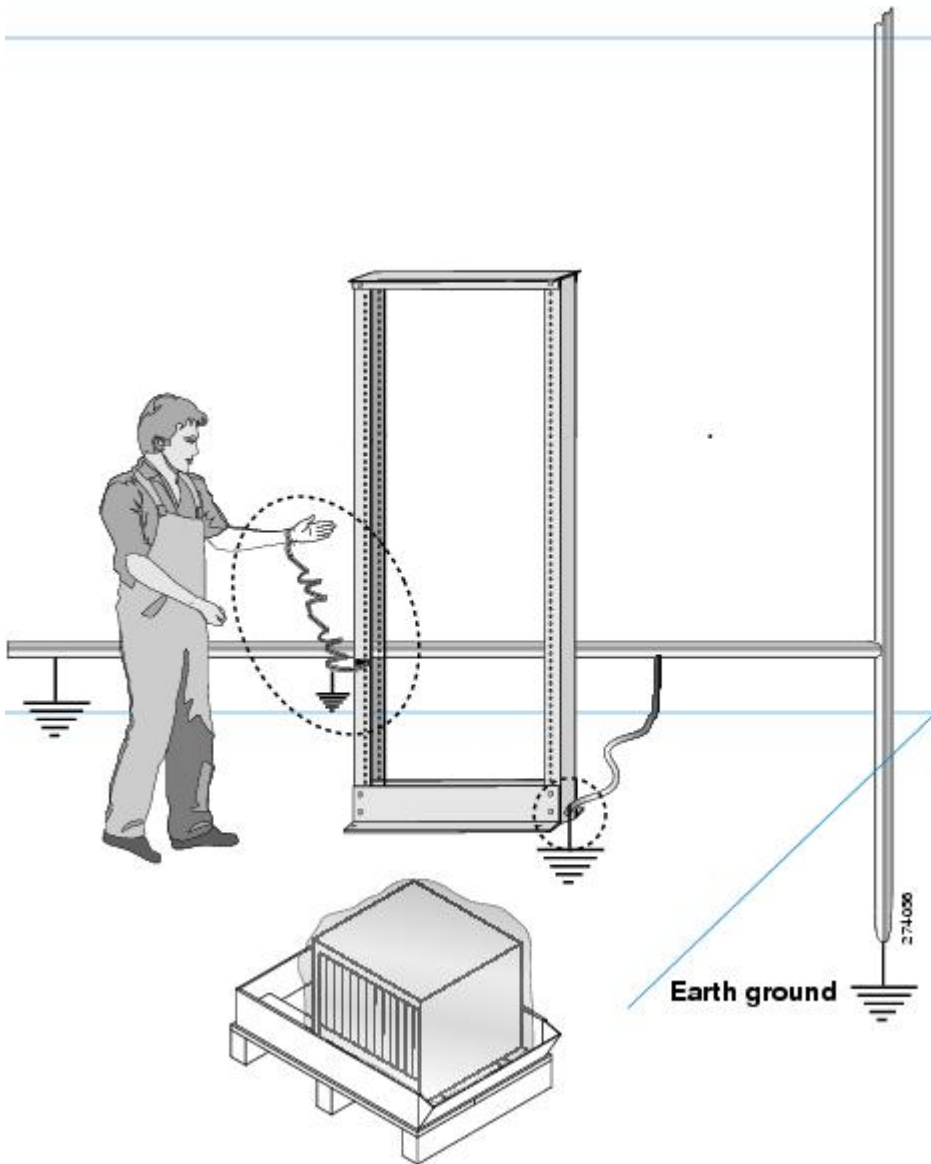
Figure 7. Wearing the ESD Strap
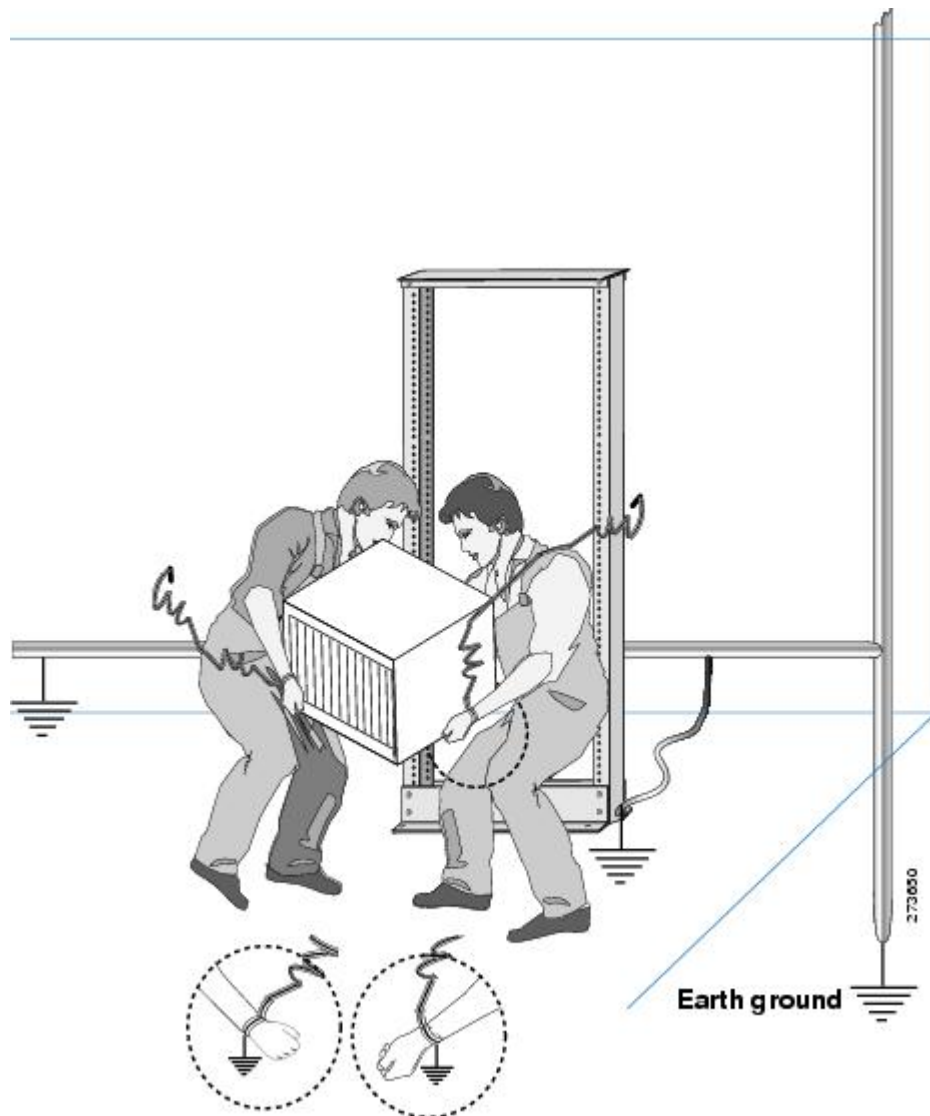
Figure 8. Handling the Chassis

Unpacking and Inspecting the Switch

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

Tip: Keep the shipping container in case the chassis requires shipping in the future.

Note: The switch is thoroughly inspected before shipment. If any damage occurred during transportation or any items are 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
- Preinstalled LEMs (3 units) with LEM screws tightened
- ESD wrist strap
- Cables and connectors
- Any optional items 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 if all the power supplies and the fan trays have the expected direction of airflow. Port-side-intake airflow modules have a burgundy coloring, and port-side exhaust airflow modules have blue coloring. The airflow direction must be the same for all modules.

Installation Options

The SAN96C-6 Switch can be installed using the following methods:
- In an open EIA rack.
- In a perforated or solid-walled 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 the port connections end of the chassis and 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 SAN c-Type Family Telco and EIA Shelf Bracket

The EIA Shelf Bracket Kit can temporarily or permanently support the SAN96C-6 switch during installation. Once the front rack-mount brackets are securely attached to the rack-mounting rails, the shelf bracket can be removed.

This kit supports a SAN96C-6 Switch in a four-post EIA rack

This section describes the procedure for installing a SAN96C-6 switch in a rack or cabinet using the 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.

CAUTION:
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 rack-mounting the chassis, ensure that the cabinet or rack meets the requirements listed in the Cabinet and Rack Requirements section

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	Slider 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 shelf brackets are level)

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.
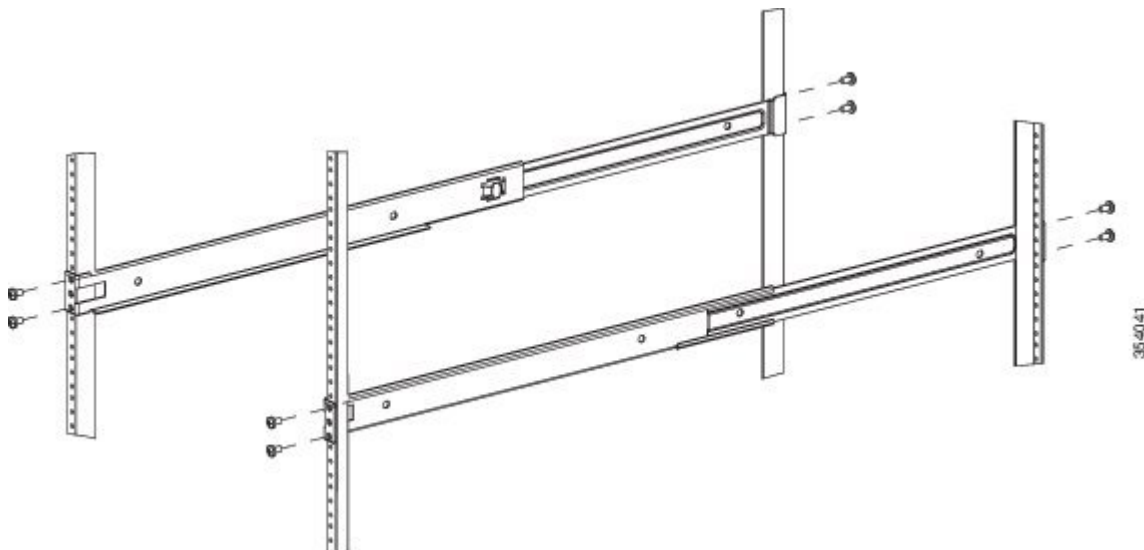
Figure 9. Installing the Shelf Bracket Kit into an EIA Rack

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

Procedure
1. Position a shelf bracket inside the rack-mounting rails as shown in the above figure. Align the screw holes at the front of the shelf bracket with the holes in the front rack-mounting rail. Then attach the shelf bracket to the front rack-mounting rail 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 of a rack unit on the rack-mounting rail (the hole immediately above the 1/2 in. spacing).
2. Repeat with the other shelf bracket.
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 the above figure, using the 10-32 screws.
5. Insert the slider rails into the shelf brackets as shown in the above figure. Attach them to the rear rack-mounting rails using a minimum of four 12-24 or 10-24 screws.

Installing the Switch on the Shelf Brackets:
About this task

This section provides general instructions for installing the switch on top of the shelf brackets.

Note: This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security. Statement 1017

Note: Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

Note: Before you install, operate, or service the system, refer to the *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 rails, 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 rails.
   CAUTION:
   We recommend grounding 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 the copper conductor must comply with National Electrical Code (NEC) for ampacity.

Removing the Shelf Bracket Kit (Optional):
About this task

The shelf bracket kit can be removed after the SAN96C-6 switch has been installed in a four-post EIA rack, and both front rack-mount brackets and both C brackets are securely attached to the rack-mounting rails.

To remove the shelf bracket kit, follow these steps:

Procedure
1. Remove the screws fastening the slider brackets to the rear rack-mounting rails, and then slide the slider brackets out of the shelf brackets.
2. Remove the screws fastening the crossbar to the shelf brackets, and then remove the crossbar.
3. Remove the screws fastening the shelf brackets to the front rack-mounting rails and remove the shelf brackets from the rack.

Preinstallation Guidelines

Airflow Considerations
The switch comes with fan modules and power supply units that have either port-side intake or port-side exhaust airflow for cooling the switch. If you are orienting the switch with the FC ports facing a cold aisle, make sure that the switch has a port-side intake fan and power supply modules with red colorings. If you are orienting the switch with the fan and power supply modules facing a cold aisle, make sure

that the switch has port-side exhaust fan and power supply units with blue colorings. All fan modules and power-supply modules must have the same direction of airflow.

Connection Guidelines for AC-Powered Systems

To connect to the SAN96C-6 switch AC power supply units to the site power source, follow these guidelines:

- For power redundancy, each power supply should be connected to a separate power feed (at a minimum, separate branch circuits).
- Circuits should be sized according to local and national codes.
- The AC power receptacles that are used to power 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 SAN96C-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.
- Each new switch requires a license; see the NX-OS Licensing Guide for instructions on installing a license.
- Ensure there is adequate space around the switch to allow for servicing the switch and for adequate airflow (airflow requirements are listed the Technical Specifications section).
- Ensure the air-conditioning meets the heat dissipation requirements listed the Technical Specifications section.
- Ensure the cabinet or rack meets the requirements listed in the Cabinet and Rack Installation section.
- Ensure that the cabinet or rack meets the requirements listed in the Cabinet and Rack Installation section.

Note: If the front cabinet mounting rails are not offset from the front door or bezel panel by a minimum of 3 inch (7.6 cm), and a minimum of 5 inch. (12.7 cm), respectively, and cable management brackets are installed on the front of the chassis, the chassis should be mounted rear-facing to ensure the minimum bend radius for fiber-optic cables.

Note: Jumper power cords are available for use in a cabinet. For more information, see the Jumper Power Cord section.

- Ensure the chassis is adequately grounded. If the switch is not mounted in a grounded rack, we recommend connecting both the system ground on the chassis and the power supply ground to an earth ground.
- Ensure the site power meets the power requirements listed in the Technical Specifications section. If available, you can use an uninterrupted 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 c-type Switch Family, which can have substantial current draw fluctuations because of fluctuating data traffic patterns.

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

  For North America, the 300 W power supplies require a 20 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 the total maximum loads on the circuits supplying power to the switch are within the electrical current ratings for circuit wiring and breakers.

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

- Use the following screw torques when installing the switch:
  - Captive screws: 4 in-lb (0.45 N•m)
  - M3 screws: 4 in-lb (0.45 N•m)
  - M4 screws: 12 in-lb (1.36 N•m)
  - M6 screws: 40 in-lb (4.5 N•m)
  - 10-32 screws: 20 in-lb (2.26 N•m)
  - 12-24 screws: 30 in-lb (3.39 N•m)

Installing the Switch

This section describes how to use the rack-mount kit to install the SAN96C-6 switch into a cabinet or rack that meets the requirements described in the "Cabinet and Rack Requirements" on page 11 section.

Attaching the Bottom-Support Rails on the Rack
Before you begin
- Verify that a four-post rack or cabinet is installed.
- If any other devices are stored in the rack or cabinet, verify that the heavier devices are installed below lighter devices and that there is at least 2 RU open to install the switch.
- Verify that the bottom-support rails kit is included in the switch accessory kit.
- Verify that you have 8 screws for attaching the bottom-support rails to the racks (typically M6 x 10 mm screws or the screws appropriate for the vertical mounting rails on the rack.

About this task

The switch chassis that you are installing ships with two adjustable bottom-support rails that you can attach to a four-post rack to hold the chassis. Each of these bottom-support rails has two pieces—one that slides into the other so that you can adjust them to fit racks with front and rear mounting posts that are spaced less than 36 inches (91 cm). On each bottom-support rail, the rail half that slides into the other rail includes a chassis stop that fits into the module end of the chassis. With the air intake on the port side of the chassis, you must position the bottom-support rail piece with the chassis stop on the hot aisle side of the rack.

Procedure
1. Look at the fan trays and power supplies installed in the chassis to determine how you must position the bottom-support rails on the rack.
    - If the modules have burgundy coloring (port-side-intake airflow), you must position the bottom-support rails so that their chassis stops are positioned in the hot aisle.
    - If the modules have blue coloring (port-side-exhaust airflow), you must position the bottom-support rails so that their chassis stops are positioned in the cold aisle.
2. Separate the two sliders that make up one bottom-support rail, and position the half with the chassis stop in the hot aisle of the rack. Make sure there is at least 2 RU open above the bottom-support rails so that you can easily install the chassis.
3. Use two customer-supplied screws (typically M6 x 10 mm screws) to attach the bottom-support rail half to the vertical mounting rails on the rack post. Tighten each screw to the appropriate torque setting for the screws (for M6 screws, use 40 in-lb [4.5 N•m] of torque).
4. Slide the other half of the bottom-support rail onto the attached half of the rail set and use two customer supplied screws (typically M6 x 10 mm screws) to secure that portion to the vertical mounting rails on the rack. Tighten each screw to the appropriate torque setting for the screws (for M6 x 10 mm screws, use 40 in-lb [4.5 N•m] of torque).
5. Repeat Steps 2 and 3 to attach the other expanding bottom-support rails to the other side of the rack.

6. Check the two installed bottom support rails to be sure that both rails are level and level with each other. If they are not level, adjust the higher rail down to the level of the lower rail.

What to do next

You are ready to install two front-mount brackets on the chassis.

Attaching the Front-Mount Brackets to the Chassis
Before you begin
- You need to attach a right-angled bracket to each side of the chassis. This bracket holds the chassis in place on a four post rack.
- You must have a Phillips-head torque screwdriver.

Procedure

1. Align the two holes in one side of one of two front-mount brackets to two holes on the left or right side of the chassis (see the following figure). Be sure that the other side of the bracket is facing towards the front (port end) of the chassis.
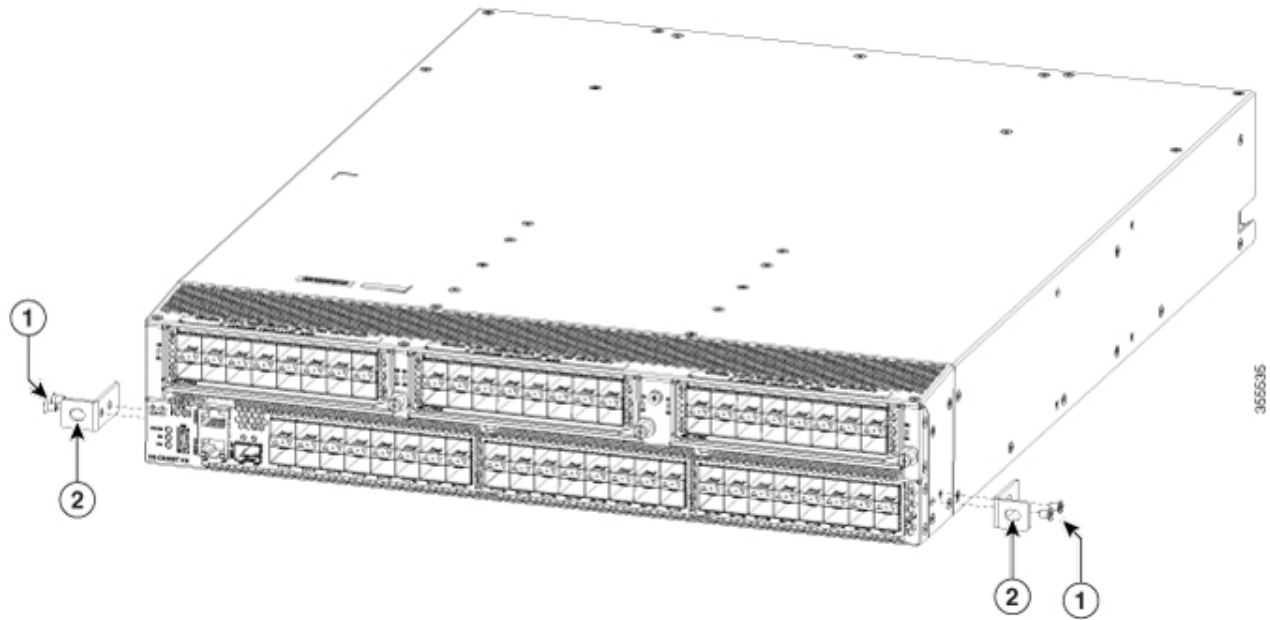
Figure 10. Aligning and Attaching Front-Mount Brackets to the Sides of the Chassis

1	Two M4 x 6 mm screws used to fasten the bracket to the chassis.	2	Front-mount bracket with two screw holes aligned to two screw holes in the chassis and one screw hole facing the port side of the chassis.

2. Use two M4 x 6 mm screws to attach the bracket to the chassis. Tighten each screw to 11 to 15 in-lb (1.2 to1.7 N•m).
3. Repeat Steps 1 and 2 to attach the second front-mount bracket to the other side of the chassis.

What to do next

You are ready to mount the chassis to the four-post rack.

Installing the Switch
Before you begin

* You need to slide the chassis onto the bottom-support rails so that the end with the fan trays and power supplies locks onto the chassis stops at the end of the rails and so that the front-mount brackets on the chassis come into contact with the front-mount rails on the rack.
* Make sure that the four-post rack is properly installed and secured to the concrete floor.
* Make sure that the bottom-support rails are installed so that the power supplies and fan trays will be in the appropriate aisle.
* The color of the stripe on fan trays and the color of the latch on power supplies determines which end of the switch must be positioned in the cold aisle as follows:
  – If the modules have burgundy coloring, position the port end of the chassis in the cold aisle.
  – If the modules have blue coloring, position the fan trays and power supply end of the chassis in the cold aisle.
* Make sure that two front-mount brackets are securely fastened to the sides of the chassis at the port end.
* Make sure that you have two customer-supplied rack-mount screws (M6 x 10 mm or appropriate screw for the vertical mounting rails on the rack).

Procedure

1. Slide the power supply and fan tray end of the chassis onto the bottom support rails that are installed on the rack. Be sure that the sides of the chassis by the fan trays and power supplies clips onto the chassis stops on the bottom support rails and the front mounting brackets come in contact with the rack (see the following figure).

   If the bottom support rails are extended a long distance, they can bend outwards slightly when you install the chassis and the chassis stops at the far end of the rails might not fit into the end of the chassis. If this happens, press the side rails toward the sides of the chassis so that the chassis stops can go inside the chassis and hold it in place on the rack.
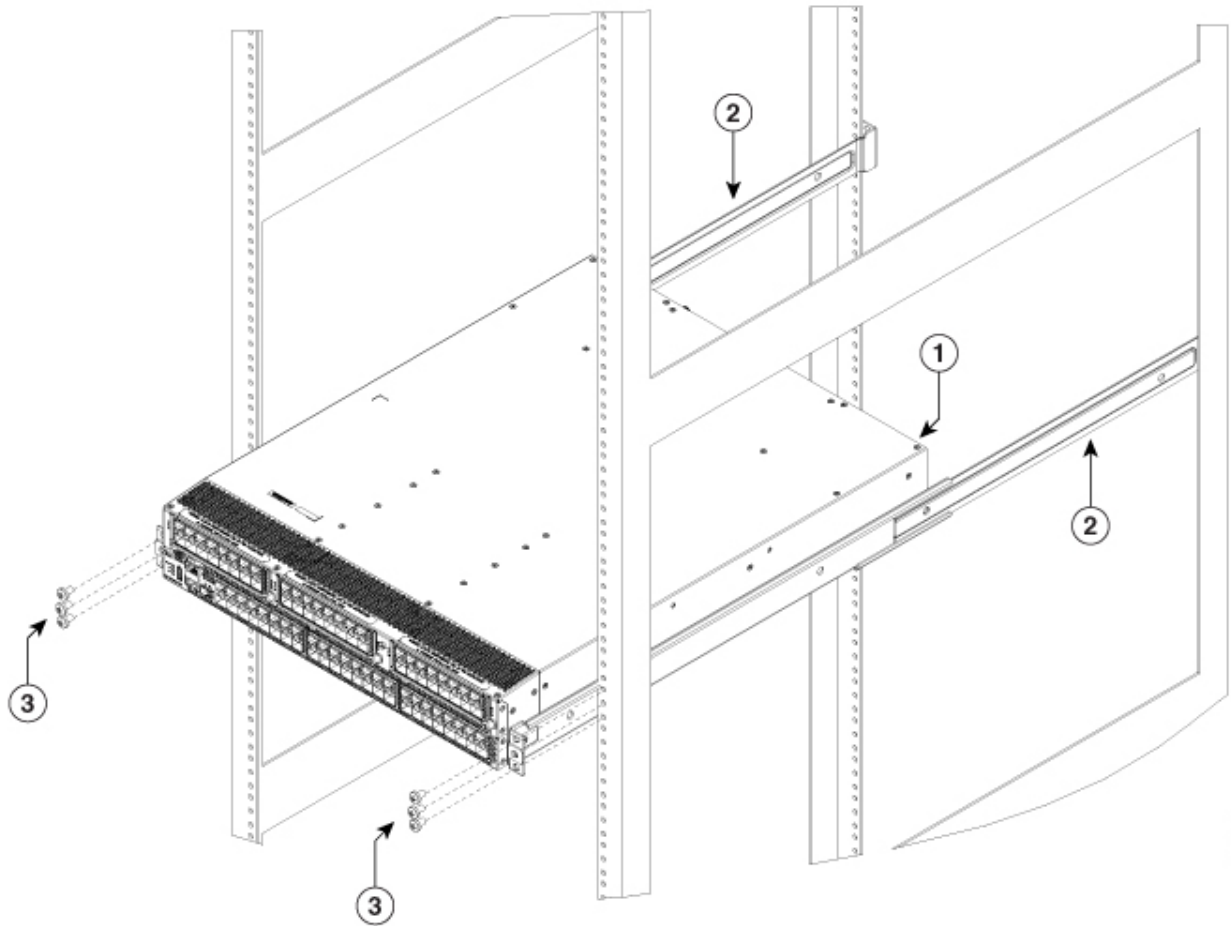
Figure 11. Sliding the Chassis onto the Bottom-Support Rails

1	Slide the fan-tray end of the chassis onto the bottom-support rails so that the chassis locks onto the chassis stops at the end of the rails.	3	Customer-supplied rack-mount screw (M6 x 10 mm screw or other appropriate screw) used to secure each side of the chassis to the rack.
2	Chassis stops for holding the chassis (installed by the hot aisle)		

2. Use a customer-supplied rack-mount screw (an M6 x 10 mm screw or other appropriate screw for the rack) to attach each of the two mounting brackets on the chassis to the rack and tighten each screw to the appropriate torque setting for the screw (for M6 x 10 mm screws, use 40 in-lb [4.5 N•m] of torque).

Grounding the Switch

Before you begin

- Before you can ground the chassis, you must have a connection to the earth ground for the data center building. If you installed the switch chassis into a bonded rack (see the rack manufacturer's instructions for more information) that now has a connection to the data center earth ground, you can ground the chassis by connecting its grounding pad to the rack. Otherwise, you must connect the chassis grounding pad directly to the data center ground.

- To connect the switch chassis to the data center ground, you need the following tools and equipment:
  - 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 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 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.

About this task

The switch is grounded when you connect the chassis and the power supplies to the earth ground in the following ways:

- You connect the chassis (at its grounding pad) to either the data center ground or to a fully bonded and grounded rack.

  Note: The chassis ground connection is active even when the AC power cables are not connected to the system.
- You connect an AC power supply to the earth ground automatically when you connect the power supply to an AC power source.

Procedure

1. Use a wire stripping tool to remove approximately 0.75 inch (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 for 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. Statement 1034
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 until the linecard expansion blank module is slightly ejected.
3. Remove the linecard expansion blank module.
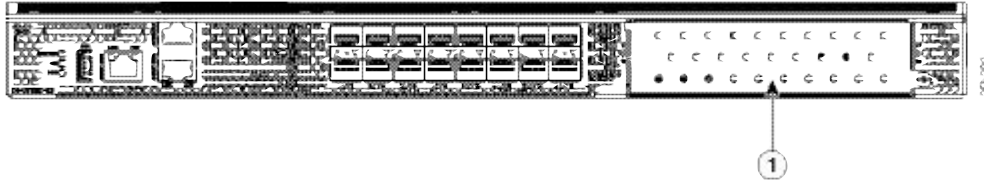
Figure 12. Inserted Linecard Expansion Blank Module

1	Linecard expansion blank module

About this task

To install a Linecard Expansion Module, do the following:

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 12 to ensure proper system cooling.

Installing and Removing AC Power Supplies

This section provides instructions for installing and removing the AC power supplies for the SAN96C-6 switch.

Installing Power Supplies
Before you begin

* HVAC/HVDC power supplies automatically use the same airflow direction as the installed fan modules. If the power supply that you are replacing has a different color handle than the replacement power supply, verify that it has or will have the same airflow direction as the other modules in the switch.
* To implement n+n redundancy, each PSU must be connected to a separate 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" on page 23.

About this task

To install a power supply, follow these steps:

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.
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" on page 7 section.

Removing Power Supplies
About this task

You can remove one faulty power supply, while the other one provides enough power to the switch.

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.

Installing and Removing Fan Modules

This section provides instructions for installing and removing the fan modules for the SAN96C-6 switch. You can replace one of the two 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

- 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. Slide the fan module into the fan module bay.
2. Tighten the fan module captive 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 SAN c-Type Family has internal temperature sensors that can shut down the system if the temperature at different points 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 the existing fan module, follow these steps:

Procedure

1. Locate the fan module in the back of the switch.
2. Loosen the fan module captive screw.
3. Grasp the fan module handle and pull it outward.
4. Once the fan blades have stopped spinning, remove the fan module completely from the fan bay.

Connecting the SAN96C-6 Switch

The SAN96C-6 switch provides the following types of ports:

- Console port—An RS-232 port that you can use to create a local management connection.
- MGMT 10/100/1000 Ethernet ports—Two Ethernet ports that you can use to access and manage the switch by IP address, such as through the CLI or Fabric Manager. One of the Ethernet ports can also be used to export analytic data.
- Fibre Channel ports—Fibre Channel ports that you can use to connect to the SAN, or for in-band management.
- USB port—USB port that you can use for configuration file backups, and capturing logs to file.

Preparing for Network Connections

When preparing your site for network connections to the SAN96C-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 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 SAN96C-6 switch.

Note:

The PC must support VT100 terminal emulation. The terminal emulation software—frequently a PC application such as HyperTerminal Plus—makes communication between the SAN96C-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. Connect the supplied RJ-45 to DB-9 female adapter or RJ-45 to DB-25 female adapter (depending on your PC connection) to the PC serial port.
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 RJ-45 to DB-9 (or RJ-45 to DB-25) adapter at the PC serial port.

Connecting a Modem to a Console Port

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.

Connecting before the switch is powered on
About this task

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 *Fabric Manager Fundamentals Configuration Guide* for instructions on how to change these settings.

Connecting after the switch is powered on
About this task

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

Procedure

1. Ensure that the system has completed booting and the system image is running.
2. Connect the supplied console cable (a rollover RJ-45 to RJ-45 cable) to the console port.
3. Connect the other end of the console cable to the supplied RJ-45 to DB-25 adapter.
4. Connect the RJ-45-to-DB-25 adapter to the DB-25 port on the modem.
5. Initialize and configure the modem as specified in the *Fabric Manager Fundamentals Configuration Guide* and the *NX-OS Fundamentals Configuration Guide*.

Connecting the Management Port

The autosensing 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 SAN96C-6 switch and data streaming to remote receivers.

Note: The MGMT ETH1 port is disabled in NX-OS Release 8.3(1).

Use a modular, RJ-45, straight-through UTP cable to connect the management ports to an external hub or switch. To connect to a router, use a crossover cable.

Connecting to a Fibre Channel Port

The Fibre Channel ports in the SAN96C-6 switch are compatible with 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 *Fabric Manager Fundamentals Configuration Guide* and the *NX-OS Fundamentals Configuration Guide*.

Each transceiver must match the transceiver on the other end of the cable, and the cable must not exceed the stipulated cable length for reliable communications. SFP+ transceivers can be ordered separately or with the SAN96C-6 switch.

Note: Class 1 laser product. Statement 1008

Note: Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

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 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 disconnecting cables before installing or removing SFP+ transceivers to prevent damage to the cable or transceiver.

Note: Use only IBM provided SFP+ transceivers on the SAN96C-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 SAN96C-6 switch supports SFP+ transceivers with the following two types of latching devices:
• Mylar tab latch
• Bale-clasp latch
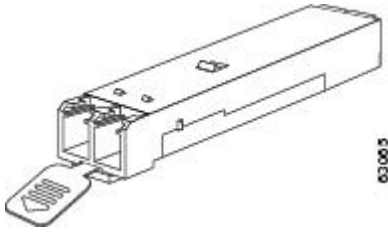
Figure 13. SFP+ Transceiver with Mylar Tab Latch
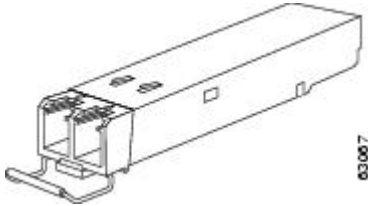
Figure 14. SFP+ Transceiver with Bale-Clasp Latch

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.
2. Remove the dust plug from the switch port cage.
3. Insert the transceiver into the port:
   - If the transceiver has a mylar tab latch, orient the transceiver with the tab on the bottom, and then gently insert the transceiver into the port until it clicks into place.
   - If the transceiver has a bale-clasp latch, orient the transceiver with the bale clasp on the bottom, close the bale clasp by pushing it up and over the transceiver, and then gently insert the transceiver into the port until it clicks into place.

   CAUTION:
   The transceiver can only be inserted one way into the switch port. If the transceiver does not install easily, ensure it is correctly oriented and the tab or clasp are in the correct position before continuing.
4. 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. Perform these steps if cable is installed in the transceiver:
   a. Record the cable and port connections for later reference.
   b. Press the release latch on the cable, grasp the connector near the connection point, and gently pull the connector from the transceiver.

c. Insert a dust plug into the connector on the cable.

d. Insert a dust plug into the cable end of the transceiver.

Tip: If the transceiver does not remove easily in the next step, push the transceiver all the way back in and then ensure that the latch is in the correct position before continuing.

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 port end of the transceiver and place the transceiver on an antistatic mat or into a static shielding bag if you plan to return it to the factory.

5. Protect the optical cage by inserting a clean cover if another transceiver is not being installed.

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 if there is no tension in the cable, or two inches 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 cover 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.
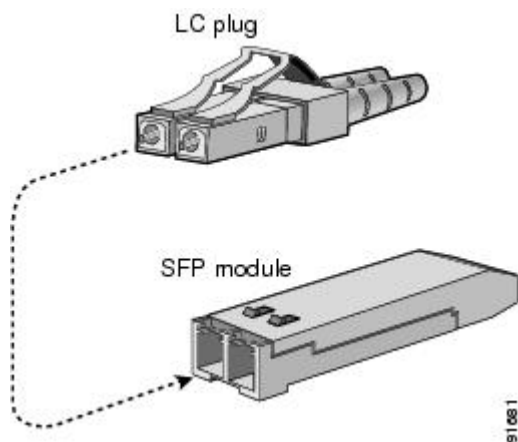
Figure 15. Connecting an LC-Type Cable to a Fibre Channel Port

> **CAUTION:**
> **The LC connector has keys to allow insertion only one way into the transceiver. If the cable does not install easily, ensure it is correctly oriented before continuing.**

For instructions on verifying connectivity, see the *Fabric Manager Fundamentals Configuration Guide* and the *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.

CAUTION:
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. Install a dust cover over the end of the cable.

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, and it 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 while handling transceivers.
- Do not remove and insert 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 them before using to prevent dust from scratching the fiber-optic cable ends.
- Do not touch ends of connectors. This prevents fingerprints and other contamination of the connectors.
- Clean regularly; the required frequency of cleaning depends upon the environment. In addition, clean connectors if they are exposed to dust or accidentally touched. Both wet and dry cleaning techniques can be effective; refer to your site's fibre-optic connection cleaning procedures.
- Inspect routinely for dust and damage. If damage is suspected, clean and then inspect fiber ends under a microscope to determine if damage has occurred.

Powering Up the Switch

Before you begin

You must have the following before powering up the switch:
- Switch installed in a rack and connected to an earth ground
- Recommended power cable for your nation or region

- AC power source with the required amperage located within reach of the power cable being used

About this task

To power up the switch, you must connect one or two power supplies to AC power sources. The number of power supplies and power sources used depends on the following conditions:

- If you are using combined power (not using power redundancy), you must connect one power supply to one AC power source.
- If you are using power supply (n+1) redundancy, you must connect two power supplies to one AC power source.
- If you are using grid (n+n) redundancy, you must use two power supplies and two AC power sources—you must connect each power supply to a different power source.

Procedure

1. Connect a power supply to an AC power source as follows:
   a. Using the recommended power cable for your country or region (see the Supported Power Cords and Plugs section), connect the C19 plug on the power cable to the power receptacle on the power supply.
   b. Connect the other end of the power cable to the AC power source.
   c. Verify that the LED is on and green. If the LED is off, check the AC power source circuit breaker to be sure that it is turned on.
2. If you are using the power supply (n+1) redundancy, you must connect the second power supply as follows:
   a. Using the recommended power cable for your country or region (see the Supported Power Cords and Plugs section), connect the C19 plug on the power cable to the power receptacle on the second power supply.
   b. Connect the other end of the power cable to the AC power source used by the other power supply.
   c. Verify that the LED is on and green. If the LED is off, check the AC power source circuit breaker to be sure that it is turned on.
3. If you are using the grid (n+n) redundancy, you must connect the second power supply as follows:
   a. Using the recommended power cable for your country or region (see the Supported Power Cords and Plugs section), connect the C19 plug on the power cable to the power receptacle on the second power supply.
   b. Connect the other end of the power cable to a second AC power source (this is a different power source than the one used by the first power supply).
   c. Verify that the LED is on and green. If the LED is off, check the AC power source circuit breaker to be sure that it is turned on.

Technical Specifications

This topic provides the specifications for the SAN96C-6 switch.

Switch Specifications

The following table lists the environmental specifications for the SAN96C-6 switch.

Table 2. Environmental Specifications for the SAN96C-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	5 to 95%
Altitude, operating	-197 to 6500 ft (-60 to 2000 m)
Noise levels	60 dB

The following table lists the physical specifications for the SAN96C-6 switch.

Table 3. SAN96C-6 Switch Specifications

Description	Specification
SAN96C-6 Switch Dimensions	HxWxD: 3.39 x 17.42 x 22.28 in. (8.61 x 44.25 x 56.59 cm)
Rack Unit (RU)	Chassis requires 2 RU (1.75 in. or 4.45 cm)
Weight	41.62 lb (18.88 kg)
Power Supply	1200W AC/ HVAC/ HVDC Bidirectional airflow (2 per switch) Part Number: DS-CAC-1200W AC input: 90V to 305V DC input: 192V to 400V 50 to 60 Hz (nominal)
Airflow	Back to front (toward ports) using port-side exhaust fans Front to back (into ports) using port-side intake fans 100 CFM (0.04 m3/s) nominal 240 CFM (0.11 m3/s) maximum Cisco recommends 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.

Power Specifications

General Power Supply Specifications

The following table lists the specifications for the SAN96C-6 switch AC power supply.

AC Input Power	Specification
AC input voltage	90V to 305V
Power consumption (typical)	246W for an idle 96-port switch with (1+1) PSU redundancy without optics modules 330W for a 96-port switch with 48 32G optics modules under typical conditions 555W for a 96-port switch with 96 32G optics modules under typical conditions
AC input frequency	Nominal = 50 to 60 Hz
Power supply output capacity	1200 W

Power Supply Requirements Specifications

The following table provides a sample calculation of power for the SAN96C-6 switch AC power supply.

Table 4. Power Dissipation for AC Power Supply

Power Mode	PSU	Traffic Rate	Temperature	Voltage	Optics Speed	Optics Number	LEM	Fan Trays	Power at 110V/60HZ (Watts)	Power at 220V/50HZ (Watts)
Typical	2	50%	25°C	Nominal	32G-SW	48	0	2	338	330
						96	3		570	555
Max	2	100%	25°C	Nominal	32G-SW	96	3	2	610	595
					32G-LW				627	618
					32G-SW				673	655
			55°C		32G-LW				798	756
				Nominal + 5%					858	806

Note: To prevent a loss of input power, ensure that the total maximum load on each circuit supplying the power supply is within the current ratings of the wiring and breakers.

Component Power Requirements and Heat Dissipation

Consider heat dissipation when sizing the air-conditioning requirements for an installation. The power

and heat associated with a SAN96C-6 32 Gbps 96-Port Fibre Channel (FC) Switch varies based upon the following considerations:

- The environment (temperature) outside the chassis
- Internal chassis temperature
- Any hardware component failure in the chassis
- Average switching traffic levels

The following table lists the power requirements and heat dissipation for the components of the SAN96C-6 32 Gbps 96-Port Fibre Channel Switch.

Table 5. Power Requirements and Heat Dissipation for the SAN96C-6 32 Gbps 96-Port FC Switch

Module Type/Product Number	Power Required (watts)	Heat Dissipation (BTU/hr)	Input Current		
			85VAC(amps)	110VAC(amps)	220VAC(amps)
SAN96C-6 32 Gbps 96-Port FC Switch	585 maximum	1996	6.89	5.33	2.67

Connection Guidelines for AC-Powered Systems

To connect to the SAN96C-6 switch AC power supply units to the site power source, follow these guidelines:

- For power redundancy, each power supply should be connected to a separate power feed (at a minimum, separate branch circuits).
- Circuits should be sized according to local and national codes.
- The AC power receptacles that are used to power 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.

SFP Transceiver Specifications

The SAN96C-6 switch is compatible with transceivers and cables that have LC connectors. Each transceiver must match the transceiver on the other end of the cable in terms of wavelength, and the cable must not exceed the stipulated cable length for reliable communications to take place.

IBM provided transceivers support 850 to 1610 nm nominal wavelengths, depending upon the transceiver.

Use only IBM provided transceivers on the SAN96C-6 switch. Each 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 transceivers, see the Release Notes.

For details about transceivers see the *IBM Storage Networking c-type family*.

For information about safety, regulatory, and standards compliance, see the *Regulatory Compliance and Safety Information*.

Fibre Channel SFP+ Transceivers

The following table lists the Fibre Channel SFP+ transceivers available for the SAN96C-6 switch.

Table 6. Fibre Channel SFP + Transceivers for the SAN96C-6 Switch

Feature Code	Description	Type
AJHE	32 Gbps Fibre Channel SW SFP+	Short wavelength
AJHF	32 Gbps Fibre Channel LW SFP+	Long wavelength
AJHB	16 Gbps Fibre Channel SW, SFP+	Short wavelength
AJHC	16 Gbps Fibre Channel LW, SFP+	Long wavelength
AJHM	8 Gbps Fibre Channel SW, SFP+	Short wavelength
AJHN	8 Gbps Fibre Channel LW, SFP+	Long wavelength

General Specifications for Fibre Channel 32 Gbps SFP+ Transceivers

The following table summarizes cabling specifications for 32 Gbps SFP+ transceivers.

Table 7. General Specifications for 32 Gbps Fibre Channel SFP+ Transceivers

SFP+	Wavelength (nm)	Fibre Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
AJHE	850	MMF	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)
AJHF	1310	SMF	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 8. 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

Table 8. Optical Parameters for 32 Gbps SFPs (continued)

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)			
AJHE	-6.2	2.0	-8.2	2.0	1.68 (8 Gbps) 1.63 (16 Gbps) 2.02 (32 Gbps)	2.04 (8 Gbps) 1.86 (16 Gbps) 1.86 (32 Gbps)	2.04 (8 Gbps) 1.95 (16 Gbps) 1.86 (32 Gbps)	2.04 (8 Gbps) 1.95 (16 Gbps) 1.86 (32 Gbps)
AJHF	-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 9. Operating and Storage Temperature Ranges for 32 Gbps SFPs

SFP+	Operating		Storage	
	Min	Max	Min	Max
AJHE	0°C	40°C	-40°C	70°C
AJHF	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 10. General Specifications for 16 Gbps Fibre Channel SFP+ Transceivers

SFP+	Wavelength (nm)	Fibre Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
AJHB	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)
AJHC	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 11. 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 11. Optical Parameters for 16 Gbps SFP+ Transceivers (continued)

SFP+	Average Transmit Power (dBm)		Average Receive Power (dBm)		Fiber-Loss Budget (dB)		
AJHB	-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)
AJHC	-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 12. Operating and Storage Temperature Ranges for 16 Gbps SFP+ Transceivers

SFP+	Operating		Storage	
	Min	Max	Min	Max
AJHB	0°C	40°C	-40°C	85°C
AJHC	0°C	40°C	-40°C	85°C

General Specifications for Fibre Channel 8 Gbps SFP+ Transceivers

The following table summarizes cabling specifications for 8 Gbps transceivers:

Table 13. General Specifications for 8 Gbps Fibre Channel SFP+ Transceivers

SFP+	Wavelength (nm)	Fibre Type	Core Size (microns)	Baud Rate (GBd)	Cable Distance
AJHM	850	MMF	62.5	2.125	150 m (492 ft)
			62.5	4.250	70 m (230 ft)
			62.5	8.500	21 m (69 ft)
			50.0 (OM2)	2.125	300 m (984 ft)
			50.0 (OM2)	4.250	150 m (492 ft)
			50.0 (OM2)	8.500	50 m (164 ft)
			50.0 (OM3)	2.125	500 m (1640 ft)
			50.0 (OM3)	4.250	380 m (1246 ft)
			50.0 (OM3)	8.500	150 m (492 ft)
			50.0 (OM4)	2.125	520 m (1706 ft)
			50.0 (OM4)	4.250	400 m (1312 ft)
			50.0 (OM4)	8.500	190 m (623 ft)
AJHN	1310	SMF	9.0	2.125	10 km (6.2 miles)
			9.0	4.250	10 km (6.2 miles)
			9.0	8.500	10 km (6.2 miles)

Power Requirements and Environmental Conditions for 8 Gbps SFP+ Transceivers

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

Table 14. 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])	
AJHM	-10 (2 Gbps) -9 (4 Gbps) -8.2 (8 Gbps)	-1.3	—	0	2.10 (2 Gbps) 1.78 (4 Gbps) 1.58 (8 Gbps)	2.08 (4 Gbps) 1.68 (8 Gbps) 1.63 (16 Gbps)	3.31 (2 Gbps) 2.88 (4 Gbps) 2.04 (8 Gbps)	
AJHN	-11.7 (2 Gbps) -8.4 (4 Gbps) -8.4 (8 Gbps)	-3 (2 Gbps) -1 (4 Gbps) 0.5 (8 Gbps)	—	-3 (2 Gbps) -1 (4 Gbps) 0.5 (8 Gbps)	—	-7.8 (2 Gbps) 7.8 (4 Gbps) 6.4 (8 Gbps)	—	—

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

Table 15. Operating and Storage Temperature Ranges for 8 Gbps SFP+ Transceivers

SFP+	Operating		Storage	
	Min	Max	Min	Max
AJHM	0°C	40°C	-40°C	85°C
AJHN	0°C	40°C	-40°C	85°C

Appendix A. Cable and Port Specifications

This appendix includes the cables and connectors used with the SAN96C-6 Multilayer Fabric Switch.

CAUTION:
We strongly recommend that power cable runs and other potential noise sources be located as far away as practical from network cabling that terminates on IBM equipment. In situations where long parallel cable runs exist but cannot be separated by at least 3.3 ft. (1 m), we recommend that you shield these potential noise sources. To avoid interference, the source should be shielded by housing it in a grounded metallic conduit.

Cables and Adapters

The SAN96C-6 Switch accessory kit includes the following:
* RJ-45 to RJ-45 rollover cable
* RJ-45 to DB-9 female DTE adapter (labeled "Terminal")
* RJ-45 to DB-25 female DTE adapter (labeled "Terminal")
* RJ-45 to DB-25 male DCE adapter (labeled "Modem")

Note: Additional cables and adapters can be ordered from your customer service representative.

Console Port

The console port is an asynchronous RS-232 serial port with an RJ-45 connector. You can use the RJ-45 to RJ-45 rollover cable and the RJ-45 to DB-9 female adapter or the RJ-45 to DB-25 female DTE adapter (depending on your computer serial port) to connect the console port to a computer running terminal emulation software.

Console Port Pinouts

The following table lists the pinouts for the console port on the SAN96C-6 Switch.

Table 16. Console Port Pinouts

Pin	Signal
1[1]	RTS
2	DTR
3	TxD
4	GND
5	GND
6	RxD
7	DSR
8	CTS

1. Pin 1 is connected internally to pin 8.

Connecting the Console Port to a Computer Using the DB-25 Adapter

You can use the RJ-45 to RJ-45 rollover cable and RJ-45 to DB-25 female DTE adapter (labeled "Terminal") to connect the console port to a computer running terminal emulation software. The following table lists the pinouts for the console port, the RJ-45 to RJ-45 rollover cable, and the RJ-45 to DB-25 female DTE adapter.

Table 17. Port Mode Signaling and Pinouts with DB-25 Adapter

Console Port	RJ-45 to RJ-45 Rollover Cable		RJ-45 to DB-25 Terminal Adapter	Console Device
Signal	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
RTS	1	8	5	CTS
DTR	2	7	6	DSR
TxD	3	6	3	RxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	TxD
DSR	7	2	20	DTR
CTS	8	1	4	RTS

Connecting the Console Port to a Computer Using the DB-9 Adapter

You can use the RJ-45 to RJ-45 rollover cable and RJ-45 to DB-9 female DTE adapter (labeled "Terminal") to connect the console port to a computer running terminal emulation software. The following table lists the pinouts for the console port, the RJ-45 to RJ-45 rollover cable, and the RJ-45 to DB-9 female DTE adapter.

Table 18. Port Mode Signaling and Pinouts with DB-9 Adapter

Console Port	RJ-45 to RJ-45 Rollover Cable		RJ-45 to DB-9 Terminal Adapter	Console Device
Signal	RJ-45 Pin	RJ-45 Pin	DB-9 Pin	Signal
RTS	1	8	8	CTS
DTR	2	7	6	DSR
TxD	3	6	2	RxD
GND	4	5	5	GND
GND	5	4	5	GND
RxD	6	3	3	TxD
DSR	7	2	4	DTR
CTS	8	1	7	RTS

MGMT 10/100/1000 Ethernet Port

Use a modular, RJ-45, straight-through UTP cable to connect the 10/100/1000 management Ethernet port to external hubs and switches. To connect to a router, use a crossover cable.
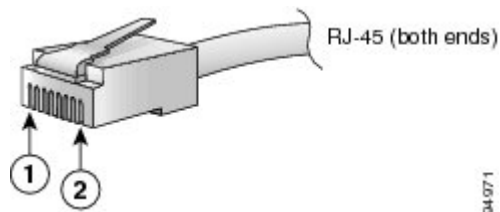
RJ-45 (both ends)

Figure 16. RJ-45 Interface Cable Connector

1	Pin 1	2	Pin 8

The following table lists the connector pinouts and signal names for a 10/100/1000BASE-T management port (MDI) cable.

Table 19. 10/100/1000BASE-T Management Port Cable Pinout

Pin	Signal
1	BI DA+
2	BI DA-
3	BI DB+
4	BI DC+
5	BI DC-
6	BI DB-
7	BI DD+
8	BI DD-

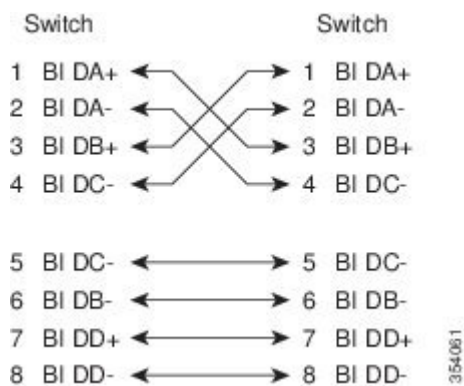The following figure shows a schematic of the 10/100/1000BASE-T cable.

Figure 17. Twisted-Pair 10/100/1000BASE-T Cable Schematic

The following table lists the connector pinouts and signal names for a 10/100BASE-T management port (MDI) cable.

Table 20. 10/100BASE-T Management Port Cable Pinout

Pin	Signal
1	TD+
2	TD-

Table 20. 10/100BASE-T Management Port Cable Pinout (continued)

Pin	Signal
3	RD+
4	RD-
5	Not used
6	Not used
7	Not used
8	Not used

The following figure shows a schematic of the 10/100BASE-T cable.
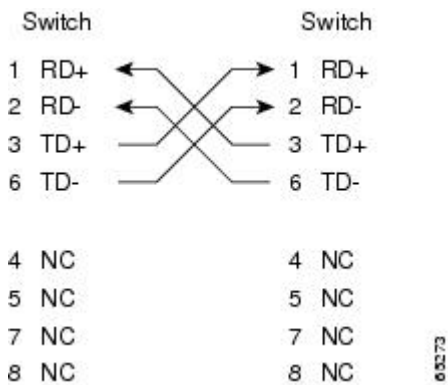

Figure 18. Twisted-Pair 10/100BASE-T Cable Schematic

Supported Power Cords and Plugs

Each switch power supply unit requires one power cord. Approved cords can be ordered with the product. Standard power cords with a country specific plug can be used with wall outlets. Jumper power cords can be used with cabinet outlets. The user may also source their own power cords for the product, as long as they meet the power cord specifications for this product.

Notes:
- Only standard power cords and jumper power cords provided with the switch are supported.
- If you do not order a power cord with the system, you are responsible for selecting the appropriate power cord for the product. Using a non-compatible power cord with this product may result in electrical safety hazard. Orders delivered to Argentina, Brazil, and Japan must have the appropriate power cord ordered with the system.

Standard Power Cords

Standard power cords for the SAN96C-6 switch have an IEC C15 connector on the outlet end of the cord and a country specific plug on the inlet end of the cord. To see the list of supported standard power cords, see the IBM Storage Networking c-type family.

Jumper Power Cords

Jumper power cords have an IEC C15 connector on the outlet end of the cord and an IEC C14 connector on the inlet end of the cord. This cord is compatible with IEC C13 outlet receptacles. This type of outlet receptacle is commonly used for power distribution inside cabinets.

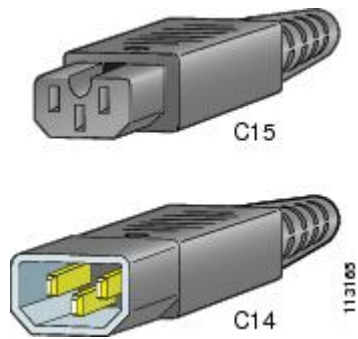The following figure lists the available plug types and cord descriptions.

Figure 19. Description of Jumper Power Cords for SAN96C-6 Switch

Appendix B. Site Planning and Maintenance Records

This section includes a site planning checklist and maintenance records to use when installing the SAN96C-6 Multilayer Fabric Switch.

Note: For information about how to query the switch for configuration information, see the *NX-OS Fundamentals Configuration Guide*.

Site Preparation Checklist

Planning the location and layout of your equipment rack or wiring closet is essential for successful switch operation, ventilation, and accessibility. The following table lists the site planning tasks that we recommend completing before installing the SAN96C-6 Switch.

Consider heat dissipation when sizing the air-conditioning requirements for an installation.

Table 21. Site Planning Checklist

Task No.	Planning Activity	Verified By	Time	Date
1	Space evaluation: • Space and layout • Floor covering • Impact and vibration • Lighting • Maintenance access			
2	Environmental evaluation: • Ambient temperature • Humidity • Altitude • Atmospheric contamination • Air flow			
3	Power Evaluation: • Input power type • Power receptacles[1] • Receptacle proximity to the equipment • Dedicated circuit for power supply • Dedicated (separate) circuits for redundant power supplies • UPS[2] for power failures			
4	Grounding evaluation: • Circuit breaker size • CO ground (AC- powered systems)			

Table 21. Site Planning Checklist (continued)

Task No.	Planning Activity	Verified By	Time	Date
5	Cable and interface equipment evaluation: • Cable type • Connector type • Cable distance limitations • Interface equipment (transceivers)			
6	Electromagnetic interference (EMI) evaluation: • Distance limitations for signaling • Site wiring • RFI[3] levels			

1. Verify that the power supply installed in the chassis has a dedicated AC source circuit.

2. UPS = uninterruptible power supply.

3. RFI = radio frequency interference.

Contact and Site Information

Use the following worksheet to record contact and site information.

Table 22. Contact and Site Information

Contact person	
Contact phone	
Contact E-Mail	
Building/site name	
Data center location	
Floor location	
Address (line 1)	
Address (line 2)	
City	
State	
Zip code	
Country	

Chassis and Network Information

Use the following worksheets to record chassis and network information.

Contract Number :

Chassis Serial Number:

Product Number:

Switch IP address	
Switch IP netmask	
Host name	
Domain name	
IP broadcast address	
Gateway/router address	
DNS address	
Modem telephone number	

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European community contact:

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IBM-Allee 1, 71139 Ehningen, Germany
Tele: +49 (0) 800 225 5423 or +49 (0) 180 331 3233
Email: halloibm@de.ibm.com

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Tel: +49 800 225 5426
e-mail: halloibm@de.ibm.com

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3F, No 7, Song Ren Rd., Taipei Taiwan
Tel: 0800-016-888
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台灣國際商業機器股份有限公司
台北市松仁路7號3樓
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• 換算係数：０

Korean Communications Commission Class A Statement

This explains the Korean Communications Commission (KCC) statement.

이 기기는 업무용(A급)으로 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Russia Electromagnetic Interference Class A Statement

This statement explains the Russia Electromagnetic Interference (EMI) statement.

ВНИМАНИЕ! Настоящее изделие относится к классу А. В жилых помещениях оно может создавать радиопомехи, для снижения которых необходимы дополнительные меры

rusemi

Index

Numerics

A

C

D

E

F

G

H

I

L

N

P

R

S

T

W

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