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EX4600 Switch Hardware Guide

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EX4600 Switch Hardware Guide

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

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About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the EX4600 switch. After completing the installation and basic configuration procedures covered in this guide, refer to the Junos OS documentation for information about further software configuration.

RELATED DOCUMENTATION

- EX4600 Quick Start

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CHAPTER

Fast Track: Initial Installation

IN THIS CHAPTER

Fast Track to Rack Installation and Power

SUMMARY

This procedure guides you through the simplest steps for the most common installation to get your EX4600 switch in a rack and connect it to power. Have more complex installation needs? See Installing and Connecting an EX4600 Switch.

IN THIS SECTION

Install the EX4600 in a Rack

You can mount the EX4600 switch on a four post 19-in. rack or cabinet using the mounting kit provided with the device. We'll walk you through the steps to install an AC-powered switch in a four-post rack.

Before you install, review the following:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See Prevention of Electrostatic Discharge Damage.
2. Verify that the site meets the requirements described in Site Preparation Checklist for an EX4600 Switch.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read General Site Guidelines, with particular attention to Chassis Lifting Guidelines for an EX4600 Switch.
5. Remove the switch from the shipping carton (see Unpacking an EX4600 Switch).
6. Ensure that you have the following parts and tools available to mount the switch in a rack:
    - ESD grounding strap (not provided).
    - Blades, rails, or brackets (provided).
        - For four-post installations:
            - One pair of rear mounting blades. These mounting blades support the rear of the chassis and must be installed (provided).

  - One pair of front mounting rails. The mounting blades slide into the mounting rails to support the switch (provided).
  - Twelve screws to secure the mounting rails to the chassis (provided).
  - Eight screws to secure the chassis and rear installation blades to the rack (not provided).
- Appropriate screwdriver for the mounting screws (not provided).
- Two power cords with plugs appropriate to your geographical location (provided).
- RJ-45 cable and RJ-45 to DB-9 serial port adapter (not provided).

  NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

  - RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
  - RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
  - RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

  If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.
- Management host, such as a PC laptop, with a serial port (not provided).

Optional equipment: Grounding cable kit with bracket, lug, and three nuts with integrated washers.

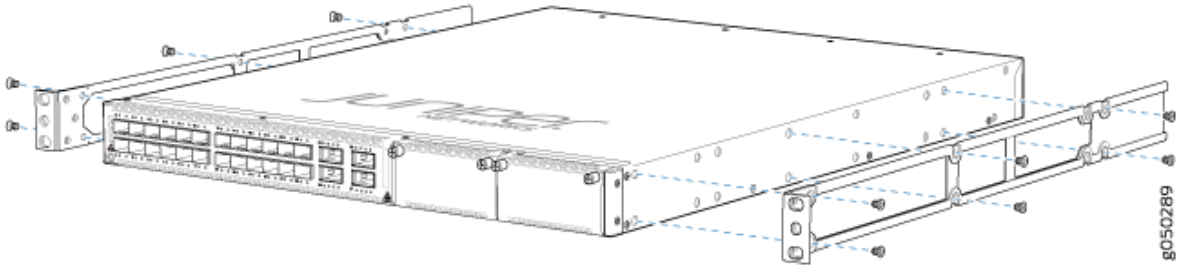
WARNING: The EX4600 switch must be supported at all four corners. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.

CAUTION: The EX4600 require two people for installation. If you are installing the EX4600 switch above 60 in. (152.4 cm) from the floor, you can remove the power supplies and fan modules to minimize the weight before attempting to install the switch.

> ⚠ **CAUTION**: If you are mounting multiple switches on a rack, mount the switch in the lowest position of the rack first. Proceed to mount the rest of the switches from the bottom to the top of the rack to minimize the risk of the rack toppling.

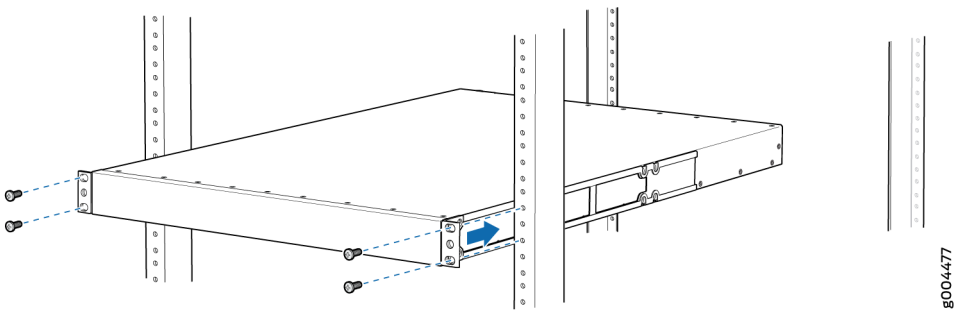
1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.
2. Decide whether the Field Replaceable Unit (FRU) end of the switch or the port end is to be placed at the front of the rack. Position the switch in such a manner that the **AIR IN** labels on components are next to the cold aisle and **AIR OUT** labels on components are next to the hot aisle.
3. Align the holes in the mounting rail with the holes on the side of the chassis. See Figure 1 on page 4 to see the proper alignment for the EX4600 switch.

Figure 1: Attaching Mounting Rails to the EX4600



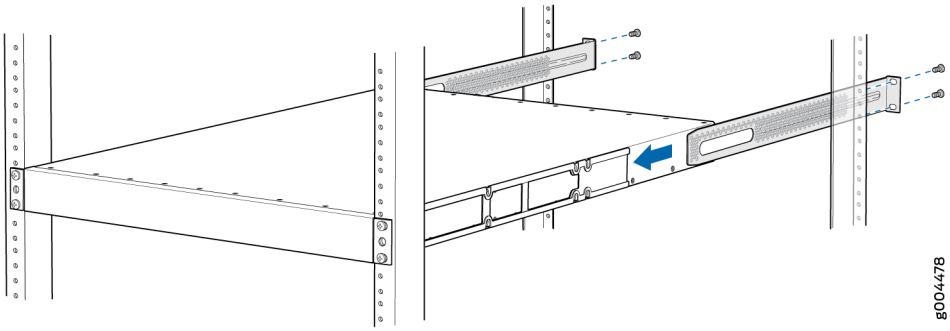
4. Attach the mounting rail to the switch using the mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.
5. Repeats steps 4 and 5 on the opposite side of the switch.
6. Have one person grasp both sides of the switch, lift it, and position it in the rack so that the front bracket is aligned with the rack holes.
7. Have a second person secure the front of the switch to the rack using four mounting screws (and cage nuts and washers if your rack requires them.) Tighten the screws. See Figure 2 on page 5 for examples of connecting the mounting rails and blades.

Figure 2: Attach EX4600 Switch to Rack



8. Continue to support the switch while sliding the rear mounting-blades into the channel of the side mounting-rails and securing the blades to the rack. Use the four mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. Tighten the screws. See Figure 3 on page 5.

Figure 3: Slide Mounting Blade into EX4600 Mounting Rail



9. Ensure that the switch chassis is level by verifying that all the screws on the front of the rack are aligned with the screws at the back of the rack.

Connect to Power

IN THIS SECTION

Connect the Power Cord and Power On the Switch | 6

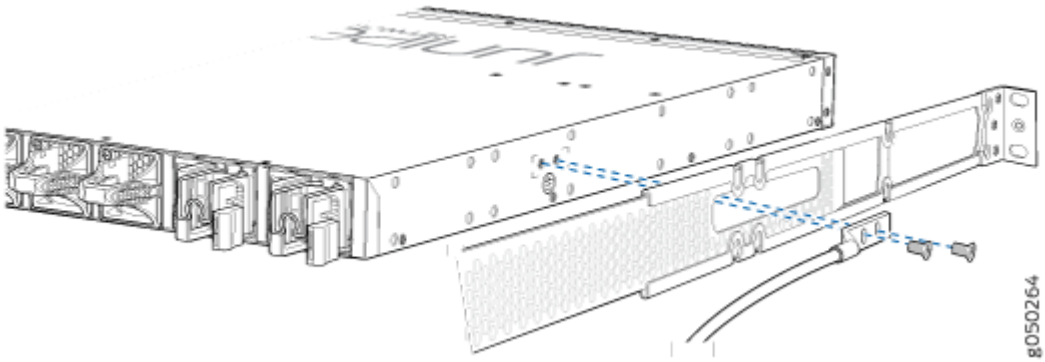
To connect the EX4600 switch to AC power, you must do the following:

Ground the EX4600 Switch

To ground the EX4600 switch, do the following:

1. Attach one end of the grounding cable to an appropriate earth ground site, such as the mounting rack.
2. Position the grounding lug over the protective earthing terminal on the side of the chassis, which is visible through the mounting bracket.
3. Secure the grounding lug to the protective earthing terminal with the washers and screws. See Figure 4 on page 6.

Figure 4: Connecting a Grounding Cable to an EX4600 Switch



4. Dress the grounding cable and ensure that it does not touch or block access to other device components and that it does not drape where people could trip over it.

Connect the Power Cord and Power On the Switch

For information about the supported AC power cord specifications, see AC Power Cord Specifications for an EX4600 Switch.

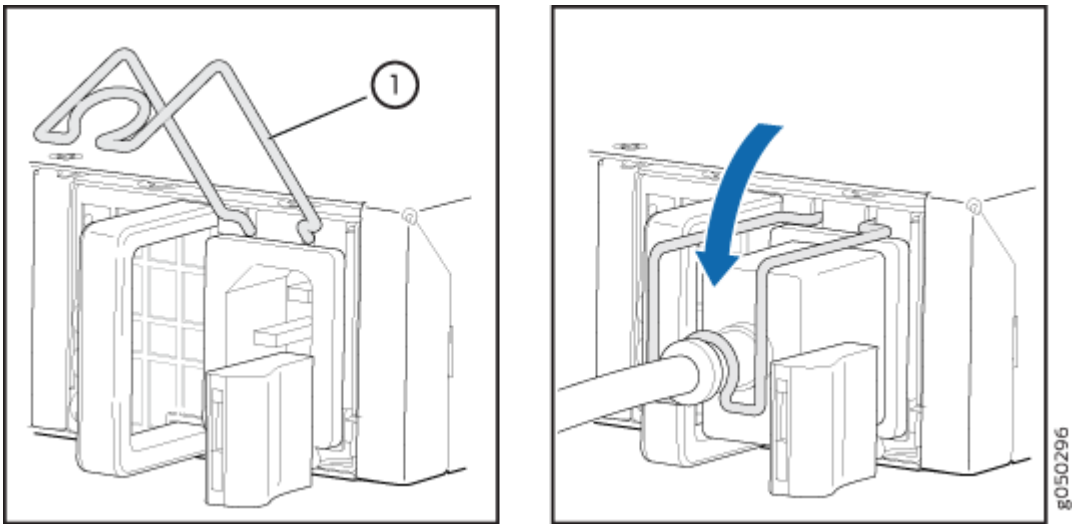
To connect the power cord, do the following:

1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure. If only one power supply is installed, ensure a that blank cover panel is installed over the second power supply slot.
3. Locate the power cord or cords shipped with the switch; the cords have plugs appropriate for your geographical location. See AC Power Cord Specifications for an EX4600 Switch.

> **WARNING**: Ensure that the power cord does not block access to device components or drape where people can trip on it.

4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate.
5. Push the power cord retainer onto the power cord (see Figure 5 on page 7).

Figure 5: Connecting an AC Power Cord to an AC Power Supply in an EX4600 Switch



6. If the AC power source outlet has a power switch, set it to the OFF (O) position.

> **NOTE**: The switch powers on as soon as power is provided to the power supply. There is no power switch on the device.

7. Insert the power cord plug into an AC power source outlet.
8. If the AC power source outlet has a power switch, set it to the ON (|) position.

9. Verify that the AC and DC LEDs on each power supply are lit green.

10. If the amber fault LED is lit, remove power from the power supply, and replace the power supply (see Removing a Power Supply from an EX4600 Switch). Do not remove the power supply until you have a replacement power supply ready: the power supplies or a blank cover panel must be installed in the switch to ensure proper airflow.

> ⚠ **CAUTION**: Replace a failed power supply with a blank panel or new power supply within 1 minute of removal to prevent chassis overheating.

Claim, Onboard, and Configure EX4600

SUMMARY

This topic provides you the pointers to onboard and configure EX4600 switches using Mist, or configure EX4600 switches using Junos CLI.

EX4600 switch is a cloud-ready switch, and you can manage this switch using Mist AI cloud portal. If you have a Mist Wired Assurance license, you can follow a few simple steps to get an EX4600 up and running in the Juniper Mist AI cloud portal. See Table 1 on page 8 for more information.

Table 1: Onboard and Configure EX4600 Using Mist

If you want to	Then
Claim and Onboard to Mist	See Cloud-Ready EX and QFX Switches with Mist
Configure Wired Assurance	See Juniper Mist Wired Configuration Guide
See all documentation available for Wired Assurance	Visit Wired Assurance Documentation

If you do not have a Mist Wired Assurance license, you can configure EX4600 using Junos CLI. See Table 2 on page 9 for more information.

Table 2: Configure EX4600 Using Junos CLI

If you want to	Then
Customize basic configuration	See Configuring Junos OS on the EX4600
Explore the software features supported on EX4600	See Feature Explorer
Configure Junos features on EX4600	See User Guides

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CHAPTER

Overview

IN THIS CHAPTER

EX4600 System Overview

IN THIS SECTION

EX4600 Switch Hardware Overview

IN THIS SECTION

The Juniper Networks EX4600 Ethernet switch is a highly versatile, second generation solution for campus environments. The EX4600 can be deployed in these environments:

- Campus distribution switches
- Small campus core switches
- As top-of-rack switches in small, low -density data centers
- As data center distribution switches in small, low-density data centers

In addition to operating as a standalone switch, the EX4600 switch can act as a member switch in a non-mixed *Virtual Chassis* (VC), which is composed entirely of EX4600 switches. The switch can also participate as a member switch in a mixed VC with EX4300 switches.. It enables the switch to provide a flexible configuration of high-performance 10-Gigabit and 40-Gigabit ports that can add higher port densities, additional scalability, and improved latency to the EX Series of switches.

Benefits of the EX4600 Switch

Compact solution—The EX4600 switch supports up to 72 10-Gigabit Ethernet ports in a 1 rack unit (1 U) chassis.

Intelligent buffer management—EX4600 switches have a total of 12 MB shared buffers. Of the total buffer space, 25 percent is for dedicated buffer space and the rest is user-configurable buffer space shared amongst all ports. The intelligent buffer mechanism in the EX4600 effectively absorbs traffic bursts while providing deterministic performance, significantly increasing performance over static allocation.

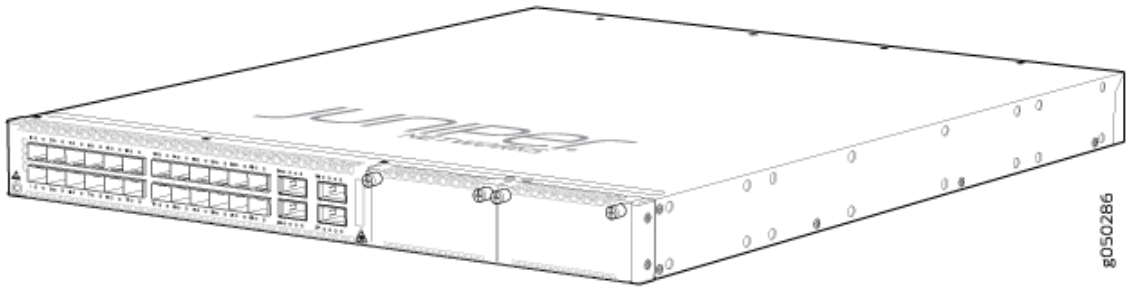
Energy efficiency—The 10-Gigabit Ethernet ports consume less than five watts, thereby offering a low power solution for top-of-rack, end-of-row, and distribution deployments.

EX4600 Hardware

The EX4600 switch is a compact 1 U model that provides line-rate packet performance, low latency, and a rich set of Layer 2 and Layer 3 features. In addition to a high-throughput Packet Forwarding Engine (PFE), the performance of the control plane running on the switch is enhanced by the 1.5-GHz dual-core Intel CPU with 32 GB of solid-state drive (SSD) storage.

The port panel of the EX4600 features 24 fixed small form-factor pluggable (SFP) or SFP+ access ports and 4 fixed quad SFP+ (QSFP+) high-speed uplinks.

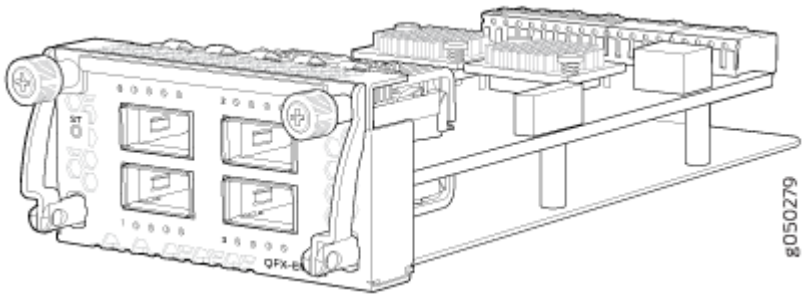
Figure 6: EX4600 Port Panel with Expansion Bays



In addition, the switch has two module bays where you can install optional expansion modules. The EX4600 switch supports two expansion modules to increase port density:

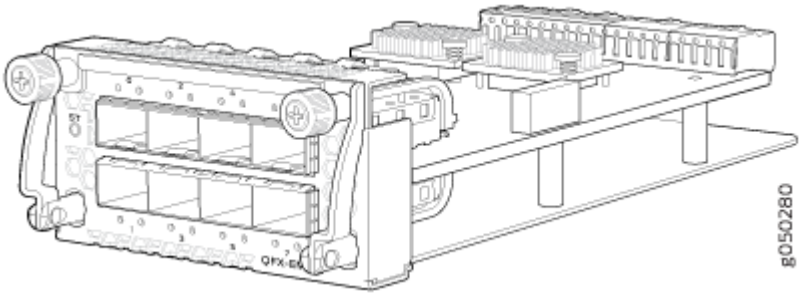
- QFX-EM-4Q–Adds four additional QSFP+ ports to the chassis. Enables the EX4600 to have a total of 72 interfaces (24 + 16 + 16 + 16). See Figure 7 on page 13.

Figure 7: QFX-EM-4Q Expansion Module



- EX4600-EM-8F–Adds a total of eight additional SFP+ ports to the chassis. Enables the EX4600 to have a total of 56 interfaces (24 + 16 + 8 + 8). See Figure 8 on page 13.

Figure 8: EX4600-EM-8F Expansion Module



The EX4600 switch can be used as:

- A standalone switch.
- A primary, backup, or *linecard* member in a *Virtual Chassis* with EX4600 switches or EX4300 switches. When in a mixed (VC) consisting of EX4600 switches and EX4300 switches, the EX4600 switches can be the primary, backup, or in the linecard role, while the EX4300 switches must be in the linecard role. An EX4600 VC enables you to interconnect up to 10 switches in a ring topology into one logical device and manage the device as a single chassis.

  In a mixed (VC) of EX4600 and EX4300 switches, the Junos OS release dictates whether the EX4600 is best used in the primary role. For Junos OS releases between 13.2X50-D10 and 14.1X53-D25, use the EX4300 as a primary and backup Routing Engine (RE) in the Virtual Chassis. For Junos OS Release 14.1X53-D25 and later, the EX4600 is fully supported as the primary role in a mixed VC of EX4600 and EX4300.

System Software

EX Series switches run the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. An EX4600 switch ships with Junos OS installed on it. The same Junos OS code base that runs on EX4600 switches also runs on all Juniper Networks QFX Series devices, M Series, MX Series, and T Series routers.

You manage the switch by using the Junos OS CL), which is accessible through the console and out-of-band management ports on the switch.

All models of the EX4600 run on Junos OS Release 13.2X51-D25 or later.

EX4600 Switch Models

The EX4600 switches have a base configuration of 24 small form-factor pluggable plus (SFP+) ports and 4 quad small-form-factor pluggable (QSFP+) ports. You can increase the number of ports by using expansion modules. All EX4600 switches, except the EX4600-40F-S switch, ship with two power supplies and five fans installed by default. Expansion modules are optional components that must be separately ordered.

Table 3 on page 14 lists the EX4600 switch configurations.

Table 3: EX4600 Switches

Product Number	Ports	Number of Expansion Modules Supported	Power Supply	Airflow
EX4600-40F-AFI	24 SFP+ and 4 QSFP+	2	AC	Air In (FRU-to-port)
EX4600-40F-AFO	24 SFP+ and 4 QSFP+	2	AC	Air Out (port-to-FRU)
EX4600-40F-DC-AFI	24 SFP+ and 4 QSFP+	2	DC	Air In (FRU-to-port)
EX4600-40F-DC-AFO	24 SFP+ and 4 QSFP+	2	DC	Air Out (port-to-FRU)

Table 3: EX4600 Switches *(Continued)*

Product Number	Ports	Number of Expansion Modules Supported	Power Supply	Airflow
EX4600-40F-S	24 SFP+ and 4 QSFP+	2	Order PSUs separately	Fan modules are not shipped by default. Order fan modules separately

CAUTION: Do not mix:

- AC and DC power supplies in the same chassis.
- Power supplies with different airflow labels (**AFI**) and (**AFO**) in the same chassis.
- Fan modules with different airflow labels (**AIR IN**I) and (**AIR OUT**) in the same chassis.
- Power supplies and fan modules with different airflow labels (**AIR IN**I) and **AIR OUT**) or **AFI** and **AFO** in the same chassis.

Understanding Redundancy of EX4600 Switch Components and Functionality

The following hardware components provide redundancy on an EX4600 switch:

- Power supplies—The EX4600 switch can operate with one power supply. However, all EX4600 switches, except the EX4600-40F-S switch, ship with two power supplies preinstalled for redundancy. Each power supply provides power to all components in the switch. Installing two power provides full power redundancy to the switch. If one power supply fails or is removed, the second power supply balances the electrical load without interruption.
- Cooling system—All EX4600 switches, except the EX4600-40F-S ship with five fan modules installed. If a fan module fails and leads to the overheating of the chassis, alarms occur and the switch might shut down.

EX4600 Chassis

IN THIS SECTION

Chassis Physical Specifications for an EX4600 Switch

The EX4600 switch chassis is a rigid sheet-metal structure that houses the hardware components. Table 4 on page 16 summarizes the physical specifications of the EX4600 chassis.

Table 4: Physical Specifications for the EX4600 Switch Chassis

Product Number	Height	Width	Depth	Weight
EX4600	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (4.37 cm)	With power supplies and fan modules installed: 21.7lbs (9.84 kg)

Field-Replaceable Units in an EX4600 Switch

Field-replaceable units (FRUs) are components that you can replace at your site. The EX4600 switch FRUs are hot-insertable and hot-removable: you can remove and replace one of them without powering off the switch or disrupting the switching function. FRU types are:

- Power supplies

- Fan modules
- Optical transceivers
- Expansion modules

CAUTION: Replace a failed power supply with a blank panel or a new power supply within one minute of removal to prevent chassis overheating. The switch continues to operate with only one power supply running. Replace a failed fan module with a new fan module within one minute of removal to prevent chassis overheating. Do not operate the switch for more than one minute after a fan module or power supply fails.

Table 5 on page 17 lists the FRUs for the EX4600 switch and actions to take before removing them.

Table 5: FRUs in a EX4600 Switch

FRU	Required Action
Power supplies	None, if two power supplies are installed as recommended. If only one power is installed, you must power down the switch. See "Removing a Power Supply from an EX4600 Switch" on page 105.
Fan modules	None. See "Removing a Fan Module from an EX4600 Switch" on page 102 for details.
Optical transceivers	None. We recommend that you disable the interface using the **set interfaces *interface-name* disable** command before you remove the transceiver. See *Disconnect a Fiber-Optic Cable*.
Expansion modules	None. See "Removing an Expansion Module from an EX4600 Switch" on page 109.

NOTE: If you have a Juniper Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/support/tools/updateinstallbase/ . Failure to do so can result in significant delays if you need replacement parts. This note does not apply if you replace existing components with the same type of component.

SEE ALSO

Installing and Removing EX4600 Switch Hardware Components | 121

Port Panel of an EX4600 Switch

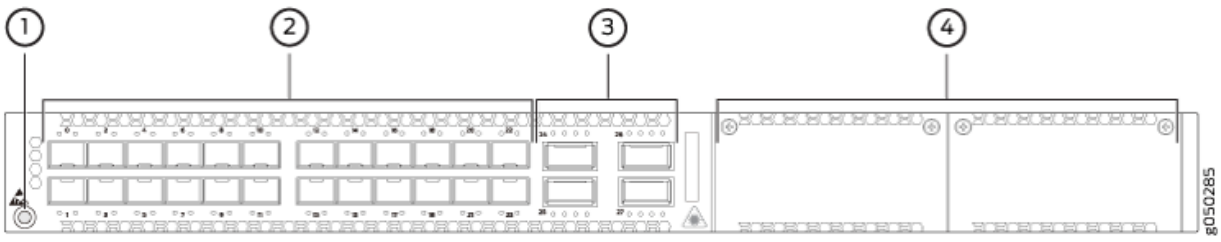
The fixed portion of the port panel of the EX4600-40F switch supports up to a maximum of 40 logical 10 GbE ports. Twenty-four physical ports (**0** through **23**) support 10 Gbps small form-factor pluggable plus (SFP+) transceivers. These ports can be configured as access ports. See The Hardware Compatibility Tool for a list of supported transceivers. All 24 of these ports can be used for SFP+ transceivers or SFP+ direct attach copper (DAC) cables. You can use 1-Gigabit Ethernet SFP+ transceivers, 10-Gigabit Ethernet SFP+ transceivers, and SFP+ direct attach copper cables in any access port.

The remaining 16 logical ports are available for four 40 GbE ports (**24** through **27**) that support up to four quad small-form factor pluggable plus (QSFP+) transceivers. Each QSFP+ port can operate either as a single 40 Gbps port or as a set of 4 independent 10 Gbps ports using QSFP+ breakout cables. The 40 GbE ports can be configured as either access ports or as uplinks. .

CAUTION: When you use the latest OEM part number FCLF8521P2BTL (printed on the transceiver label), you can install 1GbE transceivers (such as QFX-SFP-1GE-T) in any port with no restrictions. The same applies for devices that support 10GbE copper transceivers. However, if you are using the older OEM part number SP7041-M1-JN (not shipped in last 3+ years) instead, do not install 1GbE copper transceivers (such as QFX-SFP-1GE-T) directly above or below another 1GbE copper transceiver. Use only the top row or bottom row to avoid damage to the device caused when the transceivers are installed above or below each other.

Figure 9 on page 18 shows the port panel of an EX4600 switch.

Figure 9: EX4600 Switch Port Panel



1– Electrostatic Discharge (ESD) terminal	3– 40 GbE ports (4)
2– 10 G ports (24)	4– Expansion module bays with cover panels (2)

Access Port and Uplink Port LEDs on an EX4600 Switch

The Link/Activity and Status LED configuration for an EX4600 switch uses bi-colored LEDs. The two figures in this topic show the location of those LEDs:

- Figure 10 on page 19 shows the location of the LEDs on the SFP+ access ports on the EX4600 and Figure 11 on page 19 shows the location of the LEDs on the QSFP+ uplink ports on the EX4600.

Figure 10: LEDs on the SFP+ Ports

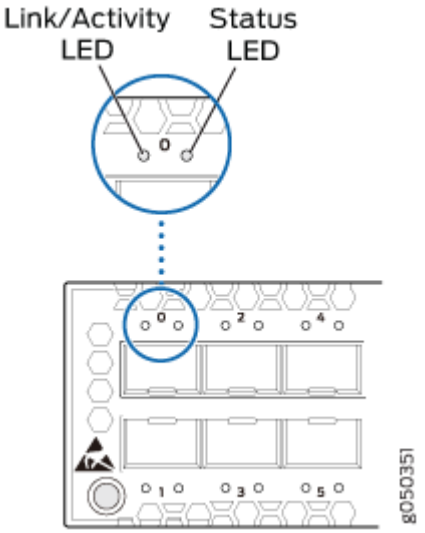
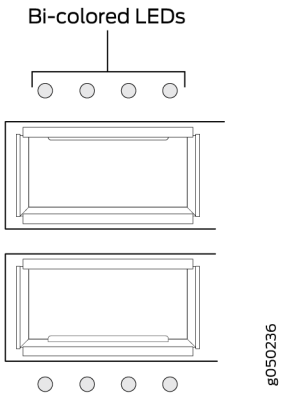


Figure 11: LEDs on the QSFP+ Ports



The LED in Figure 10 on page 19 labeled Link/Activity indicate link activity or a fault. The LED labeled Status in indicates transceiver presence.

Table 6 on page 20 describes how to interpret the SFP+ port LEDs.

Table 6: Network Port LEDs on SFP+ Ports on an EX4600 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	The port is administratively disabled, there is no power, the link is down, or there is a fault.
	Green	On steadily	A link is established, but there is no link activity.
		Blinking	A link is established, and there is link activity.
	Amber	Blinking	The beacon is enabled on the port.
Status	Unlit	Off	The link is down.
	Amber	Blinking	The beacon function is enabled on the port.
	Green	Blinking	A 1-Gigabit Ethernet transceiver is installed in the port and the link is established.
	Green	On steadily	A 10-Gigabit Ethernet transceiver is installed in the port and link is established.

As shown in Figure 11 on page 19, there are four bi-color LEDs for each QSFP+ port. The first LED is used and the remaining LEDs are not used when the interface is configured for 40-Gigabit Ethernet and connected to a QSFP+ transceiver. All four LEDs are used when the interface is configured for 10-Gigabit Ethernet and the port is connected using an optical split cable or a copper DACBO cable. Table 7 on page 21 describes how to interpret the QSFP+ LEDs.

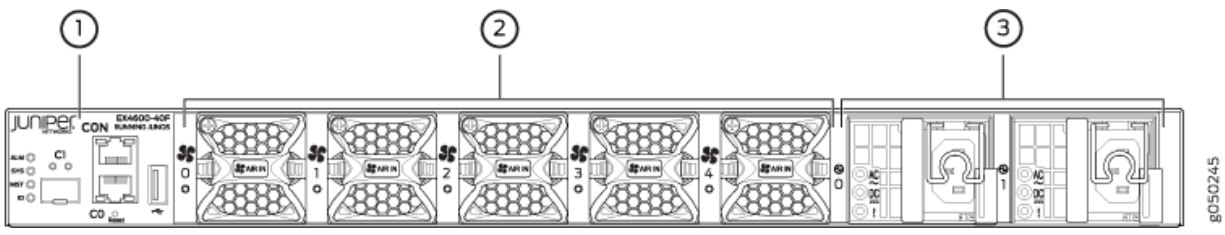
Table 7: Network Port LEDs on QSFP+ Ports on an EX4600 Switch

Color	State	Description
Unlit	Off	The port is administratively disabled, there is no power, the link is down, or there is a fault. **NOTE**: When configured for 10-Gigabit Ethernet, the LED remains unlit only if all four of the 10-Gigabit Ethernet SFP+ breakout links are down.
Green	On steadily	A link is established, but there is no link activity. **NOTE**: When configured for 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.
	Blinking	A link is established, and there is link activity. **NOTE**: When configured for 10-Gigabit Ethernet, the LED is lit green when at least one of the four 10-Gigabit Ethernet SFP+ breakout links is established.
Amber	Blinking	All four LEDs blink to indicate the beacon function was enabled on the port.

Management Panel of an EX4600 Switch

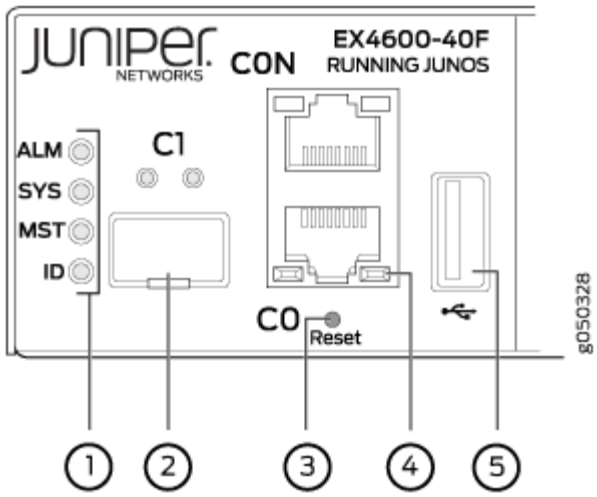
The management panel of the EX4600 switch is located on the Field Replaceable Unit (FRU) side of the switch, as shown in Figure 12 on page 21. See Figure 13 on page 22 for management panel details.

Figure 12: EX4600 Switch, FRU Side with Fans Modules and Power Supplies Installed



1– Management panel	3– Power supply units
2– Fan modules	

Figure 13: Management Panel Components



1– Status LEDs	4– RJ-45 console port (**CON**) and em0–RJ-45 (1000 Base-T) management Ethernet port (C0)
2– em1–SFP management Ethernet port (C1) Cage (socket for either 1 GbE copper SFP or fiber SFP)	5– USB port
3– **Reset** button, see caution statement below	

CAUTION: Do not use the **Reset** button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

The management panel consists of the following components:

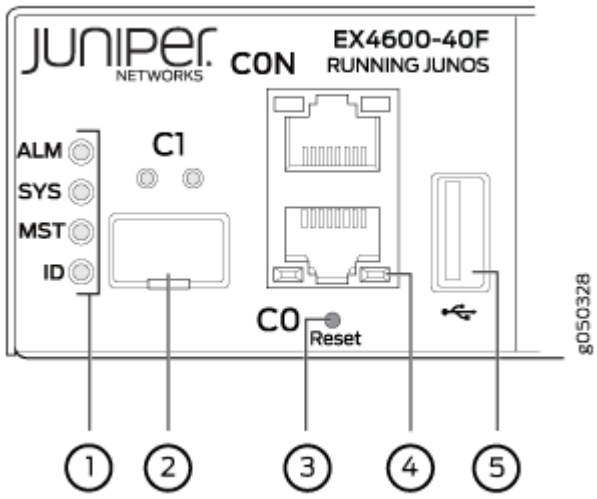
- Status LEDs
  - ALM (Alarm or beacon)
    - Unlit indicates the switch is halted or that there is no alarm.
    - Red indicates a major alarm.
    - Amber indicates a minor alarm.

- SYS (System)
  - Unlit indicates the switch is powered off or halted.
  - Solid green indicates that Junos OS for EX Series is loaded on the switch.
  - Blinking green indicates that the switch is a participating member in a Virtual Chassis.
- MST (Primary) in a Virtual Chassis
  - Unlit indicates the switch is standalone or is a line card member in a Virtual Chassis.
  - Solid green indicates the switch is the primary in a Virtual Chassis.
  - Blinking green indicates the switch is the backup primary in a Virtual Chassis.
- ID (Identification)
  - Unlit indicates the beacon feature is not enabled.
  - Blinking blue indicates the beacon feature is enabled. This feature is enabled using the `request chassis beacon` command.
- Switch model number
- Management Ports C0 and C1
  - C0–Use the RJ-45 connectors for 10/100/1000 BaseT.
  - C1–Use the SFP connector for 1000 BaseX.
- USB port for image updates.
- Console port (RJ-45) to support RS-232 serial ports. The LEDs above the port indicate status and link.

Chassis Status LEDs on an EX4600 Switch

The EX4600 switch has four status LEDs on the field-replaceable unit (FRU) end of the chassis, next to the management ports (see Figure 14 on page 24).

Figure 14: Chassis Status LEDs on an EX4600 Switch



1– Status LEDs	3– RJ-45 console port (**CON**) and em0–RJ-45 (1000 Base-T) management Ethernet port (C0)
2– em1–SFP management Ethernet port (C1) Cage (socket for either 1 GbE copper SFP or fiber SFP)	4– USB port

CAUTION: Do not use the **Reset** button to restart the power sequence unless under the direction of Juniper Networks Technical Assistance Center (JTAC).

Table 8 on page 24 describes the chassis status LEDs on an EX4600 switch, their colors and states, and the status they indicate. You can view the colors of the three LEDs remotely through the CLI by issuing the operational mode command `show chassis lcd`.

Table 8: Chassis Status LEDs on an EX4600 Switch

Name	Color	State	Description
ALM (Alarm or beacon)	Unlit	Off	The switch is halted or there is no alarm.

Table 8: Chassis Status LEDs on an EX4600 Switch *(Continued)*

Name	Color	State	Description
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the switch has halted. Power off the EX4600 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Correct any voltage or site temperature issues, and allow the switch to cool down. Power on the EX4600 switch and monitor the power supply and fan LEDs to help determine where the error is occurring.
	Amber	On steadily	A minor alarm has occurred, such as a software error. Power off the EX4600 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Power on the EX4600 switch and monitor the status LEDs to ensure that Junos OS boots properly.
SYS (System)	Unlit	Off	The switch is powered off or halted.
	Green	On steadily	Junos OS for EX Series is loaded on the switch.
MST (Primary)	Unlit	Off	The switch is standalone.
ID (Identification)	Unlit	Off	The beacon feature is not enabled on the switch. This feature is enabled using the `request chassis beacon` command.

Table 8: Chassis Status LEDs on an EX4600 Switch *(Continued)*

Name	Color	State	Description
	Blue	Blinking	The beacon feature is enabled on the switch. This feature is enabled using the `request chassis beacon` command.

SEE ALSO

- show chassis alarms
- request chassis beacon

Expansion Modules for the EX4600

IN THIS SECTION

The EX4600 switch has two bays on the port panel in which you can optionally install one or two expansion modules. The EX4600 supports the same two expansion modules as the QFX5100, which increase port density:

- EX4600-EM-8F, which provides 8 additional 10-Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) ports.
- QFX-EM-4Q, which provides 4 additional 40-Gigabit Quad SFP+ (QSFP+) ports.

The EX4600 is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of the default QFX-EM-4Q, the new configuration causes the interfaces to temporarily go down. Likewise when an EX4600-EM-8F is running on the EX4600 and it is swapped with a QFX-EM-4Q, the interfaces temporarily go down, which can cause a short disruption in traffic.

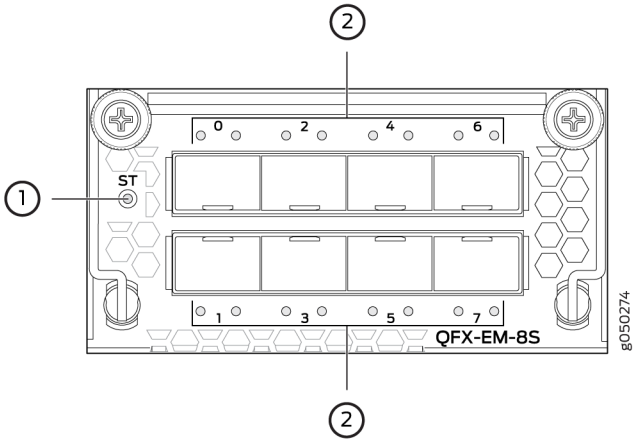
NOTE: Expansion modules and transceivers are not shipped with the switch and must be ordered separately.

EX4600-EM-8F

The EX4600-EM-8F, provides 8 additional 10-Gigabit Ethernet SFP+ ports or 8 additional 1-Gigabit SFP ports to one of the bays in the EX4600 switch. Figure 7 shows the ports and LEDs on the expansion module.

CAUTION: Copper SFP transceivers (1000BASE-T) are restricted to the top four ports or the bottom four ports; fiber SFP transceivers (1000BASE-X) can be used in any of the eight ports. Attempting to stack copper SFP transceivers causes internal damage to the module.

Figure 15: EX4600-EM-8F Faceplate and LEDs



1– Expansion module status LED	2– SFP+ port LEDs

When the expansion module is inserted into the expansion bay, the chassis detects the additional ports, recognizes them as 10GbE ports, and lights the Status LED.

Table 6 describes the Status LED on the EX4600-EM-8F.

Table 9: EX4600-EM-8F Status LED

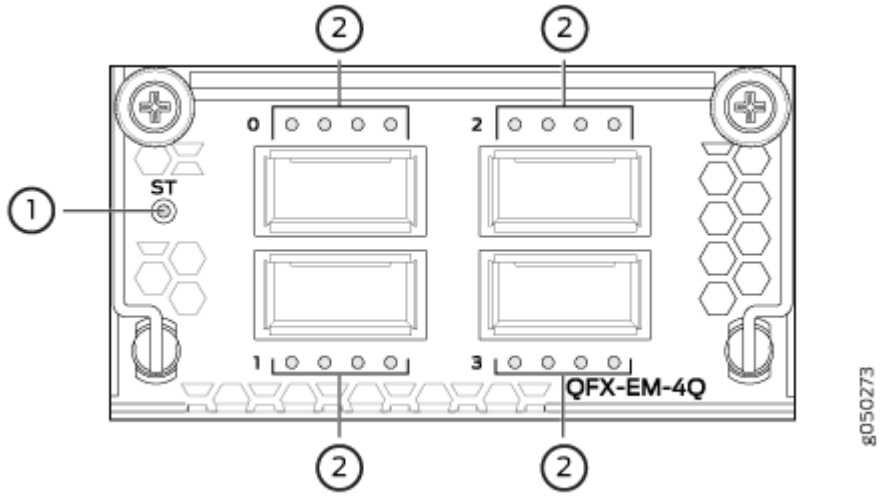
LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.

QFX-EM-4Q

The QFX-EM-4Q, provides 4 additional 40-Gigabit Ethernet QSFP+ ports to one of the bays in the EX4600 switch. Port 0 and port 2 can be used for port channelization by configuring the system mode for 104 port mode.

Figure 16 on page 28 shows the QFX-EM-4Q ports and LEDs.

Figure 16: QFX-EM-4Q Faceplate and LEDs



1– Expansion module status LED	2– QSFP+ port LEDs

When the expansion module is inserted into the expansion bay, the chassis detects the additional ports, recognizes them as 40 GbE ports, and lights the Status LED.

Table 10 on page 29 describes the Status LED on the QFX-EM-4Q expansion module.

Table 10: Expansion Module Status LED

LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.

EX4600 Cooling System

IN THIS SECTION

Cooling System and Airflow in an EX4600 Switch

IN THIS SECTION

The cooling system in an EX4600 switch consists of five fan modules and a single fan in each power supply. The switch can be set up to work in one of two airflow directions:

- Airflow In–Air enters the switch through the vents in the field-replaceable units (FRUs)

- Airflow Out–Air enters the switch through the vents in the port panel.

All EX4600 switches, except the EX4600-40F-S, are shipped with five fan modules and two power supplies. Order fans for the EX4600-40F-S separately.

CAUTION: Do not mix:

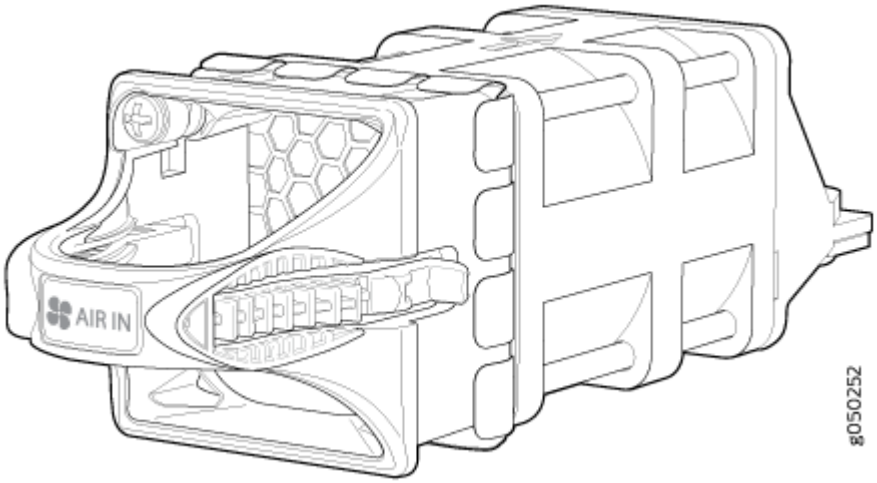
- AC and DC power supplies in the same chassis.
- Power supplies with different airflow labels (**AFI**) and (**AFO**) in the same chassis.
- Fan modules with different airflow labels (**AIR INI**) and (**AIR OUT**) in the same chassis.
- Power supplies and fan modules with different airflow labels (**AIR INI**) and **AIR OUT**) or **AFI** and **AFO**in the same chassis.

Fan Modules

The fan modules in EX4600 switches are hot-insertable and hot-removable field-replaceable units (FRUs). These fan modules are designed for one of the two available airflow directions airflow in (**AIR IN**) or airflow out (**AIR IN**)) and are the same fan modules used in the QFX5100 switches. Some modules are also color-coded for the indication of the airflow direction. The fan modules are installed in the fan module slots on the FRU end of the switch, next to the power supplies. The fan module slots are numbered 0 through 4 from left to right. Each slot has a fan icon next to it.

Figure 17 on page 30 shows the fan module for the EX4600 switch.

Figure 17: Fan Module for EX4600 Switches



You remove and replace a fan module from the FRU end of the chassis. The switch continues to operate for a limited period of time (30 seconds) during the replacement of the fan module without thermal shutdown.

NOTE: All fan modules must be installed for optimal operation of the switch.

The fan modules are available in two product SKUs that have different airflow directions—FRU-to-port airflow, indicated on some units by the blue color and the label **AIR IN** , or port-to-FRU, indicated by the orange and the label **AIR OUT** . On legacy switches or switches with LCDs, this airflow is also called front-to-back and back-to-front. Table 11 on page 31 lists the available fan module product SKUs and the direction of airflow in them:

Table 11: Fan Modules for EX4600 Switches

Fan Module	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-FAN-AFI	Figure 18 on page 32	**AIR IN**	Blue	FRU-to-port, that is, air enters from the FRUs; air exhausts from the vents in the port panel (also known as back-to-front airflow).	You must install only power supplies that have **AFI** labels or that are blue, in switches in which the fan modules have **AIR IN** labels or that are blue..
QFX5100-FAN-AFO	Figure 19 on page 32	**AIR OUT**	orange	Port-to-FRU, that is, air enters through vents on the port panel; air exhausts out the FRUs (also known as front-to-back airflow).	You must install only power supplies that have **AFO** labels or that are orange in switches in which the fan modules have **AIR OUT** labels or that are orange.

In data center deployments, position the switch in such a manner that the **AIR IN** labels on switch components are next to the cold aisle, and **AIR OUT** labels on switch components are next to the hot aisle.

Figure 18: Air In Airflow Through EX4600 Switch Chassis

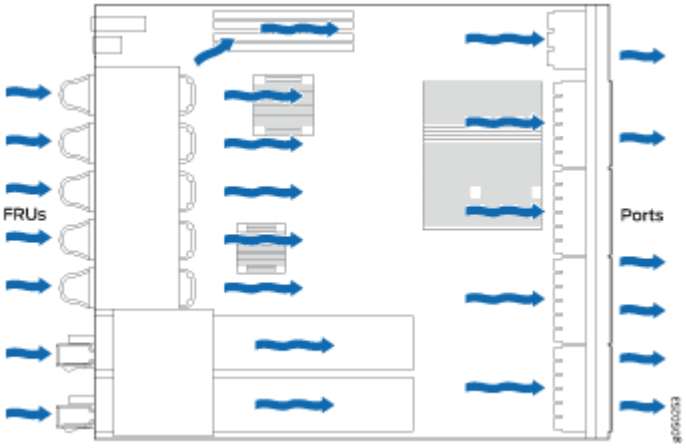
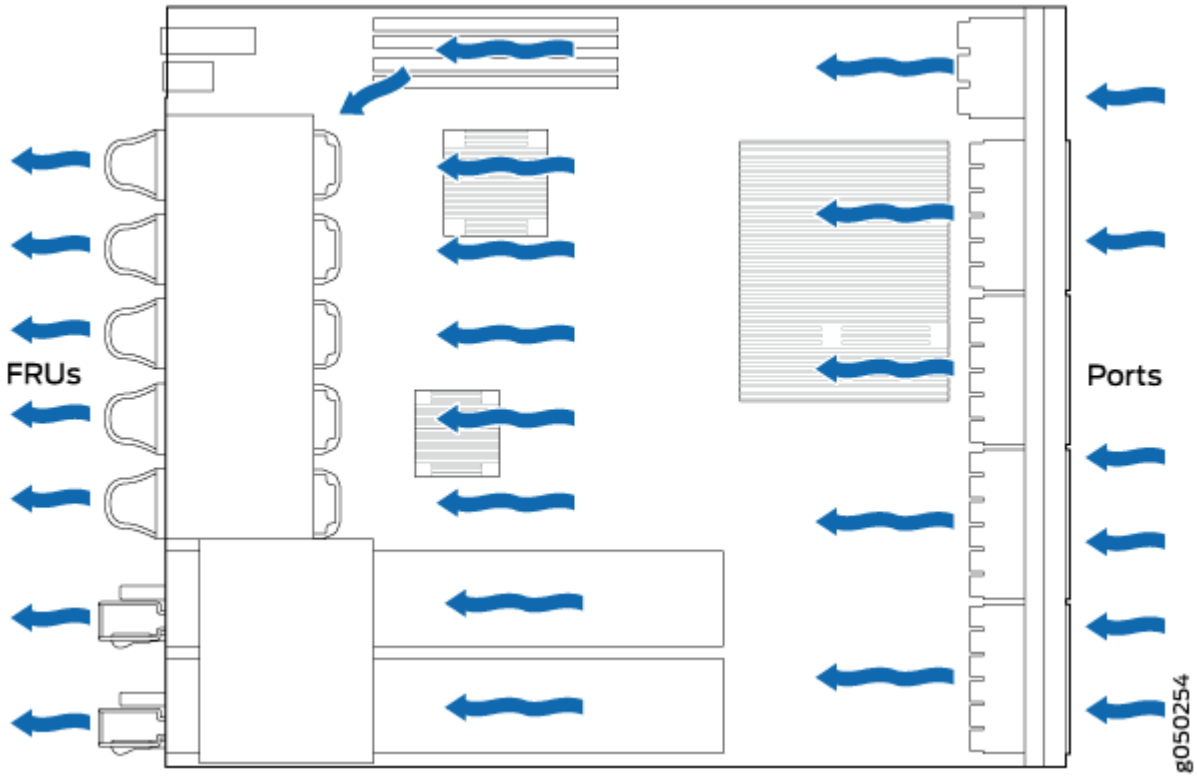


Figure 19: Air Out Airflow Through EX4600 Switch Chassis



Do Not Install Components with Different Airflow or Wattage in the Switch

Do not mix power supplies with different airflow labels (**AFI** and **AFO**) and fan modules with different airflow labels (**AIR IN** and **AIR OUT**) in the same chassis. If the fan modules have **AIR IN** labels, the power supplies must also have **AFI** labels; if the fan modules have **AIR OUT** labels, the power supplies must also have **AFI** labels. Blue and orange modules may not be mixed.

Mixing components with different airflow directions in the same chassis hampers the performance of the cooling system of the switch and leads to overheating of the chassis.

CAUTION: The system raises an alarm if a fan module fails or if the ambient temperature inside the chassis rises above the acceptable range. If the temperature inside the chassis rises above the threshold temperature, the system shuts down automatically.

Do not mix fans with different wattage. Only use the replacement fans that are designed for use with your EX4600. See Table 11 on page 31 for the correct part number for your switch product SKU.

CAUTION: Do not mix AC and DC power supplies in the same chassis. Do not mix power supplies with different wattages in the same chassis.

However if you need to convert an EX4600 switch to have a different airflow, you can change the airflow pattern. To convert an **AIR IN** product SKU to an **AIR OUT** product SKU or an **AIR OUT** product SKU to a **AIR IN** product SKU, you must replace all of the fans and power supplies at one time to use the new direction. The system raises an alarm when the system is converted, which is normal.

Fan Module Status

You can check the status of fans through the `show system alarms` command or by looking at the LEDs next to each fan module.

Each switch has a Status LED (labeled **ST**) for each fan module on the left side of the corresponding fan module slot. It indicates the status of all the fan modules. Table 12 on page 34 describes the Status LED on the fan module in an EX4600 switch.

Table 12: Fan Module LED

LED State	Description
Solid Green	The individual fan module is present. After the hardware senses the fan module, software ensures the airflow is consistent with the other fan modules and that it is functioning correctly.
Blinking Amber	Indicates one of the following: • The fan module is not present. • The airflow direction is not consistent among the modules. • The fan module is not functioning normally.

Under normal operating conditions, the fan modules operate at a moderate speed. Temperature sensors in the chassis monitor the temperature within the chassis.

The system raises an alarm if a fan module fails or if the ambient temperature inside the chassis rises above the acceptable range. If the temperature inside the chassis rises above the threshold temperature, the system shuts down automatically.

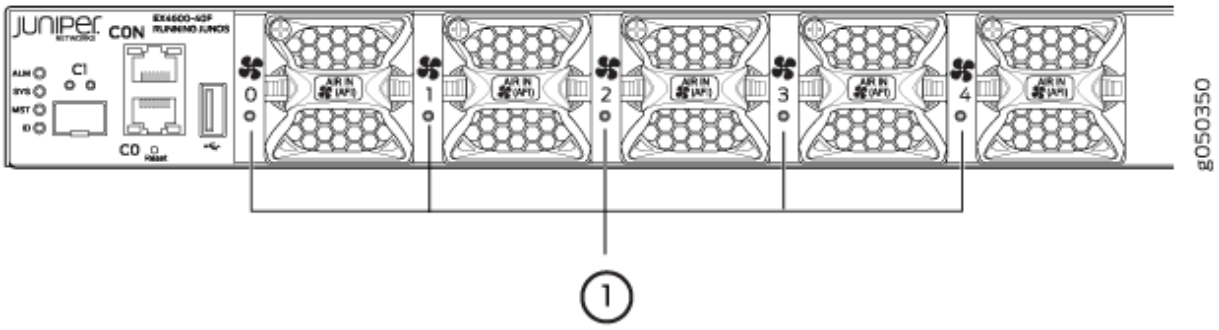
SEE ALSO

Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch | 61

Fan Module LED on an EX4600 Switch

Figure 20 on page 35 shows the location of the LED next to the fan module.

Figure 20: Fan Module LED in an EX4600 Switch



1– Fan LED

Table 13 on page 35 describes the function of the fan tray LED.

Table 13: Fan Tray LED in an EX4600 Switch

Name	Color	State	Description
Fan	Green	On steadily	The fan module is operating normally. The system has verified that the module is engaged, that the airflow is in the correct direction, and that the fan is operating correctly.
	Amber	Blinking	An error has been detected in the fan module. Replace the fan module as soon as possible. Either the fan has failed or it is seated incorrectly. To maintain proper airflow through the chassis, leave the fan module installed in the chassis until you are ready to replace it.

EX4600 Power System

IN THIS SECTION

AC Power Supply in an EX4600 Switch

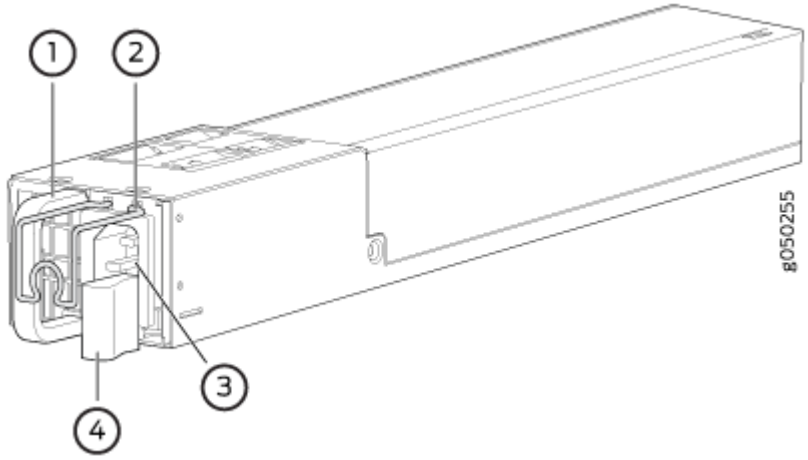
Except for the EX4600-40F-S switch, the EX4600 is shipped from the factory with two power supplies pre-installed. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

The AC power supply is 650 W. It is the same power supply used in Juniper Networks QFX5100 switches.

CAUTION: Do not mix power supplies with different airflow or different wattage. The system raises an alarm when a power supply having a different airflow or wattage is inserted into the chassis.

See Figure 21 on page 37 for an example of the power supply.

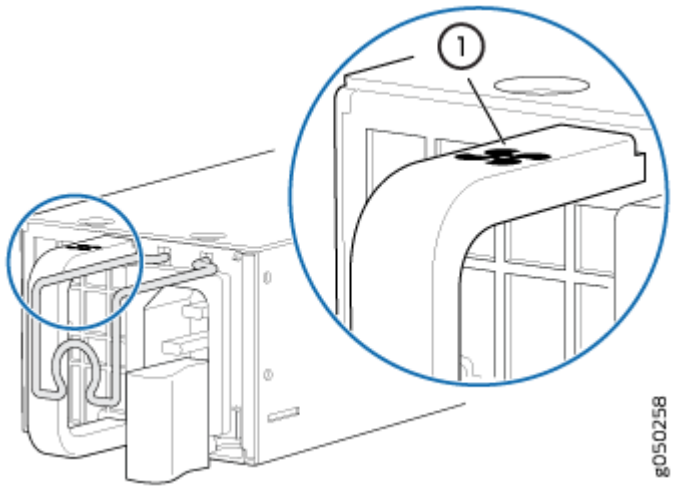
Figure 21: AC Power Supply in EX4600 Switches



1– Handle	3– AC appliance inlet
2– Security latch	4– Ejector lever

The power supply provides FRU-to-port or port-to-FRU airflow depending on the product SKU you purchase. On legacy switches, or switches with an LCD, this airflow is called back-to-front and front-to-back. The power supplies either have labels on the handles that indicate the direction of airflow or they have color-coded handles with a fan icon. See Figure 22 on page 37 for an example of the power supply. Either a power supply has the label **AFI** or a blue handle, which denotes FRU-to-port airflow. A power supply with the label **AFO** or a orange-colored handle denotes port-to-FRU airflow.

Figure 22: Power Supply Handle Detail



1– Fan icon on handle	

CAUTION: Verify that the airflow direction on the power supply handle matches the direction of airflow in the chassis. Ensure that each power supply you install in the chassis has the same airflow direction. If you install power supplies with two different airflow directions, Junos OS raises an alarm, and the fault **ALM** LED blinks amber. If you need to convert the airflow pattern on a chassis, you must change out all the fans and power supplies at one time to use the new direction.

Table 14 on page 38 shows the different power supplies and their direction of airflow.

Table 14: Airflow Direction in EX4600 and QFX5100 AC Power Supplies

Product Number	Direction of Airflow	Color of Power Supply Handle
JPSU-650W-AC-AFI QFXC01-PWRACI-650A	FRU-to-port	Blue
JPSU-650W-AC-AFO	Port-to-FRU	Orange

To avoid electrical injury, carefully follow instructions in "Connecting AC Power to an EX4600 Switch" on page 85.

SEE ALSO

Connecting AC Power to an EX4600 Switch | 85

AC Power Supply LEDs on an EX4600 Switch

Figure 23 on page 39 shows the location of the LEDs on the power supply.

Figure 23: AC Power Supply LEDs on an EX4600 Switch

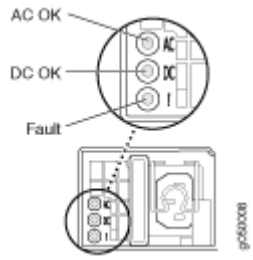


Table 15 on page 39 describes the LEDs on the AC power supplies.

Table 15: AC Power Supply LEDs on a EX4600 Switch

LED	Color	State	Description
AC OK	Unlit	Off	The power supply is disconnected from power, or power is not coming into the power supply.
	Green	On steadily	Power is coming into the power supply.
DC OK	Unlit	Off	The power supply is disconnected from power, or the power supply is not sending out power correctly.
	Green	On steadily	The power supply is sending out power correctly.
Fault	Amber	On steadily	An error has been detected in the power supply. Replace the power supply as soon as possible. To maintain proper airflow through the chassis, leave the power supply installed in the chassis until you are ready to replace it.

NOTE: If the **AC OK** LED and the **DC OK** LED are unlit, either the AC power cord is not installed properly or the power supply fuse has failed. If the **AC OK** LED is lit and the **DC OK** LED is unlit, the AC power supply is installed properly, but the power supply has an internal failure.

AC Power Specifications for an EX4600 Switch

Table 16 on page 40 describes the AC power specifications for an EX4600 switch.

Table 16: AC Power Specifications for an EX4600 Switch

Item	Specification
AC input voltage	Operating range: 100–240 VAC
AC input line frequency	50–60 Hz
AC input current rating	• 4.5 A at 100–120 VAC • 2.0 A at 200–240 VAC
Typical power consumption: 230 W	
Maximum power consumption: 365 W	

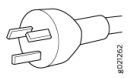
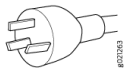
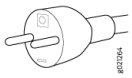
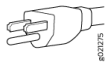
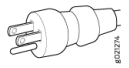
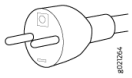
AC Power Cord Specifications for an EX4600 Switch

Detachable AC power cords are shipped with the chassis, if you include them as part of your order. The coupler is type C13 as described by International Electrotechnical Commission (IEC) standard 60320. The plug end of the power cord fits into the power source outlet that is standard for your geographical location.

NOTE: In North America, AC power cords must not exceed 4.5 meters (approximately 14.75 feet) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52 and Canadian Electrical Code (CEC) Section 4-010(3). The cords that can be ordered for the EX4600 switch are in compliance.

Table 17 on page 41 lists AC power cord specifications provided for each country or region.

Table 17: AC Power Cord Specifications

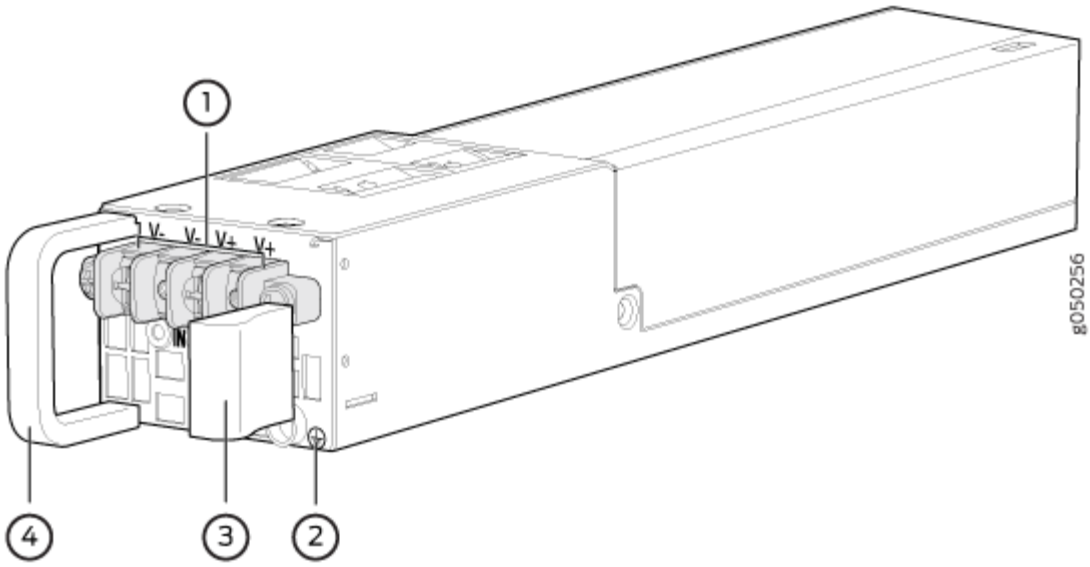
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number	Graphic
Australia	250 VAC, 10 A, 50 Hz	AS/NZ 3109-1996	CBL-EX-PWR-C13-AU	
China	250 VAC, 10 A, 50 Hz	GB 1002-1996	CBL-EX-PWR-C13-CH	
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII	CBL-EX-PWR-C13-EU	
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16/VII	CBL-EX-PWR-C13-IT	
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	JIS C8303	CBL-EX-PWR-C13-JP	
North America	125 VAC, 13 A, 60 Hz	CAN/CSA No. 49-92	CBL-EX-PWR-C13-US	
South Korea	250 VAC, 10 A, 60 Hz	KSC 8305; K60884-1	CBL-EX-PWR-C13-KR	
Switzerland	250 VAC, 10 A, 50 Hz	SEV 1011 SEV 1991; EN 60320 C13	CBL-EX-PWR-C13-SZ	
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A	CBL-EX-PWR-C13-UK	

DC Power Supply in an EX4600 Switch

Except for the EX4600-40F-S switch, the EX4600 is shipped from the factory with two power supplies pre-installed. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

The DC power supply is 650 W with dual feeds for power resiliency. It is same power supply that is used in the Juniper Networks QFX5100 line of switches (see Figure 24 on page 42).

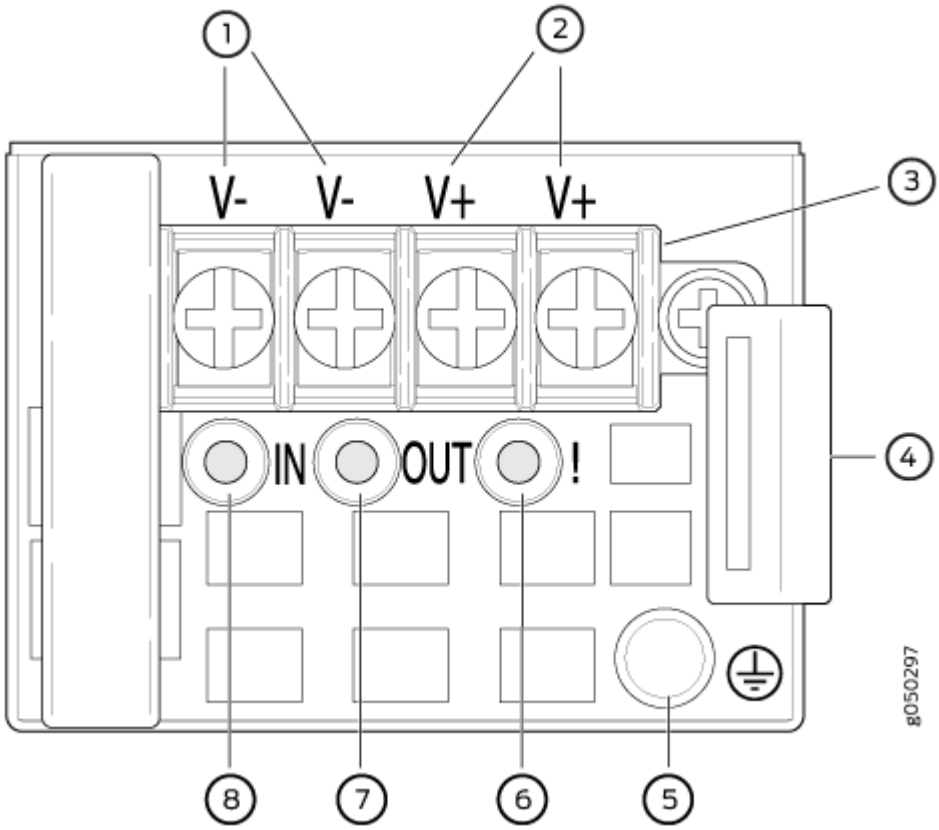
Figure 24: DC Power Supply in EX4600 and QFX5100 Switches



1– Terminal block	3– Ejector lever
2– ESD grounding point	4– Handle

NOTE: The DC power supply in the switch has four terminals labeled V-, V-, V+, and V+ (see Figure 25 on page 43) for connecting DC power source cables labeled positive (+) and negative (–).

Figure 25: DC Power Supply Faceplate in EX4600 Switches



1– Feed B input terminals	5– ESD grounding point
2– Feed A input terminals	6– Fault LED
3– Terminal block	7– Output LED
4– Ejector lever	8– Input LED

To supply sufficient power, terminate the DC input wiring on a facility DC source that is capable of supplying a minimum of 7 A at –48 VDC.

To avoid electrical injury, carefully follow instructions in "Installing a Power Supply in an EX4600 Switch" on page 107 and "Removing a Power Supply from an EX4600 Switch" on page 105.

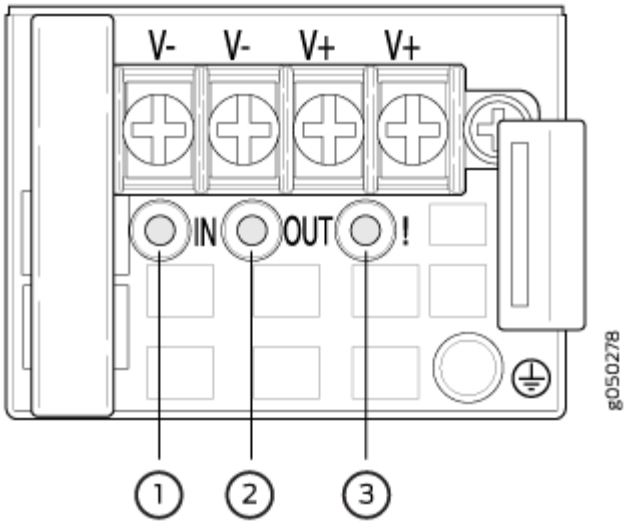
SEE ALSO

Connecting DC Power to an EX4600 Switch | 88

DC Power Supply LEDs in EX4600 Switches

Figure 26 on page 44 shows the location of the LEDs on the DC power supply.

Figure 26: DC Power Supply Faceplate on an EX4600 Switch



1– Input LED	3– Fault LED
2– Output LED	

CAUTION: The V+ terminals are shunted internally together, as are the V- terminals. The same polarity terminal can be wired together from the same source to provide an additional current path in a higher power chassis. Do not connect the terminals to different sources.

Table 18 on page 44 describes the LEDs on the DC power supplies.

Table 18: DC Power Supply LEDs on an EX4600 Switch

LED	Color	State	Description
In	Unlit	Off	The power supply is disconnected from power, or power is not coming into the power supply.

Table 18: DC Power Supply LEDs on an EX4600 Switch *(Continued)*

LED	Color	State	Description
	Green	On steadily	Power is coming into the power supply.
Out	Unlit	Off	The power supply is disconnected from power, or the power supply is not sending out power correctly.
	Green	On steadily	The power supply is sending out power correctly.
Fault	Amber	On steadily	An error has occurred in the power supply. Replace the power supply as soon as possible. To maintain proper airflow through the chassis, leave the power supply installed in the chassis until you are ready to replace it.

DC Power Specifications for an EX4600 Switch

Table 19 on page 45 describes the DC power specifications for DC product SKUs of the EX4600 switch.

Table 19: DC Power Specifications for an EX4600 Switch

Item	Specifications
DC input voltage	• Rated operating voltage: –48 VDC to -60 VDC • Operating voltage range: -40 VDC through –72 VDC
DC input current rating	10 A maximum
Typical power consumption	300 W

Table 19: DC Power Specifications for an EX4600 Switch *(Continued)*

Item	Specifications
Maximum power consumption	385 W

Grounding Cable and Lug Specifications for an EX4600 Switch

For installations that require a separate grounding conductor to the chassis, the switch must be adequately grounded before power is connected to ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements. To ground an EX4600 switch, connect a grounding cable to earth ground and then attach it to the chassis grounding points.

WARNING: The switch is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth ground for installations that require a separate grounding conductor to the chassis.

CAUTION: Before switch installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. See "Connecting Earth Ground to an EX4600 Switch" on page 83. A cable with an incorrectly attached lug can damage the switch.

Before connecting the switch to earth ground, review the following information:

- A protective earthing terminal bracket is provided in the accessory kit for connecting the switch to earth ground. This L-shaped bracket attaches to the side of the EX4600 chassis through the mounting bracket, providing a protective earthing terminal for the switch.
- The grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided).. The grounding lug should accommodates 14–10 AWG (2–5.3 mm^2) stranded wire.
- The grounding cable that you provide for a EX4600 must be 14 AWG (2 mm^2), minimum 60° C wire, or as permitted by the local code.
- Ensure you have two SAE 10-32 washers and screws to attach the cable and bracket (not provided).

CHAPTER 3

Site Planning, Preparation, and Specifications

IN THIS CHAPTER

Site Preparation Checklist for an EX4600 Switch

The checklist in Table 20 on page 48 summarizes the tasks you need to perform when preparing a site for EX4600 switch installation.

Table 20: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed switch tolerances.	"Environmental Requirements and Specifications for EX Series Switches" on page 50		
Power			
Measure the distance between external power sources and switch installation site.			
Calculate the power consumption and requirements.	"AC Power Specifications for an EX4600 Switch" on page 40		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the switch.	"Rack Requirements for an EX4600 Switch" on page 58 "Cabinet Requirements for an EX4600 Switch" on page 60		
Plan rack or cabinet location, including required space clearances.	"Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch" on page 61		
Secure the rack or cabinet to the floor and building structure.			

Table 20: Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Cables			
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	"Determining Interface Support for an EX4600 Switch" on page 63		
Plan the cable routing and management.			

RELATED DOCUMENTATION

General Safety Guidelines and Warnings

General Site Guidelines

Installing and Connecting an EX4600 Switch | 77

EX4600 Site Guidelines and Requirements

IN THIS SECTION

Environmental Requirements and Specifications for EX Series Switches

The switch must be installed in a rack or cabinet housed in a dry, clean, well-ventilated, and temperature-controlled environment.

Ensure that these environmental guidelines are followed:

- The site must be as dust-free as possible, because dust can clog air intake vents and filters, reducing the efficiency of the switch cooling system.
- Maintain ambient airflow for normal switch operation. If the airflow is blocked or restricted, or if the intake air is too warm, the switch might overheat, leading to the switch temperature monitor shutting down the switch to protect the hardware components.

Table 21 on page 50 provides the required environmental conditions for normal switch operation.

Table 21: EX Series Switch Environmental Tolerances

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX2200-C	No performance degradation up to 5,000 feet (1524 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 104° F (40° C) at altitudes up to 5,000 ft (1,524 m). For information about extended temperature SFP transceivers supported on EX2200 switches, see Pluggable Transceivers Supported on EX2200 Switches.	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX2200 (except EX2200-C switches)	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX2300-C	No performance degradation up to 5,000 feet (1524 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX2300 (except EX2300-C switches)	No performance degradation up to 13,000 feet (3962 meters) at 104° F (40° C) as per GR-63	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX3200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX3300	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX3400	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4100	No performance degradation up to 5,000 feet (1524 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4300	EX4300 switches except the EX4300-48MP model— No performance degradation up to 10,000 feet (3048 meters) EX4300-48MP model— No performance degradation up to 6,000 feet (1829 meters)	EX4300 switches except the EX4300-48MP model — Normal operation ensured in the relative humidity range 10% through 85% (noncondensing) EX4300-48MP model— Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX4400	No performance degradation up to 6,000 feet (1829 meters)	Normal operation ensured in the relative humidity range 10% through 90% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4500	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4550	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	• EX4550-32F switches—Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C) • EX4550-32T switches—Normal operation is ensured in the temperature range 32° F through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX4600	No performance degradation to 6,562 feet (2000 meters)	Normal operation ensured in the relative humidity range 5% through 90%, noncondensing • Short-term operation ensured in the relative humidity range 5% through 93%, noncondensing **NOTE**: As defined in NEBS GR-63-CORE, Issue 4, short-term events can be up to 96 hours in duration but not more than 15 days per year.	• Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C) • Nonoperating storage temperature in shipping container: – 40° F (– 40° C) through 158° F (70° C)	Complies with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 4.
EX4650	No performance degradation to 6,000 feet (1829 meters)	Normal operation ensured in the relative humidity range 10% through 85% (condensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX6210	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX8208	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX8216	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX9204	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: – 40° F (– 40° C) to 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.
EX9208	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: – 40° F (– 40° C) to 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.

Table 21: EX Series Switch Environmental Tolerances *(Continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX9214	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: – 40° F (– 40° C) through 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.
EX9251	No performance degradation up to 10,000 ft (3048 m)	Normal operation ensured in relative humidity range of 5% to 90%, noncondensing	Normal operation ensured in temperature range of 32° F (0° C) to 104° F (40° C) Nonoperating storage temperature in shipping container: – 40° F (– 40° C) to 158° F (70° C)	Complies with Telcordia Technologies Zone 4 earthquake requirements
XRE200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 41° F (5° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

NOTE: Install EX Series switches only in restricted areas, such as dedicated equipment rooms and equipment closets, in accordance with Articles 110– 16, 110– 17, and 110– 18 of the National Electrical Code, ANSI/NFPA 70.

General Site Guidelines

Efficient device operation requires proper site planning. For the device to operate properly, you must ensure maintenance and proper layout of the equipment, rack or cabinet, and wiring closet.

To plan and create an acceptable operating environment for your device and prevent environmentally caused equipment failures:

- Keep the area around the chassis free from dust and conductive material, such as metal flakes.
- Follow the prescribed airflow guidelines to ensure that the cooling system functions properly. Ensure that the exhaust from other equipment does not blow into the intake vents of the device.
- Follow the prescribed electrostatic discharge (ESD) prevention procedures to prevent damaging the equipment. Static discharge can cause components to fail completely or intermittently over time.
- Install the device in a secure area, so that only authorized personnel can access the device.

Site Electrical Wiring Guidelines

Table 22 on page 58 describes the factors you must consider while planning the electrical wiring at your site.

WARNING: You must provide a properly grounded and shielded environment and use electrical surge-suppression devices.

Avertissement Vous devez établir un environnement protégé et convenablement mis à la terre et utiliser des dispositifs de parasurtension.

Table 22: Site Electrical Wiring Guidelines

Site Wiring Factor	Guidelines
Signaling limitations	If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding: • Radio frequency interference (RFI) because of improperly installed wires. • Damage from lightning strikes occurring when wires exceed recommended distances or pass between buildings. • Damage to unshielded conductors and electronic devices as a result of electromagnetic pulses (EMPs) caused by lightning.
Radio frequency interference	To reduce or eliminate RFI from your site wiring, do the following: • Use a twisted-pair cable with a good distribution of grounding conductors. • If you need to exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal, when applicable.
Electromagnetic compatibility	If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, seek expert advice. Strong sources of electromagnetic interference (EMI) can cause: • Destruction of the signal drivers and receivers in the device. • Electrical hazards as a result of power surges conducted over the lines into the equipment.

Rack Requirements for an EX4600 Switch

EX4600 Switches are designed to be installed on four-post racks.

Rack requirements consist of:

- Rack type
- Mounting bracket hole spacing
- Rack size and strength

Table 23 on page 59 provides the rack requirements and specifications for the EX4600 Switch.

Table 23: Rack Requirements for the EX4600 Switch

Rack Requirement	Guidelines
Rack type	Use a four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association.
Mounting bracket hole spacing	The holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm), so that the switch can be mounted in any rack that provides holes spaced at that distance.
Rack size and strength	• Ensure that the rack complies with the standards for a 19-in. or 23-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association. • A 600-mm rack as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute. The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the device's mounting brackets, which measure 19 in. (48.26 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required. • Ensure that the rack rails are spaced widely enough to accommodate the switch chassis' external dimensions. The outer edges of the front-mounting brackets extend the width to 19 in. (48.26 cm). • The front and rear rack rails must be spaced between 23 in. (58.5 cm) and 30.25 in. (76.8 cm) front-to-back. • The rack must be strong enough to support the weight of the switch. • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the switch and rack.

Table 23: Rack Requirements for the EX4600 Switch *(Continued)*

Rack Requirement	Guidelines
Rack connection to building structure	• Secure the rack to the building structure. • If earthquakes are a possibility in your geographical area, secure the rack to the floor. • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

SEE ALSO

Rack-Mounting and Cabinet-Mounting Warnings | 151

Cabinet Requirements for an EX4600 Switch

You can mount the EX4600 switch in a cabinet that contains a four-post 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association.

Cabinet requirements consist of:

- Cabinet size and clearance
- Cabinet airflow requirements

Table 24 on page 60 provides the cabinet requirements and specifications for the EX4600 switch.

Table 24: Cabinet Requirements for the EX4600 Switch

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a EX4600 switch is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.

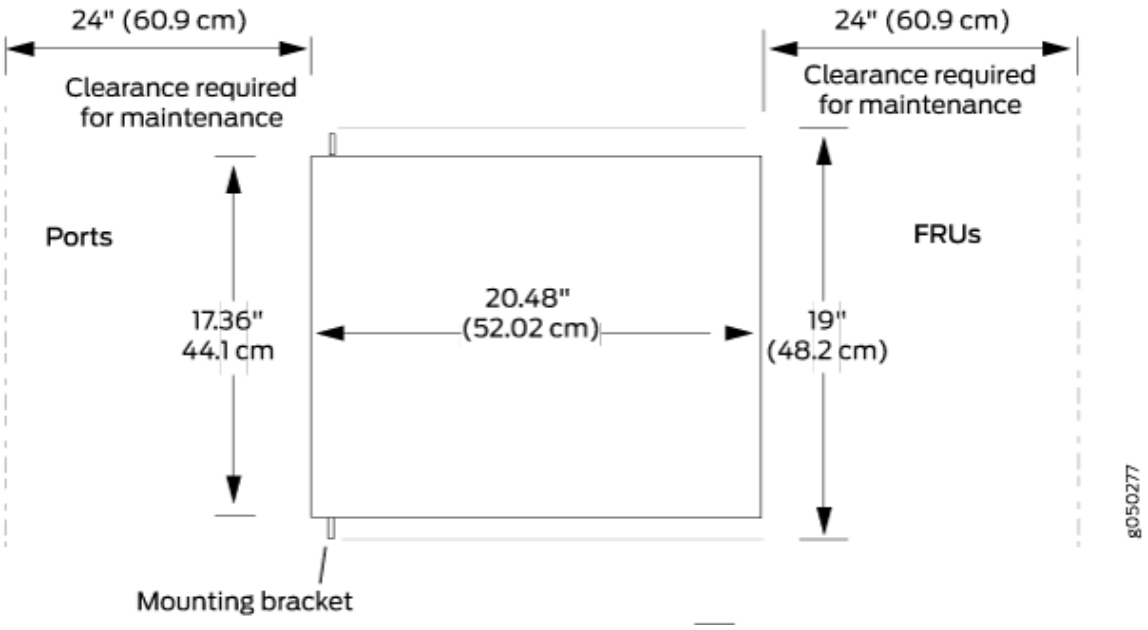
Table 24: Cabinet Requirements for the EX4600 Switch *(Continued)*

Cabinet Requirement	Guidelines
Cabinet airflow requirements	When you mount the switch in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating. • Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the switch (or switches). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the switch. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. • The EX4600 fans exhaust hot air either through the vents on the port panel or through the fans and power supplies. Install the switch in the cabinet in a way that maximizes the open space on the FRU side of the chassis. This maximizes the clearance for critical airflow. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the switch and cabinet.

Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch

When planning the site for installing an EX4600 switch, you must allow sufficient clearance around the installed chassis (see Figure 27 on page 62).

Figure 27: Clearance Requirements for Airflow and Hardware Maintenance for a EX4600 Switch



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "Cooling System and Airflow in an EX4600 Switch" on page 29 for more information about the airflow through the chassis.
- If you are mounting an EX4600 switch in a rack or cabinet with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- Leave at least 24 in. (61 cm) both in front of and behind the EX4600 switch. For service personnel to remove and install hardware components, you must leave adequate space at the front and back of the switch. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack or cabinet and 24 in. (61 cm) behind the rack or cabinet.

EX4600 Network Cable and Transceiver Planning

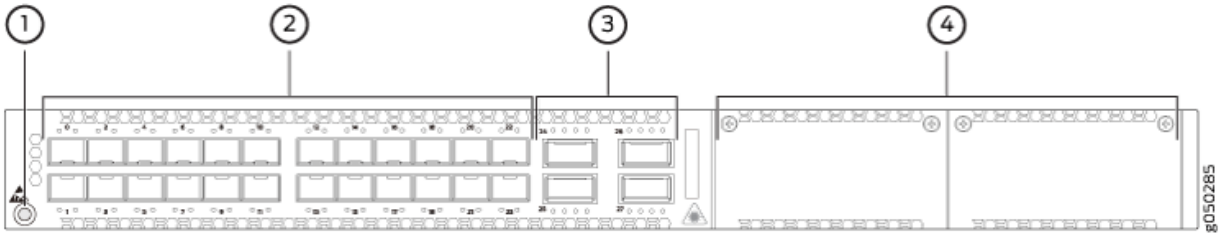
IN THIS SECTION

Determining Interface Support for an EX4600 Switch

The 24 small form-factor pluggable (SFP) network ports on EX4600 switches support 10-Gigabit Ethernet transceivers and direct-attach copper (DAC) cables. The switch also supplies four quad small form-factor pluggable plus (QSFP+) ports for use as uplinks. These 40-Gigabit Ethernet ports support QSFP+ transceivers, QSFP+ DAC cables, and DAC breakout cables (DACBO). Each QSFP+ port on an EX4600 switch can be configured to operate as 10-Gigabit Ethernet interface by using a breakout cable or as a single 40-Gigabit Ethernet interface. The ports on an EX4600 switch are disabled by default. You enable a port through the CLI.

Figure 28 on page 63 shows the different ports available on the EX4600 switch.

Figure 28: Port Panel of EX4600



1– Electrostatic discharge (ESD) terminal	3– 40 GbE ports (4)
2– 10 G ports (24)	4– Expansion module bays with cover panels (2)

You can find information about the optical transceivers supported on your Juniper device by using the Hardware Compatibility Tool. In addition to transceiver and connection type, the optical and cable characteristics–where applicable–are documented for each transceiver. The Hardware Compatibility Tool enables you to search by product, displaying all the transceivers supported on that device, or category, by interface speed or type. The list of supported transceivers for the EX4600 is located at https://pathfinder.juniper.net/hct/product/#prd=EX4600.

CAUTION: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem running a Juniper device that uses third-party optical modules or cables, JTAC may help you diagnose host-related issues if the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

Use of third-party optical modules with high-power consumption (for example, coherent ZR or ZR+) can potentially cause thermal damage to or reduce the lifespan of the host equipment. Any damage to the host equipment due to the use of third-party optical modules or cables is the users' responsibility. Juniper Networks will accept no liability for any damage caused due to such use.

Cable Specifications for QSFP+ Transceivers on EX4600 Series Switches

The 40-Gigabit Ethernet QSFP+ transceivers that are used in EX Series switches use 12-ribbon multimode fiber crossover cables with socket MPO/UP, MPO/UPC, or MPO/APC connectors. The fiber can be either OM3 or OM4. These cables are not sold by Juniper Networks.

CAUTION: To maintain agency approvals, use only a properly constructed, shielded cable.

TIP: Ensure that you order cables with the correct polarity. Vendors refer to these crossover cables as *key up to key up*, *latch up to latch up*, *Type B*, or *Method B*. If you are using patch panels between two QSFP+, ensure that the proper polarity is maintained through the cable plant.

Table 25 on page 65 describes the signals on each fiber. Table 26 on page 65 shows the pin-to-pin connections for proper polarity.

Table 25: QSFP+ MPO Cable Signals

Fiber	Signal
1	Tx0 (Transmit)
2	Tx1 (Transmit)
3	Tx2 (Transmit)
4	Tx3 (Transmit)
5	Unused
6	Unused
7	Unused
8	Unused
9	Rx3 (Receive)
10	Rx2 (Receive)
11	Rx1 (Receive)
12	Rx0 (Receive)

Table 26: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

Pin	Pin
1	12
2	11

Table 26: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts *(Continued)*

Pin	Pin
3	10
4	9
5	8
6	7
7	6
8	5
9	4
10	3
11	2
12	1

Network Cable Specifications for EX4600 Switches

EX4600 switches have interfaces that use various types of network cables.

Table 27 on page 67 lists the specifications for the cables that connect the console (**CON**) and management (**MGMT**) ports to management devices.

NOTE: The EX4600 can be configured with SFP management ports that support 1000BASE-SX transceivers.

Table 27: Cable Specifications for Switch-to-Management-Device Connections

Ports on EX4600 Switches	Cable Specification	Cable/Wire Required	Maximum Length	Switch Receptacle	Additional Information
RJ-45 Console (**CON**) port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter) length RJ-45 patch cable and RJ-45 to DB-9 adapter	7 ft (2.13 m)	RJ-45	*Connect a Device to a Management Console Using an RJ-45 Connector*
Management (**MGMT**) Ethernet port (10/100/1000)	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter) length RJ-45 patch cable	328 feet (100 meters)	RJ-45	*Connect a Device to a Network for Out-of-Band Management*

Overview of EX Series Switches: Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

IN THIS SECTION

To determine the power budget and power margin needed for fiber-optic connections, you need to understand how signal loss, attenuation, and dispersion affect transmission. EX Series switches use various types of network cables, including multimode and single-mode fiber-optic cable.

Signal Loss in Multimode and Single-Mode Fiber-Optic Cable

Multimode fiber is large enough in diameter to allow rays of light to reflect internally (bounce off the walls of the fiber). Interfaces with multimode optics typically use LEDs as light sources. However, LEDs are not coherent light sources. They spray varying wavelengths of light into the multimode fiber, which reflects the light at different angles. Light rays travel in jagged lines through a multimode fiber, causing signal dispersion. When light traveling in the fiber core radiates into the fiber), higher-order mode loss (HOL) occurs. (Cladding consists of layers of lower-refractive index material in close contact with a core material of higher refractive index.) Together, these factors reduce the transmission distance of multimode fiber compared to that of single-mode fiber.

Single-mode fiber is so small in diameter that rays of light reflect internally through one layer only. Interfaces with single-mode optics use lasers as light sources. Lasers generate a single wavelength of light, which travels in a straight line through the single-mode fiber. Compared to multimode fiber, single-mode fiber has a higher bandwidth and can carry signals for longer distances. Single-mode fiber is consequently more expensive than multimode fiber.

Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

Attenuation and Dispersion in Fiber-Optic Cable

An optical data link functions correctly provided that modulated light reaching the receiver has enough power to be demodulated correctly. *Attenuation* is the reduction in strength of the light signal during transmission. Passive media components such as cables, cable splices, and connectors cause attenuation. Although attenuation is significantly lower for optical fiber than for other media, it still occurs in both multimode and single-mode transmissions. An efficient optical data link must transmit enough light to overcome attenuation.

Dispersion is the spreading of the signal over time. The following two types of dispersion can affect signal transmission through an optical data link:

- Chromatic dispersion, which is the spreading of the signal over time caused by the different speeds of light rays
- Modal dispersion, which is the spreading of the signal over time caused by the different propagation modes in the fiber

For multimode transmission, modal dispersion usually limits the maximum bit rate and link length. Chromatic dispersion or attenuation is not a factor.

For single-mode transmission, modal dispersion is not a factor. However, at higher bit rates and over longer distances, chromatic dispersion limits the maximum link length.

An efficient optical data link must have enough light to exceed the minimum power that the receiver requires to operate within its specifications. In addition, the total dispersion must be within the limits specified for the type of link in Telcordia Technologies document GR-253-CORE (Section 4.3) and International Telecommunications Union (ITU) document G.957.

When chromatic dispersion is at the maximum allowed, you can consider its effect as a power penalty in the power budget. The optical power budget must allow for the sum of component attenuation, power penalties (including those from dispersion), and a safety margin for unexpected power loss.

Calculate the Fiber-Optic Cable Power Budget for EX Series Devices

To ensure that fiber-optic connections have sufficient power for correct operation, calculate the link's power budget when planning fiber-optic cable layout and distances. This planning helps you ensure that fiber-optic connections have sufficient power for correct operation. The power budget is the maximum amount of power the link can transmit. When you calculate the power budget, you use a worst-case analysis to provide a margin of error. You use a worst-case analysis even though not all the parts of an actual system operate at the worst-case levels.

To calculate the worst-case estimate for a fiber-optic cable power budget (P_B) for the link:

1. Determine values for the link's minimum transmitter power (P_T) and minimum receiver sensitivity (P_R). In the following example, we measure both (P_T) and (P_R) in decibels relative to one milliwatt (dBm).

   P_T = – 15 dBm

   P_R = – 28 dBm

   > **NOTE**: See the specifications for your transmitter and receiver to find the minimum transmitter power and minimum receiver sensitivity.

2. Calculate the power budget (P_B) by subtracting (P_R) from (P_T):

   – 15 dBm – (–28 dBm) = 13 dBm

Calculating the Fiber-Optic Cable Power Margin for EX Series Devices

Before calculating the power margin, calculate the power budget (see Calculating the Fiber-Optic Cable Power Budget for EX Series Devices).

Calculate the link's power margin when planning fiber-optic cable layout and distances to ensure that fiber-optic connections have sufficient signal power to overcome system loss and still satisfy the minimum input requirements of the receiver for the required performance level. The power margin (P_M) is the amount of power available after you subtract attenuation or link loss (LL) from the power budget (P_B).

When you calculate the power margin, you use a worst-case analysis to provide a margin of error, even though not all parts of an actual system operate at worst-case levels. A power margin (P_M) greater than zero indicates that the power budget is sufficient to operate the receiver and that it does not exceed the maximum receiver input power. This means that the link will work. A (P_M) that is zero or negative indicates insufficient power to operate the receiver. See the specification for your receiver to find the maximum receiver input power.

To calculate the worst-case estimate for the power margin (P_M) for the link:

1. Determine the maximum value for link loss (LL) by adding estimated values for applicable link-loss factors—for example, use the sample values for various factors as provided in Table 28 on page 70 (here, the link is 2 km long and multimode, and the (P_B) is 13 dBm):

   Table 28: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value	Sample (LL) Calculation Values
Higher-order mode losses (HOL)	• Multimode—0.5 dBm • Single mode—None	• 0.5 dBm • 0 dBm
Modal and chromatic dispersion	• Multimode—None, if product of bandwidth and distance is less than 500 MHz/km • Single mode—None	• 0 dBm • 0 dBm
Connector	0.5 dBm	This example assumes 5 connectors. Loss for 5 connectors: (5) * (0.5 dBm) = 2.5 dBm
Splice	0.5 dBm	This example assumes 2 splices. Loss for two splices: (2) * (0.5 dBm) = 1 dBm

Table 28: Estimated Values for Factors Causing Link Loss *(Continued)*

Link-Loss Factor	Estimated Link-Loss Value	Sample (LL) Calculation Values
Fiber attenuation	• Multimode—1 dBm/km • Single mode—0.5 dBm/km	This example assumes the link is 2 km long. Fiber attenuation for 2 km: • (2 km) * (1.0 dBm/km) = 2 dBm • (2 km) * (0.5 dBm/km) = 1 dBm
Clock Recovery Module (CRM)	1 dBm	1 dBm

NOTE: For information about the actual amount of signal loss caused by equipment and other factors, see your vendor documentation for that equipment.

2. Calculate the (P_M) by subtracting (LL) from (P_B):

   $P_B - LL = P_M$

   (13 dBm) – (0.5 dBm [HOL]) – ((5) * (0.5 dBm)) – ((2) * (0.5 dBm)) – ((2 km) * (1.0 dBm/km)) – (1 dB [CRM]) = P_M

   13 dBm – 0.5 dBm – 2.5 dBm – 1 dBm – 2 dBm – 1 dBm = P_M

   P_M = 6 dBm

   The calculated power margin is greater than zero, indicating that the link has sufficient power for transmission. Also, the power margin value does not exceed the maximum receiver input power. Refer to the specification for your receiver to find the maximum receiver input power.

EX4600 Management Cable Specifications and Pinouts

IN THIS SECTION

Cable Specifications for Console and Management Connections for the EX4600

Table 29 on page 72 lists the specifications for the cables that connect the QFX Series to a management device.

NOTE: The QFX Series can be configured with SFP management ports that support 1000BASE-SX transceivers.

Table 29: Cable Specifications for Console and Management Connections for the QFX Series

Port on QFX Series Device	Cable Specification	Cable Required	Maximum Length	Device Receptacle
Console port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter) length RJ-45 patch cable and RJ-45 to DB-9 adapter	7 feet (2.13 meters)	RJ-45
Management port	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter) length RJ-45 patch cable	328 feet (100 meters)	RJ-45

USB Port Specifications for an EX Series Switch

Juniper Networks tested and officially supports the following USB flash drives for the USB port on all EX Series switches:

- RE-USB-1G-S
- RE-USB-2G-S
- RE-USB-4G-S

> **CAUTION**: Any USB memory product not listed as supported for EX Series switches has not been tested by Juniper Networks. The use of any unsupported USB memory product could expose your EX Series switch to unpredictable behavior. Juniper Networks Technical Assistance Center (JTAC) can provide only limited support for issues related to unsupported hardware. We strongly recommend that you use only supported USB flash drives.

All USB flash drives used on EX Series switches must have the following features:

- USB 2.0 or later.
- Formatted with a FAT32 or MS-DOS file system.
- If the switch is running Junos OS Release 9.5 or earlier, the formatting method must use a primary boot record. Microsoft Windows formatting, by default, does not use a primary boot record. See the documentation for your USB flash drive for information about how your USB flash drive is formatted.

Console Port Connector Pinout Information

The console port on a Juniper Networks device is an RS-232 serial interface that uses an RJ-45 connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 30 on page 74 provides the pinout information for the RJ-45 console connector.

> **NOTE**: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

NOTE: If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC directly to a device, use a combination of the RJ-45-to-DB-9 socket adapter and a USB-to-DB-9 plug adapter. You must provide the USB-to-DB-9 plug adapter.

Table 30: Console Port Connector Pinout Information

Pin	Signal	Description
1	NC	No connect
2	NC	No connect
3	TxD Output	Transmit data
4	GND	Signal ground
5	GND	Signal ground
6	RxD Input	Receive data
7	DCD Input	Data carrier detect
8	NC	No connect

RJ-45 Management Port Connector Pinout Information

Table 31 on page 75 provides the pinout information for the RJ-45 connector for the management port on Juniper Networks devices.

Table 31: RJ-45 Management Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1
2	TRP1-	Transmit/receive data pair 1
3	TRP2+	Transmit/receive data pair 2
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

4

CHAPTER

Initial Installation and Configuration

IN THIS CHAPTER

Unpacking and Mounting an EX4600 Switch

IN THIS SECTION

Installing and Connecting an EX4600 Switch

You can mount an EX4600 switch:

- Flush with the front of a 19-in. four-post rack. Use the standard mounting brackets provided with the switch for this configuration.
- Recessed 2 in. (5 cm) from the front of a 19-in. four-post rack. Use the extension bracket provided in the standard mounting kit for this configuration. Recessed mounting is primarily used in enclosed cabinets.

To install and connect an EX4600 switch:

1. Follow the instructions in "Unpacking an EX4600 Switch" on page 78.
2. Determine how the switch is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see "Mounting an EX4600 Switch in a Rack or Cabinet" on page 79.
3. Follow the instructions in:
   a. "Connecting Earth Ground to an EX4600 Switch" on page 83
   b. "Connecting DC Power to an EX4600 Switch" on page 88 or "Connecting AC Power to an EX4600 Switch" on page 85
   c. *Register Products—Mandatory to Validate SLAs*
   d. "Configuring Junos OS on the EX4600" on page 98

SEE ALSO

Rack Requirements for an EX4600 Switch | 58

Cabinet Requirements for an EX4600 Switch | 60

Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch | 61

Unpacking an EX4600 Switch

The EX4600 switch chassis is a rigid sheet-metal structure that houses the hardware components. A EX4600 switch is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box.

CAUTION: EX4600 switches are maximally protected inside the shipping carton. Do not unpack the switch until you are ready to begin installation.

To unpack a EX4600 switch:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.
2. Position the carton so that the arrows are pointing up.
3. Open the top flaps on the shipping carton.
4. Remove the accessory box and verify the contents against the inventory included in the box. Table 32 on page 78 lists the inventory of components supplied with a EX4600 switch.
5. Pull out the packing material holding the switch in place.
6. Verify the chassis components received:
   - Two power supplies
   - Five fan modules
7. Save the shipping carton and packing materials in case you need to move or ship the switch later.

Table 32: Inventory of Components Supplied with an EX4600 Switch

Component	Quantity
Chassis with five fan modules and two power supplies.	1
Rear mounting blades	2

Table 32: Inventory of Components Supplied with an EX4600 Switch *(Continued)*

Component	Quantity
Front mounting brackets	2
Extension brackets	2
Power cords	2

SEE ALSO

Mounting an EX4600 Switch in a Rack or Cabinet | 79

Installing and Connecting an EX4600 Switch | 77

Mounting an EX4600 Switch in a Rack or Cabinet

IN THIS SECTION

You can mount the EX4600 switch on a four post 19-in. rack or cabinet using the mounting kit provided with the device.

For four post rack or cabinet installations, the mounting kit contains two front mounting rails with two matching rear mounting blades. This configuration allows either end of the switch to be mounted flush with the rack and still be adjustable for racks with different depths.

The remainder of this topic uses “rack” to mean “rack or cabinet”. Space the front and rear rack rails between 23 in (58.5 cm) to 30.25 in (76.8 cm) front-to-back.

Before You Begin Rack Installation

Before you begin mounting an EX4600 switch in the rack or cabinet:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See *Prevention of Electrostatic Discharge Damage*.
2. Verify that the site meets the requirements described in "Site Preparation Checklist for an EX4600 Switch" on page 48.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read *General Site Guidelines*, with particular attention to Chassis Lifting Guidelines for an EX4600 Switch.
5. Remove the switch from the shipping carton (see "Unpacking an EX4600 Switch" on page 78).
6. Ensure that you have the following parts and tools available to mount the switch in a rack:
   - ESD grounding strap (not provided).
   - Blades, rails, or brackets (provided).
     - For four-post installations:
       - One pair of rear mounting blades. These mounting blades support the rear of the chassis and must be installed (provided).
       - One pair of front mounting rails. The mounting blades slide into the mounting rails to support the switch (provided).
       - Twelve screws to secure the mounting rails to the chassis (provided).
       - Eight screws to secure the chassis and rear installation blades to the rack (not provided).
   - Appropriate screwdriver for the mounting screws (not provided).
   - Two power cords with plugs appropriate to your geographical location (provided).
   - RJ-45 cable and RJ-45 to DB-9 serial port adapter (not provided).

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

- Management host, such as a PC laptop, with a serial port (not provided).

Optional equipment: Grounding cable kit with bracket, lug, and three nuts with integrated washers.

WARNING: The EX4600 switch must be supported at all four corners. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.

CAUTION: The EX4600 require two people for installation. If you are installing the EX4600 switch above 60 in. (152.4 cm) from the floor, you can remove the power supplies and fan modules to minimize the weight before attempting to install the switch.

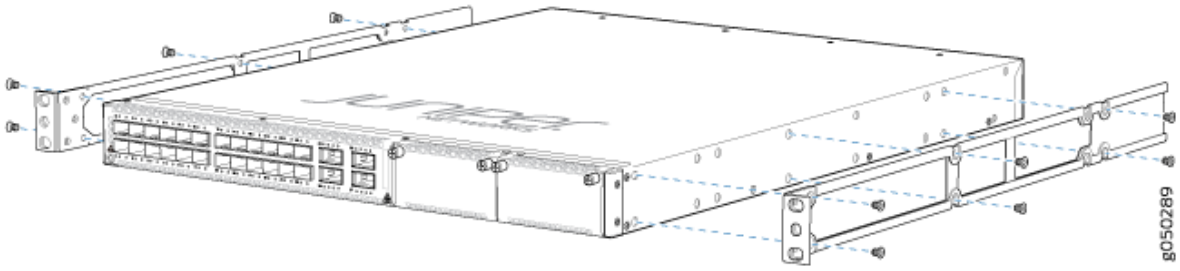
CAUTION: If you are mounting multiple switches on a rack, mount the switch in the lowest position of the rack first. Proceed to mount the rest of the switches from the bottom to the top of the rack to minimize the risk of the rack toppling.

Four Post Procedure

To mount the switch on four posts in a rack using the provided mounting kit:

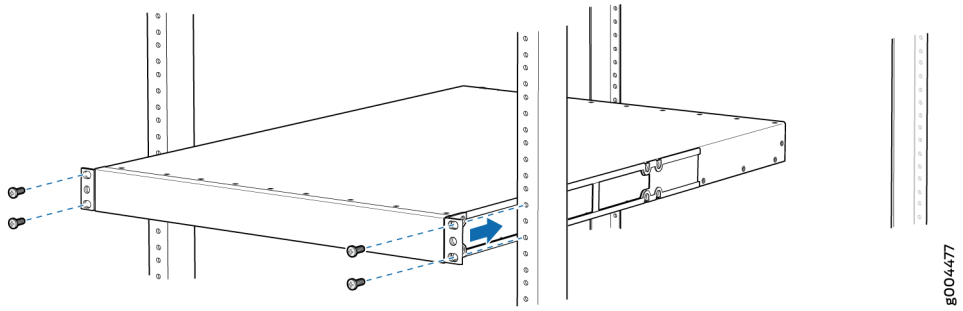
1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.
2. Decide whether the Field Replaceable Unit (FRU) end of the switch or the port end is to be placed at the front of the rack. Position the switch in such a manner that the **AIR IN** labels on components are next to the cold aisle and **AIR OUT** labels on components are next to the hot aisle.
3. Align the holes in the mounting rail with the holes on the side of the chassis. See Figure 29 on page 82 to see the proper alignment for the EX4600 switch.

Figure 29: Attaching Mounting Rails to the EX4600



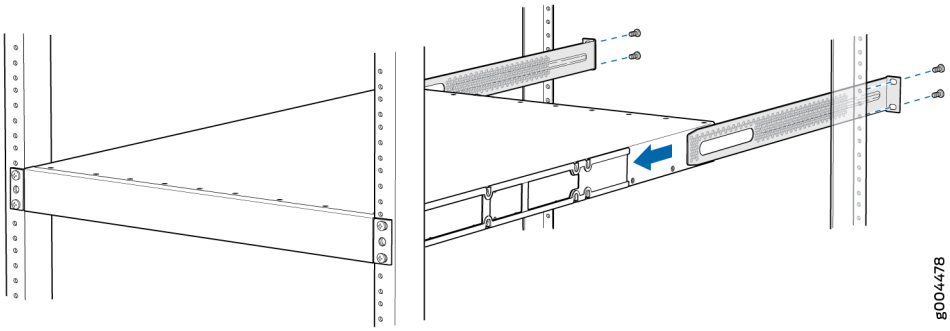
4. Attach the mounting rail to the switch using the mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.
5. Repeats steps 4 and 5 on the opposite side of the switch.
6. Have one person grasp both sides of the switch, lift it, and position it in the rack so that the front bracket is aligned with the rack holes.
7. Have a second person secure the front of the switch to the rack using four mounting screws (and cage nuts and washers if your rack requires them.) Tighten the screws. See Figure 30 on page 82 for examples of connecting the mounting rails and blades.

Figure 30: Attach EX4600 Switch to Rack



8. Continue to support the switch while sliding the rear mounting-blades into the channel of the side mounting-rails and securing the blades to the rack. Use the four mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. Tighten the screws. See Figure 31 on page 83.

Figure 31: Slide Mounting Blade into EX4600 Mounting Rail



9. Ensure that the switch chassis is level by verifying that all the screws on the front of the rack are aligned with the screws at the back of the rack.

RELATED DOCUMENTATION

Connecting AC Power to an EX4600 Switch | 85

Connecting DC Power to an EX4600 Switch | 88

Connecting the EX4600 to Power

IN THIS SECTION

Connecting Earth Ground to an EX4600 Switch

To ensure proper operation and to meet electromagnetic interference (EMI) requirements, you must connect an EX4600 switch to earth ground before you connect power to the switch. You must use the protective earthing terminal on the switch chassis to connect the switch to earth ground (see Figure 32 on page 85).

You must install the EX4600 switch in a restricted–access location and ensure that the chassis is always properly grounded. EX4600 switches have a two–hole protective grounding terminal provided on the left side of the chassis. EX4600 switches have a two–hole protective grounding terminal provided on the left side of the chassis. Under all circumstances, use this grounding connection to ground the chassis. For AC-powered systems, you must also use the grounding wire in the AC power cord along with the two-hole grounding lug connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

CAUTION: Ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable you supply. Using a grounding cable with an incorrectly attached lug can damage the switch.

NOTE: Mount your switch in the rack or cabinet before attaching the grounding lug to the switch. See "Mounting an EX4600 Switch in a Rack or Cabinet" on page 79.

Ensure that you have the parts and tools listed in Table 33 on page 84available:

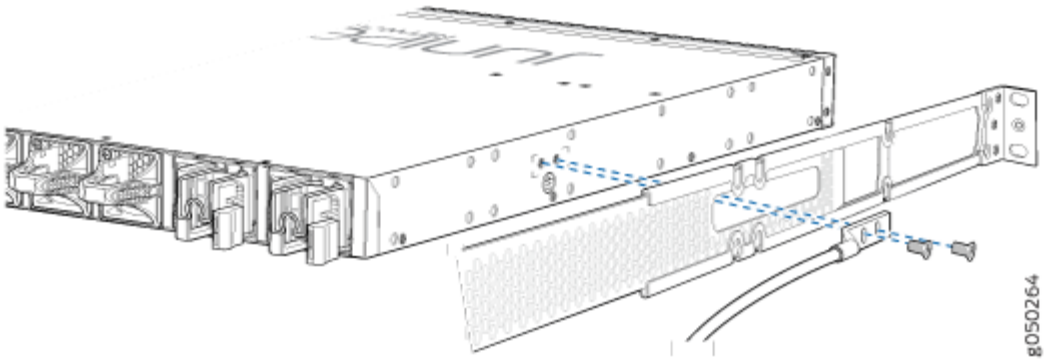
Table 33: Parts and Tools Required for Connecting an EX4600 Switch to Earth Ground

Item	Description
Earthing terminal location	Left side of the chassis
Protective earthing terminal bracket	This bracket attaches to the EX4600 switch chassis through the left front mounting bracket, providing a protective earthing terminal for the switch.
Grounding cable requirements	14 AWG (2 mm^2), minimum 90° C wire, or as permitted by the local code—not provided
Grounding lug specifications	Panduit LCD10-10A-L or equivalent—not provided
Screws to secure the grounding lug	Two SAE 10-32 screws and washers—not provided
Tools required	Number 2 Phillips (+) screwdriver—not provided Electrostatic discharge (ESD) grounding strap—not provided

To connect earth ground to a EX4600 switch:

1. Attach one end of the grounding cable to an appropriate earth ground site, such as the mounting rack.
2. Position the grounding lug over the protective earthing terminal on the side of the chassis, which is visible through the mounting bracket.
3. Secure the grounding lug to the protective earthing terminal with the washers and screws. See Figure 32 on page 85.

Figure 32: Connecting a Grounding Cable to an EX4600 Switch



4. Dress the grounding cable and ensure that it does not touch or block access to other device components and that it does not drape where people could trip over it.

SEE ALSO

General Safety Guidelines and Warnings | 143

Grounded Equipment Warning | 155

Connecting AC Power to an EX4600 Switch

Ensure that you have a power cord appropriate for your geographical location available to connect AC power to the switch.

Before you begin connecting AC power to the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- Ensure that you have connected the device chassis to earth ground.

CAUTION: For installations that require a separate grounding conductor to the chassis, have a licensed electrician complete this connection before you connect the switch to power. For instructions on connecting earth ground, see *Connect Earth Ground to an EX Series Switch*.

- Install the power supply in the chassis. For instructions on installing a power supply in an EX4600 switch, see "Installing a Power Supply in an EX4600 Switch" on page 107.

The EX4600 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

NOTE: Each power supply must be connected to a dedicated power source outlet.

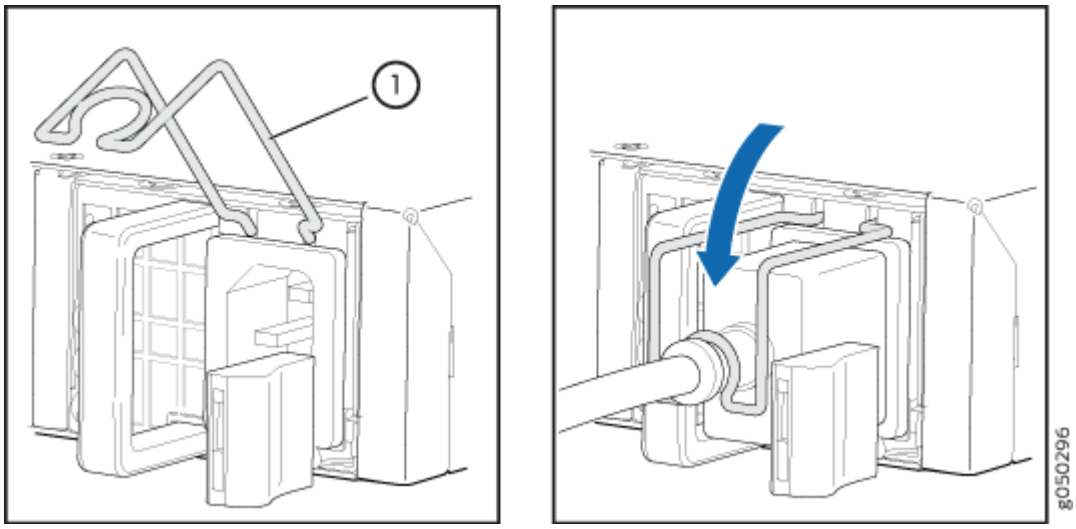
To connect AC power to an EX4600 switch:

1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure. If only one power supply is installed, ensure a that blank cover panel is installed over the second power supply slot.
3. Locate the power cord or cords shipped with the switch; the cords have plugs appropriate for your geographical location. See "AC Power Cord Specifications for an EX4600 Switch" on page 40.

   WARNING: Ensure that the power cord does not block access to device components or drape where people can trip on it.

4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate.
5. Push the power cord retainer onto the power cord (see Figure 33 on page 87).

Figure 33: Connecting an AC Power Cord to an AC Power Supply in an EX4600 Switch



1– Power cord retainer

6. If the AC power source outlet has a power switch, set it to the OFF (O) position.

> **NOTE**: The switch powers on as soon as power is provided to the power supply. There is no power switch on the device.

7. Insert the power cord plug into an AC power source outlet.
8. If the AC power source outlet has a power switch, set it to the ON (|) position.
9. Verify that the AC and DC LEDs on each power supply are lit green.

   If the amber fault LED is lit, remove power from the power supply, and replace the power supply (see"Removing a Power Supply from an EX4600 Switch" on page 105). Do not remove the power supply until you have a replacement power supply ready: the power supplies or a blank cover panel must be installed in the switch to ensure proper airflow.

> **CAUTION**: Replace a failed power supply with a blank panel or new power supply within 1 minute of removal to prevent chassis overheating.

SEE ALSO

AC Power Supply in an EX4600 Switch | 36

Connecting DC Power to an EX4600 Switch

Before you begin connecting DC power to the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- Ensure that you have connected the switch chassis to earth ground.

  CAUTION: Before you connect power to the switch, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the switch (for example, by causing a short circuit).

  To meet electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the switch chassis to connect to the earth ground. For instructions on connecting earth ground, see "Connecting Earth Ground to an EX4600 Switch" on page 83.
- Install the power supply in the chassis. For instructions on installing a power supply in an EX4600 switch, see "Installing a Power Supply in an EX4600 Switch" on page 107.

Ensure that you have the following parts and tools available:

- DC power source cables (14–16 AWG) with ring lug (Molex 190700069 or equivalent) (not provided)
- Phillips (+) screwdriver, number 2 (not provided)
- Multimeter (not provided)

The EX4600 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

WARNING: DC-powered EX4600 switches are intended for installation only in a restricted access location.

NOTE: The battery returns of the DC power supply should be connected as an isolated DC return (DC-I).

To connect DC power to an EX4600 switch:

1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Verify that the DC power cables are correctly labeled before making connections to the power supply. In a typical power distribution scheme where the return is connected to chassis ground at the battery plant, you can use a multimeter to verify the resistance of the –48V and RTN DC cables to chassis ground:
   - The cable with very low resistance (indicating a closed circuit) to chassis ground is positive (+) and will be installed on the V+ (return) DC power input terminal.
   - The cable with very high resistance (indicating an open circuit) to chassis ground is negative (–) and will be installed on the V– (input) DC power input terminal.

   CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the DC power input terminals on each power supply.
3. Install heat-shrink tubing insulation around the power cables.

   To install heat-shrink tubing:

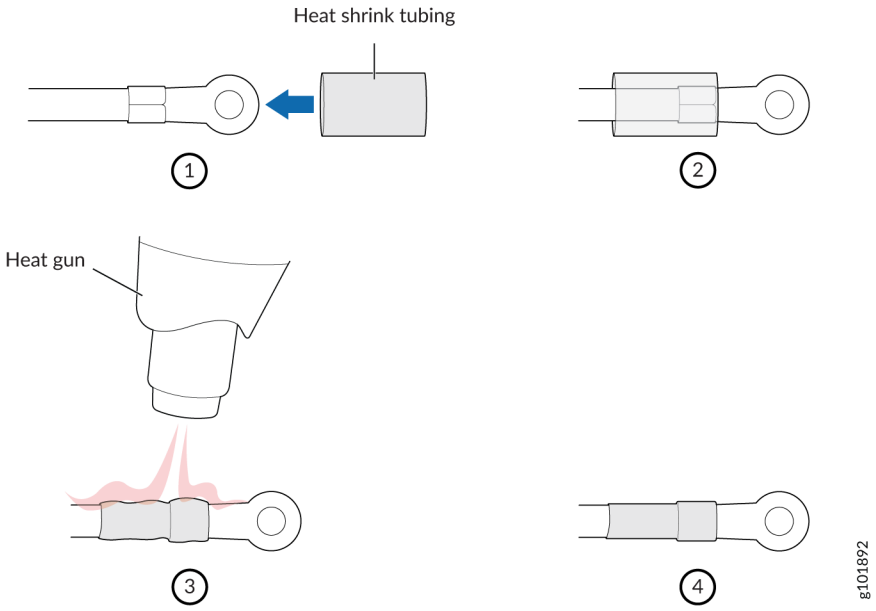
   a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

   b. Shrink the tubing with a heat gun. Ensure that you heat all sides of the tubing evenly so that it shrinks around the cable tightly.

   Figure 34 on page 90 shows the steps to install heat-shrink tubing.

   NOTE: Do not overheat the tubing.

Figure 34: How to Install Heat-Shrink Tubing



4. Ensure that the input circuit breaker is open so that the voltage across the DC power source cable leads is 0 V and that the cable leads do not become active while you are connecting DC power.

> **NOTE**: The V+ terminals are referred to as +RTN, and V– terminals are referred to as –48 V in *DC Power Wiring Sequence Warning* and *DC Power Electrical Safety Guidelines*.

5. Ensure that the power supplies are fully inserted in the chassis.
6. Remove the terminal block cover. The terminal block cover is a piece of clear plastic that snaps into place over the terminal block (see Figure 35 on page 92).
7. Remove the screws on the terminals using the screwdriver. Save the screws.

> **WARNING**: Ensure that the power cables do not block access to device components or drape where people can trip on them.

8. Connect each power supply to the power sources. Secure power source cables to the power supplies by screwing the ring lugs attached to the cables to the appropriate terminals by using the screw from the terminals (see Figure 35 on page 92 and Figure 36 on page 93).

   The EX4600 is designed to operate with a DC power supply that has a single, non-redundant, feed input. For source redundancy, two DC power supplies must be installed in EX4600; connect source

(A) to one power supply and connect source (B) to the second power supply. This configuration provides the commonly deployed A/B feed redundancy for the system.

The terminal block of the power supply has four terminals labeled V+, V+, V–, and V– for connecting DC power source cables labeled positive (+) and negative (–). The V+ terminals are shunted internally together, as are the V- terminals.

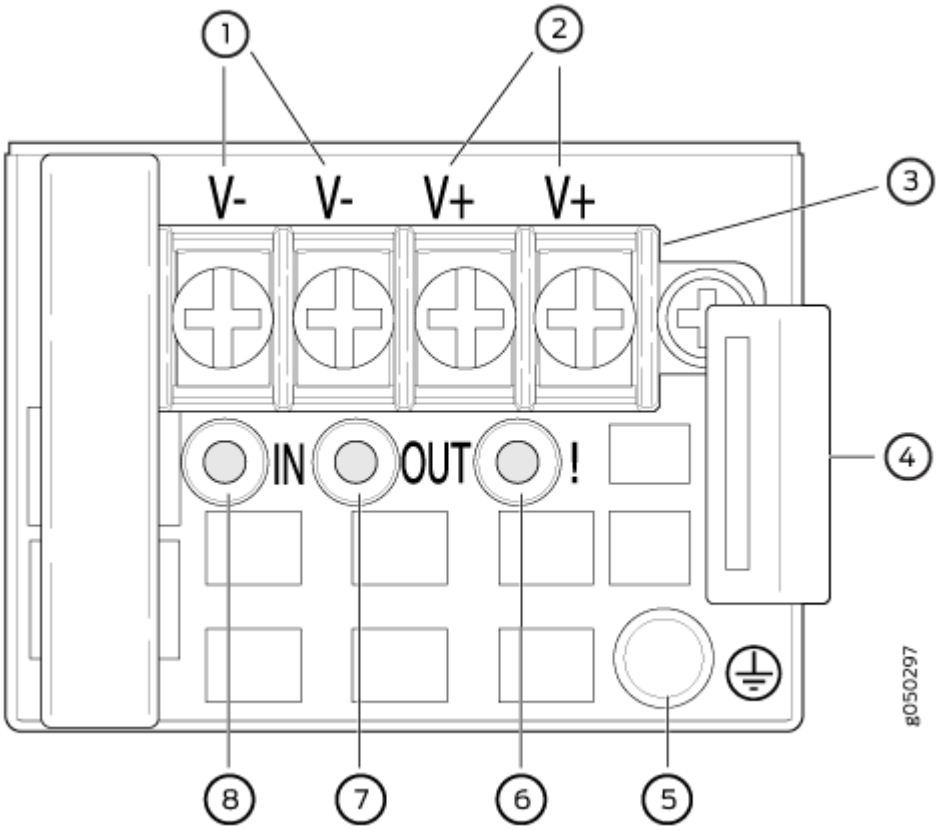
> ⚠ **CAUTION**: The connection between each power source and power supply must include a circuit breaker.
>
> Do not connect two sources to a single power supply because doing so can potentially cause circulating current in feed wires whenever there is any difference in the voltage of the two sources.

a. Secure the ring lug of the positive (+) DC power source cable to the V+ terminal on the DC power supply.

b. Secure the ring lug of the negative (–) DC power source cable to the V– terminal on the DC power supply.

c. Tighten the screws on the power supply terminals until snug using the screwdriver. Do not overtighten—apply between 5 in-lb (0.56 Nm) and 6 in-lb (0.68 Nm) of torque to the screws.

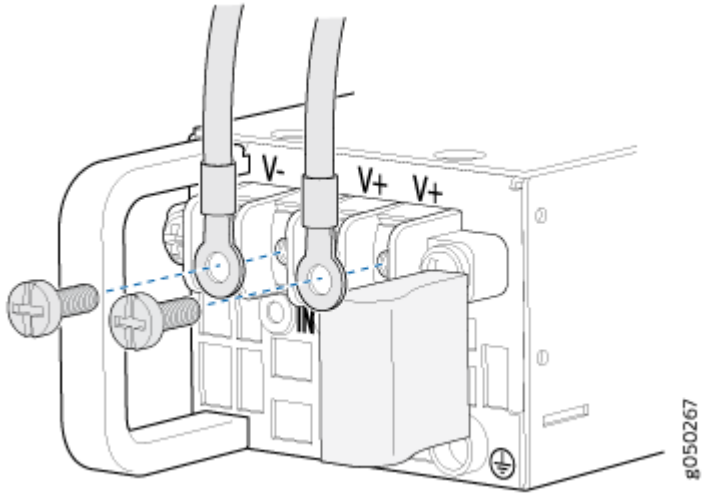
Figure 35: DC Power Supply Faceplate for an EX4600 Switch



1– Shunt negative input terminals (-48V)	5– ESD grounding point
2– Shunt positive input terminals (+RTN)	6– Fault LED
3– Terminal block	7– Output LED
4– Ejector lever	8– Input LED

CAUTION: The V+ terminals are shunted internally together, as are the V- terminals. The same polarity terminal can be wired together from the same source to provide an additional current path in a higher power chassis. Do not connect the terminals to different sources.

Figure 36: Securing Ring Lugs to the Terminals on the EX4600 DC Power Supply



9. Replace the terminal block cover.
10. Close the input circuit breaker.

> **NOTE**: The switch powers on as soon as power is provided to the power supply. There is no power switch on the device.

11. Verify that the **IN** and **OUT** LEDs on the power supply are lit green and are on steadily.

SEE ALSO

DC Power Supply in an EX4600 Switch | 42

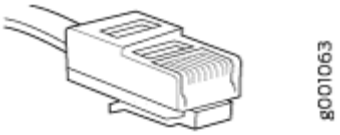
Connecting the EX4600 to Management Devices

IN THIS SECTION

Connect a Device to a Network for Out-of-Band Management

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end.

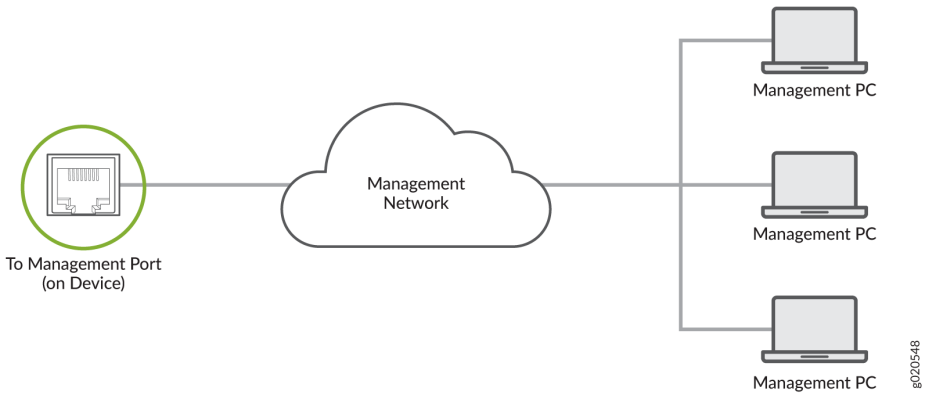
Figure 37: RJ-45 Connector on an Ethernet Cable



You can monitor and manage a network device, such as a router or a switch, by using a dedicated management channel. Each device has a management port to which you can connect an Ethernet cable with an RJ-45 connector. Use the management port to connect the device to the management device.

To connect a device to a network for out-of-band management:

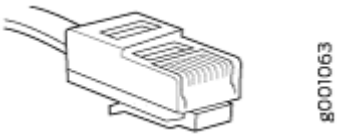
1. Connect one end of the Ethernet cable to the management port on the device.
2. Connect the other end of the Ethernet cable to the management device.



Connect a Device to a Management Console Using an RJ-45 Connector

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end and an RJ-45-to-DB-9 serial port adapter.

Figure 38: RJ-45 Connector on an Ethernet Cable



NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter, you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

NOTE: If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC directly to the device, use a combination of the RJ-45-to-DB-9 socket adapter and a USB-to-DB-9 plug adapter. You must provide the USB-to-DB-9 plug adapter.

You can configure and manage your network devices using a dedicated management channel. Each device has a console port that you can connect to using an Ethernet cable with an RJ-45 connector. Use the console port to connect the device to the console server or management console. The console port accepts a cable that has an RJ-45 connector.

To connect the device to a management console:

1. Connect one end of the Ethernet cable to the console port (labeled **CON**, **CONSOLE**, or **CON1**) on the device.
2. Connect the other end of the Ethernet cable to the console server (see Figure 39 on page 96) or management console (see Figure 40 on page 96).

Figure 39: Connect a Device to a Management Console Through a Console Server

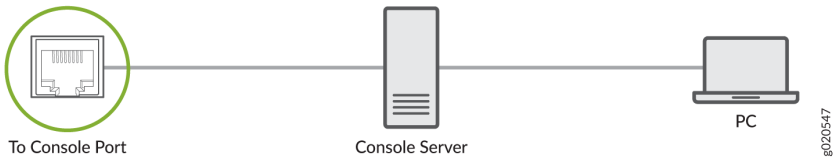


Figure 40: Connect a Device Directly to a Management Console

Connecting EX4600 Switches in a Virtual Chassis

EX4600 switches can be cabled together to create a Virtual Chassis in a ring topology. Each Virtual Chassis can have up to 10 switches (members) participating in the ring. The Virtual Chassis can be comprised of all EX4600 switches filling the primary Routing Engine (RE), backup RE, and linecard roles. You can also add EX4300 switches to the Virtual Chassis in the primary or backup roles.

Virtual Chassis can be installed in a single rack, multiple rack, or in wire closets.

You configure an EX4600 Virtual Chassis by configuring the SFP+ or QSFP+ interfaces into Virtual Chassis ports (VCPs). VCPs connect switches together to form a Virtual Chassis, and are responsible for passing all data and control traffic between member switches in the Virtual Chassis. All non-channelized QSFP+ uplink interfaces on standalone EX4600 switches can be configured into VCPs. All fixed SFP+ interfaces on EX4600 can also be configured into VCPs.

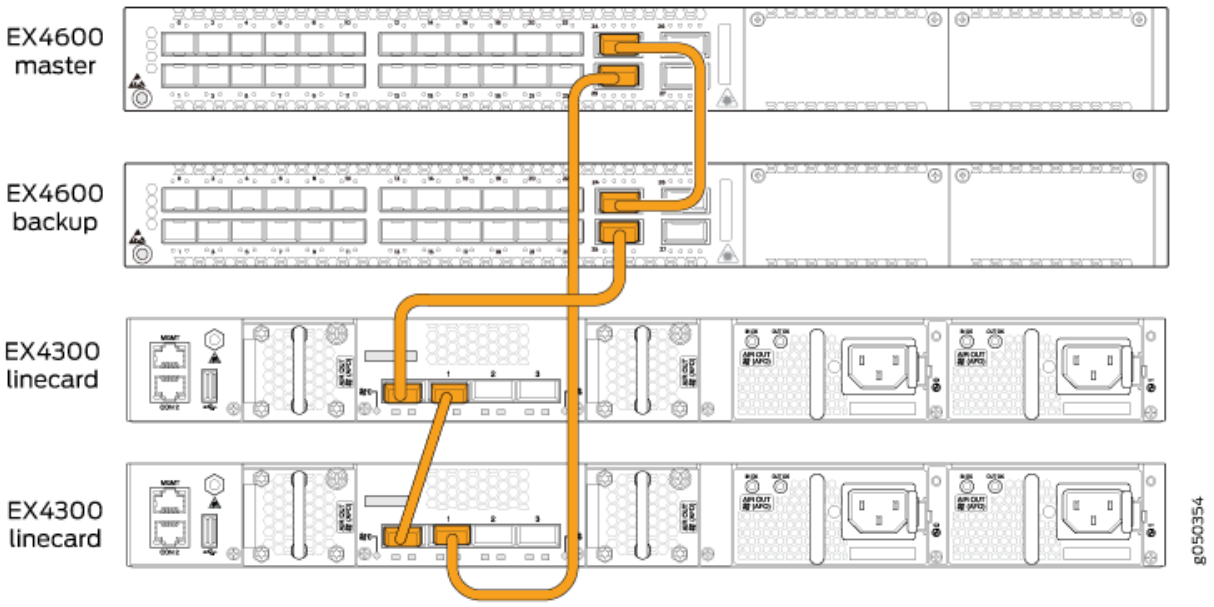
BEST PRACTICE: Use the 40-Gigabit interfaces for the VCPs.

In a mixed Virtual Chassis of EX4600 and EX4300 switches, the Junos OS release dictates whether the EX4600 is best used in the primary role. For Junos OS releases between 13.2X50-D10 and 14.1X53-D25, use the use the EX4300 as a primary and backup RE in the Virtual Chassis. For Junos OS Release 14.1X53-D25 and later, the EX4600 is fully supported as the primary in a mixed Virtual Chassis of

EX4600 and EX4300. Ensure all members of the Virtual Chassis are running the same Junos OS Release by issuing the `show chassis version` CLI command.

See for a diagram of how to cable two EX4600 switches and two EX4300 switches into a Virtual Chassis for Junos OS Release 14.1X53-D25 and later.

Figure 41: Four Member Virtual Chassis with EX4600 Primary and Backup



SEE ALSO

Port Panel of an EX4600 Switch | 18

Register Products—Mandatory to Validate SLAs

Juniper Networks auto registers newly purchased products based on the end customer information provided at the point of sale. Registering products and changes to products activates your hardware replacement service-level agreements (SLAs).

CAUTION: Update the installation base data if any installation base data is added or changed or if the installation base is moved. Juniper Networks is not responsible for customers not meeting the hardware replacement service-level agreement (SLA) for products that do not have registered serial numbers or accurate installation base data.

To know more about how to register your product and update your installation base, see Juniper Networks Product Registration and Install Base Management.

Configuring Junos OS on the EX4600

Before you begin connecting and configuring an EX4600 switch, set the following parameter values on the console server or PC:

- Baud Rate—9600
- Flow Control—None
- Data—8
- Parity—None
- Stop Bits—1
- DCD State—Disregard

You must perform the initial configuration of the EX4600 switch through the console port using the command-line interface (CLI).

To connect and configure the switch from the console:

1. Connect the console port to a laptop or PC using the RJ-45 cable and RJ-45 to DB-9 adapter. The console (**CON**) port is located on the management panel of the switch.

   NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

   - RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

2. Log in as **root**. There is no password. If the software booted before you connected to the console port, you might need to press the Enter key for the prompt to appear.

```
login: root
```

3. Start the CLI.

```
root@% cli
```

4. Enter configuration mode.

```
root> configure
```

5. Add a password to the root administration user account.

```
[edit]
root@# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

6. (Optional) Configure the name of the switch. If the name includes spaces, enclose the name in quotation marks (“ ”).

```
[edit]
root@# set system host-name host-name
```

7. Configure the default gateway.

```
[edit]
root@# set routing-options static route default next-hop address
```

8. Configure the IP address and prefix length for the switch management interface.

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

CAUTION: Although the CLI permits you to configure two management Ethernet interfaces within the same subnet, only one interface is usable and supported.

NOTE: The management ports, `em0` (**C0**) and `em1` (**C1**) are found on the management panel of the EX4600 switch.

9. (Optional) Configure the static routes to remote prefixes with access to the management port.

```
[edit]
root@# set routing-options static route remote-prefix next-hop destination-ip retain no-readvertise
```

10. Enable telnet service.

```
[edit]
root@# set system services telnet
```

NOTE: When Telnet is enabled, you cannot log in to the EX4600 switch through Telnet using root credentials. Root login is allowed only for SSH access.

11. Commit the configuration to activate it on the switch.

```
[edit]
root@# commit
```

RELATED DOCUMENTATION

Installing and Connecting an EX4600 Switch | 77

5

CHAPTER

Maintaining Components

IN THIS CHAPTER

Maintaining the EX4600 Switch Cooling System

IN THIS SECTION

Removing a Fan Module from an EX4600 Switch

Before you remove a fan module from an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available to remove a fan module from an EX4600 switch:

- ESD grounding strap
- Antistatic bag or an antistatic mat

The fan modules in an EX4600 switch are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed fan module with a new fan module within 1 minute of removal to prevent chassis overheating. Before removing the fan module, ensure you have a replacement fan module at hand.

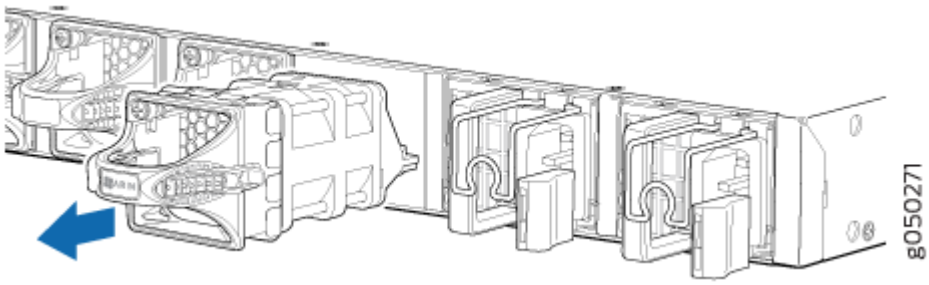
To remove a fan module from an EX4600 switch (see Figure 42 on page 103):

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
3. Using a Phillips screwdriver, loosen the locking screw (3 or 4 turns).
4. Grasp the handle on the fan module and squeeze the outside of the handle to release the module.

WARNING: To avoid injury, do not touch the fan with your hands or any tools as you slide the fan module out of the chassis—the fan might still be running.

5. Pull firmly to slide the fan module halfway out of the chassis.
6. When the fan stop spinning, slide the fan module completely out of the chassis.
7. Place the fan module in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

Figure 42: Removing a Fan Module from an EX4600 Switch



NOTE: When a fan module is removed, the CLI message **Fan/Blower is Absent** is logged in the system log, and the system raises a minor alarm.

SEE ALSO

Cooling System and Airflow in an EX4600 Switch | 29

Installing a Fan Module in an EX4600 Switch

Before you install a fan module in an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

The fan modules in an EX4600 switch are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed fan module with a new fan module within 1 minute of removal to prevent chassis overheating. Before removing the fan module, ensure you have a replacement fan module at hand.

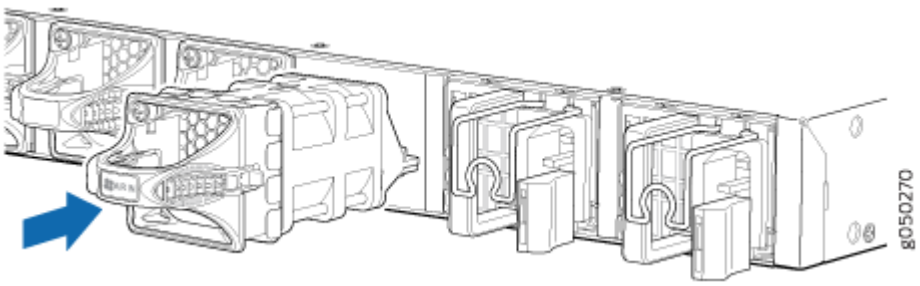
NOTE: The fan module provides FRU-to-port or port-to-FRU airflow depending on the switch product SKU you purchase. In legacy switches, or switches with an LCD, this airflow is called front to back and back to front.

To install a fan module in an EX4600 switch (see Figure 43 on page 104):

1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Taking care not to touch the connectors, remove the fan module from its bag.
3. Align the module with the open slot on the management panel of the chassis and slide it in until it is fully seated.

   CAUTION: Damage can occur if you attempt to install a fan module into a chassis with a different airflow direction. Compare the switch product SKU with the airflow marking on the handle to ensure that you are installing a fan module with the same airflow direction as the chassis. The fan modules are designed so that they can only be inserted into the EX4600 switch product SKU that supports the same airflow type. See "Cooling System and Airflow in an EX4600 Switch" on page 29 for more information.
4. Using a Phillips screwdriver, turn the locking screw until it is tight.

Figure 43: Installing a Fan Module in an EX4600 Switch



Maintaining the EX4600 Switch Power System

IN THIS SECTION

Removing a Power Supply from an EX4600 Switch

Before you remove a power supply from an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available to remove a power supply from an EX4600 switch:

- ESD grounding strap
- Antistatic bag or an antistatic mat
- Phillips (+) screwdriver, number 2 (DC power supply)

The EX4600 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

CAUTION: Replace the power supply with a new power supply within 1 minute of removal to prevent chassis overheating.

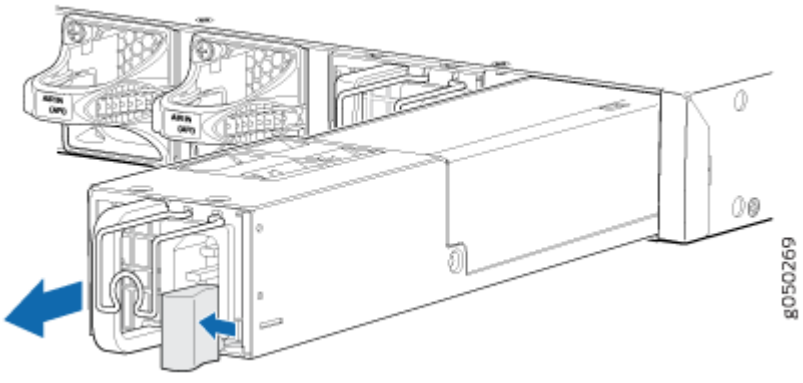
To remove a power supply from an EX4600 switch (see Figure 44 on page 106):

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.

NOTE: If only one power supply is installed in your EX4600 switch, you need to power off the switch before removing the power supply. See "Powering Off an EX4600 Switch" on page 122.

3. Disconnect power to the switch:
   - AC power supply—If the AC power source outlet has a power switch, set it to the OFF (O) position. If the AC power source outlet does not have a power switch, gently pull out the plug end of the power cord connected to the power source outlet.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the OFF position.
4. Remove the power source cable from the power supply faceplate:
   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the socket end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.
5. Slide the locking lever toward the handle until it stops.
6. Grasp the power supply handle and pull firmly to slide the power supply halfway out of the chassis.
7. Place one hand under the power supply to support it and slide it completely out of the chassis. Take care not to touch power supply components, pins, leads, or solder connections.
8. Place the power supply in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

Figure 44: Removing a Power Supply from an EX4600 Switch



SEE ALSO

AC Power Supply in an EX4600 Switch | 36

Installing a Power Supply in an EX4600 Switch

- Before you install a power supply in an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- Ensure that the airflow direction of the power supply is the same as the chassis. Labels on the power supply handle indicate the direction of airflow. See "Cooling System and Airflow in an EX4600 Switch" on page 29 for more information.

The EX4600 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the two slots next to the fan modules without powering off the switch or disrupting the switching function.

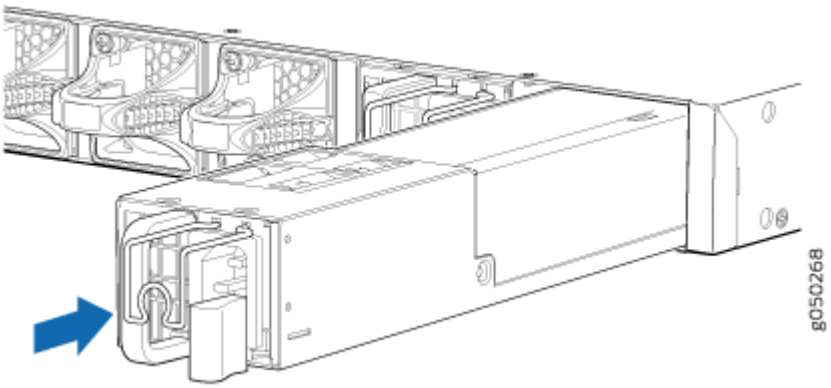
To install a power supply in an EX4600 switch (see Figure 45 on page 108):

1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Taking care not to touch power supply components, pins, leads, or solder connections, remove the power supply from its bag.

   CAUTION: Verify that the direction of the arrow on the power supply handle matches the direction of airflow in the chassis. Ensure that each power supply you install in the chassis has the same airflow direction. If you install power supplies with two different airflow directions, Junos OS raises an alarm, and the status (**ALM**) LED blinks amber.

3. Using both hands, place the power supply in the power supply slot on the FRU panel of the switch and slide it in until it is fully seated and the locking lever slides into place.

Figure 45: Installing a Power Supply in an EX4600 Switch



NOTE: Each power supply must be connected to a dedicated power source outlet.

To provide power redundancy to the system both power supplies must be installed. Connect power source feed A to one power supply and power source feed B to the second power supply.

CAUTION: Do not connect feed A and feed B to the same power supply input terminal.

NOTE: If you have a Juniper Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/support/tools/updateinstallbase/ . Failure to do so can result in significant delays if you need replacement parts. This note does not apply if you replace existing components with the same type of component.

Maintaining the Expansion Module in an EX4600 Switch

IN THIS SECTION

Removing an Expansion Module from an EX4600 Switch

Before you begin removing an expansion module from the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- If there are any transceivers installed in the expansion module, remove them before you remove the expansion module. For instructions on removing transceivers, see *Remove a Transceiver*.

Ensure that you have the following parts and tools available:

- ESD grounding strap
- Phillips screwdriver, number 2
- A replacement optional module or cover panel
- An antistatic bag or antistatic mat

The expansion modules used in EX4600 switches are hot-removable and hot-insertable field-replaceable units (FRUs): You can remove and replace them without powering off the switch.

The EX4600 is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of the default QFX-EM-4Q, the PFE reboots and all of the interfaces on the switch and expansion module temporarily go down. Likewise when an EX4600-EM-8F is running on the EX4600 and it is swapped with a QFX-EM-4Q, all of the interfaces temporarily go down, which can cause a short disruption in traffic.

CAUTION: We recommend that you install either a replacement optional module or a cover panel in the empty module slot to avoid chassis overheating and dust accumulation.

To remove an expansion module from the switch (see Figure 46 on page 110):

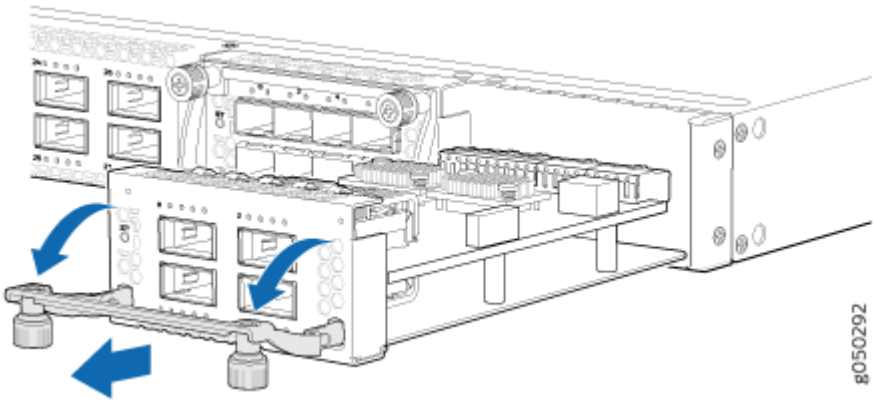
1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Unscrew both captive screws on the faceplate of the expansion module by using your fingers. If you are unable to unscrew the captive screws by using your fingers, use the screwdriver.
3. Hold the handle and gently pull the expansion module toward you and out of the module slot.
4. Place the expansion module in an antistatic bag or on an antistatic mat placed on a flat, stable surface.

5. If you are not replacing the expansion module with an optional module, install the cover panel over the slot.

> **NOTE**: After you have removed an expansion module, wait for at least 5 seconds before you install an expansion module. If you do not wait for at least 5 seconds, the interfaces on the expansion module might not come up.

Figure 46 on page 110 shows removing a QFX-EM-4Q expansion module from the port panel of a EX4600 switch.

Figure 46: Removing a QFX-EM-4Q Expansion Module from an EX4600 Switch



Installing an Expansion Module in an EX4600 Switch

Before you begin installing an expansion module in the switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available:

- ESD grounding strap. If a grounding strap is not available, follow the alternative grounding method described in Step 1 of the following procedure.
- Phillips (+) screwdriver, number 2

The EX4600 switch allows up to two expansion modules to be added to the port panel to increase port density. The EX4600 switch holds two bays of expansion modules that can be mixed and matched as desired. The supported modules are:

- QFX-EM-4Q–Each module adds four Quad Enhanced Small Form-Factor Pluggable (QSFP+) ports
- EX4600-EM-8F–Each module adds eight 10-Gigabit Ethernet SFP+ ports or 1-Gigabit SFP ports.

The EX4600 is configured for the QFX-EM-4Q by default, but any combination of the two modules is supported. Expansion modules can be hot-inserted or hot-removed. However, when an EX4600-EM-8F is inserted instead of the default QFX-EM-4Q, the PFE reboots and all of the interfaces on the switch and expansion module temporarily go down. Likewise when an EX4600-EM-8F is running on the EX4600 and it is swapped with a QFX-EM-4Q, all of the interfaces temporarily go down, which can cause a short disruption in traffic.

NOTE: When an expansion module is installed in the switch or an existing expansion module is replaced with another expansion module, the switch detects the ports on the expansion module. The switch creates the required interfaces when transceivers are installed in these ports.

To install an expansion module in an EX4600 switch (see Figure 47 on page 112):

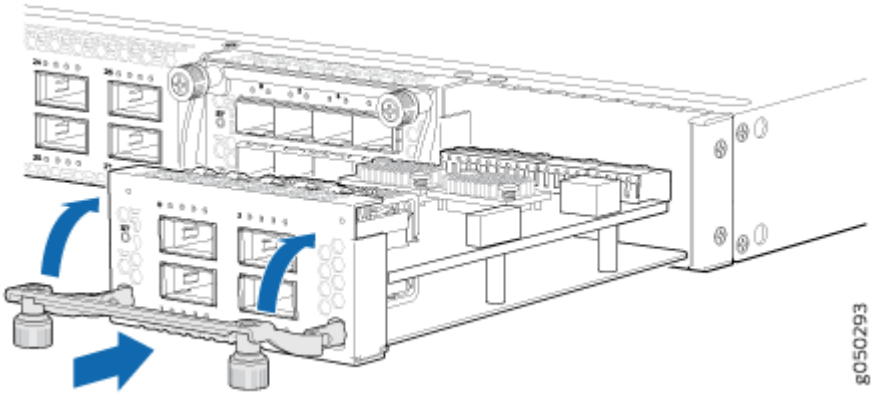
1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.

   If a grounding strap is not available, hold the expansion module in its antistatic bag in one hand and touch the exposed metallic part of the switch with the other hand to ground yourself and the component.
2. If the module slot has a cover panel on it, remove the cover panel by using the screwdriver and save it for later use.
3. Taking care not to touch module components, pins, leads, or solder connections, remove the expansion module from its bag.
4. Loosen the captive screws on the front faceplate of the expansion module by using your fingers. If you are unable to loosen the captive screws by using your fingers, use the screwdriver.
5. Using both hands, place the expansion module in the empty slot and slide it in gently until it is fully seated.

   NOTE: After you have removed an expansion module, wait for at least 5 seconds before you install an expansion module. If you do not wait for at least 5 seconds, the interfaces on the expansion module might not come up.
6. Raise the handle and tighten the captive screws by using your fingers or the screwdriver. When the **ST** LED turns green, the expansion module is ready for use.

Figure 47 on page 112 shows how to install a QSFP+ expansion module on the port panel of a EX4600 switch.

Figure 47: Installing a QFX4Q Expansion Module in an EX4600 Switch



NOTE: If you have a Juniper Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/support/tools/updateinstallbase/ . Failure to do so can result in significant delays if you need replacement parts. This note applies if you change the type of power supply or add a new type of expansion module. It does not apply if you replace these components with the same type of component.

Maintain Transceivers

IN THIS SECTION

Remove a Transceiver

Before you remove a transceiver from a device, ensure that you have taken the necessary precautions for the safe handling of lasers (see Laser and LED Safety Guidelines and Warnings).

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat
- Rubber safety caps to cover the transceiver and fiber-optic cable connector
- A dust cover to cover the port or a replacement transceiver

The transceivers for Juniper Networks devices are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace the transceivers without powering off the device or disrupting device functions.

NOTE: After you remove a transceiver, or when you change the media-type configuration, wait for 6 seconds for the interface to display the operational commands.

Figure 48 on page 114 shows how to remove a quad small form-factor pluggable plus (QSFP+) transceiver. The procedure is the same for all types of transceivers except the QSFP28 and C form-factor pluggable (CFP) transceivers.

To remove a transceiver from a device:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the rack.
3. Label the cable connected to the transceiver so that you can reconnect it correctly.

   LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

   LASER WARNING: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

   CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.

4. Remove the cable connected to the transceiver (see Disconnect a Fiber-Optic Cable). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.

5. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.
6. To remove an SFP56-DD, SFP, SFP+, XFP, a QSFP+, or QSFP56-DD transceiver:
   a. Using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.

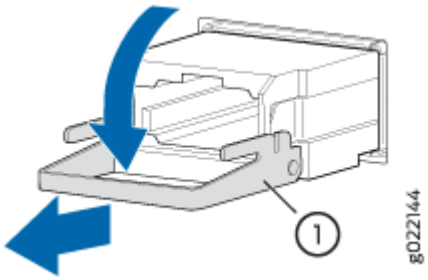
      Note that QSFP-DD and SFP-DD transceivers don't have ejector levers, instead they have a pull tab which can be used to unlock and remove the transceiver.

      CAUTION: Before removing the transceiver, make sure that you open the ejector lever completely until you hear it click. This precaution prevents damage to the transceiver.

   b. Grasp the transceiver ejector lever and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port.

      CAUTION: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

Figure 48: Remove a QSFP+ Transceiver



1– Ejector lever

To remove a CFP transceiver:

a. Using your fingers, loosen the screws on the transceiver.

b. Grasp the screws on the transceiver and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port.

CAUTION: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

7. Using your fingers, grasp the body of the transceiver and pull it straight out of the port.
8. Place the transceiver in the antistatic bag or on the antistatic mat placed on a flat, stable surface.
9. Place the dust cover over the empty port, or install the replacement transceiver.

Install a Transceiver

Before you install a transceiver in a device, ensure that you have taken the necessary precautions for safe handling of lasers (see Laser and LED Safety Guidelines and Warnings).

Ensure that you have a rubber safety cap available to cover the transceiver.

The transceivers for Juniper Networks devices are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace the transceivers without powering off the device or disrupting the device functions.

NOTE: After you insert a transceiver or after you change the media-type configuration, wait for 6 seconds for the interface to display operational commands.

NOTE: We recommend that you use only optical transceivers and optical connectors purchased from Juniper Networks with your Juniper Networks device.

CAUTION: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem running a Juniper device that uses third-party optical modules or cables, JTAC may help you diagnose host-related issues if the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

Use of third-party optical modules with high-power consumption (for example, coherent ZR or ZR+) can potentially cause thermal damage to or reduce the lifespan of the host equipment. Any damage to the host equipment due to the use of third-party optical

modules or cables is the users' responsibility. Juniper Networks will accept no liability for any damage caused due to such use.

Figure 49 on page 118 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers.

To install a transceiver:

CAUTION: To prevent electrostatic discharge (ESD) damage to the transceiver, do not touch the connector pins at the end of the transceiver.

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point or to the ESD point on the device.
2. Remove the transceiver from its bag.
3. Check to see whether the transceiver is covered with a rubber safety cap. If it is not, cover the transceiver with a rubber safety cap.

   LASER WARNING: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

4. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later. If you are hot-swapping a transceiver, wait for at least 10 seconds after removing the transceiver from the port before installing a new transceiver.
5. Using both hands, carefully place the transceiver in the empty port. The connectors must face the chassis.

   CAUTION: Before you slide the transceiver into the port, ensure that the transceiver is aligned correctly. Misalignment might cause the pins to bend, making the transceiver unusable.

6. Slide the transceiver in gently until it is fully seated. If you are installing a CFP transceiver, use your fingers to tighten the captive screws on the transceiver.
7. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

8. If there is a cable management system, arrange the cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs toward the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

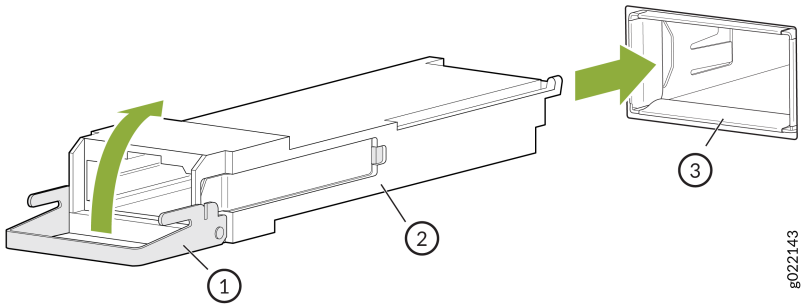
CAUTION: Avoid bending the fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

NOTE: When you install SFP-DD transceivers, push it hard until you hear a click sound. Use a long nose plier to pull the SFP-DD transceiver connected on the top and bottom rows of the chassis where the pull tabs face each other.

NOTE: Make sure to use a dust cap to cover ports that are unused.

NOTE: While using Finisar AOC SFP+ optical module with the QFX5130-48C switch, you may need to pull the module upwards to pull out the module smoothly from the cage.

Figure 49: Install a Transceiver



1– Ejector lever	3– Port
2– Transceiver	

Maintain Fiber-Optic Cables

IN THIS SECTION

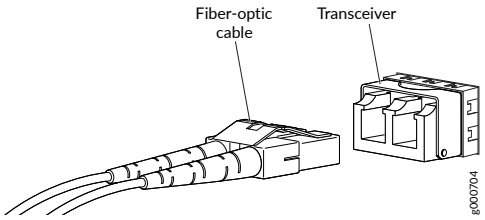
Connect a Fiber-Optic Cable

Before you connect a fiber-optic cable to an optical transceiver installed in a device, take the necessary precautions for safe handling of lasers (see Laser and LED Safety Guidelines and Warnings).

To connect a fiber-optic cable to an optical transceiver installed in a device:

LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

1. If the fiber-optic cable connector is covered with a rubber safety cap, remove the cap. Save the cap.
2. Remove the rubber safety cap from the optical transceiver. Save the cap.
3. Insert the cable connector into the optical transceiver.



4. Secure the cables so that they do not support their own weight. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on a loop helps cables maintain their shape.

CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.

Do not let fiber-optic cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

Disconnect a Fiber-Optic Cable

Before you disconnect a fiber-optic cable from an optical transceiver, ensure that you have taken the necessary precautions for safe handling of lasers. See Laser and LED Safety Guidelines and Warnings.

Ensure that you have the following parts and tools available:

- A rubber safety cap to cover the transceiver
- A rubber safety cap to cover the fiber-optic cable connector

Juniper Networks devices have optical transceivers to which you can connect fiber-optic cables.

To disconnect a fiber-optic cable from an optical transceiver installed in the device:

1. Disable the port in which the transceiver is installed by issuing the following command:

```
[edit interfaces]
user@device# set interface-name disable
```

LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

2. Carefully unplug the fiber-optic cable connector from the transceiver.
3. Cover the transceiver with a rubber safety cap.

LASER WARNING: Do not leave a fiber-optic transceiver uncovered except when inserting or removing a cable. The rubber safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

4. Cover the fiber-optic cable connector with the rubber safety cap.

How to Handle Fiber-Optic Cables

Fiber-optic cables connect to optical transceivers that are installed in Juniper Networks devices.

Follow these guidelines when handling fiber-optic cables:

- When you unplug a fiber-optic cable from a transceiver, place rubber safety caps over the transceiver and on the end of the cable.
- Anchor fiber-optic cables to prevent stress on the connectors. When attaching a fiber-optic cable to a transceiver, be sure to secure the fiber-optic cable so that it does not support its own weight as it hangs to the floor. Never let a fiber-optic cable hang free from the connector.
- Avoid bending the fiber-optic cables beyond their minimum bend radius. Bending fiber-optic cables into arcs smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cables in and out of optical instruments can damage the instruments, which are expensive to repair. To prevent damage from overuse, attach a short fiber extension to the optical equipment. The short fiber extension absorbs wear and tear due to frequent plugging and unplugging. Replacing the short fiber extension is easier and cost efficient compared with replacing the instruments.

- Keep fiber-optic cable connections clean. Microdeposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reduction in signal power, and possibly intermittent problems with the optical connection.
  - To clean the transceiver canal, use an appropriate fiber-cleaning device such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the instructions in the cleaning kit you use.
  - After cleaning the transceiver, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit such as the Opptex Cletop-S® Fiber Cleaner. Follow the instructions in the cleaning kit you use.

Removing the EX4600 Switch

IN THIS SECTION

Installing and Removing EX4600 Switch Hardware Components

The EX4600 switch chassis is a rigid sheet-metal structure that houses the hardware components. The field-replaceable units (FRUs) in EX4600 switches are:

- Power supply
- Fan module
- Expansion modules
- SFP+ transceiver
- QSFP+ transceiver

All of the EX4600 switch FRUs are hot-insertable and hot-removable: you can remove and replace them without powering off the switch or disrupting switch functions.

CAUTION: Replace a failed power supply with a new power supply within 1 minute of removal to prevent chassis overheating. Replace a failed fan module with a new fan within 1 minute of removal to prevent chassis overheating.

To install a power supply in a EX4600 switch, follow the instructions in "Installing a Power Supply in an EX4600 Switch" on page 107. To remove a power supply from a EX4600 switch, follow the instructions in "Removing a Power Supply from an EX4600 Switch" on page 105.

To install a fan module in a EX4600 switch, follow the instructions in "Installing a Fan Module in an EX4600 Switch" on page 103. To remove a fan module from a EX4600 switch, follow the instructions in "Removing a Fan Module from an EX4600 Switch" on page 102.

To install an SFP+ or QSFP+ transceiver in an EX4600 switch, follow the instructions in *Install a Transceiver*. To remove an SFP+ or QSFP+ transceiver from an EX4600 switch, follow the instructions in *Remove a Transceiver*.

To connect a fiber-optic cable to an SFP+ or QSFP+ transceiver in an EX4600 switch, follow the instructions in *Connect a Fiber-Optic Cable*. To disconnect a fiber-optic cable from an SFP+ or QSFP+ transceiver from an EX4600 switch, follow the instructions in *Disconnect a Fiber-Optic Cable*.

Powering Off an EX4600 Switch

Before you power off an EX4600 switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See *Prevention of Electrostatic Discharge Damage*.
- Ensure that you do not need to forward traffic through the switch.

Ensure that you have the following parts and tools available to power off the switch:

- An ESD grounding strap
- An external management device such as a PC
- An RJ-45 to DB-9 rollover cable to connect the external management device to the console port

To power off an EX4600 switch:

1. Connect to the switch using one of the following methods:
   - Connect a management device to the console (**CON**) port on a EX4600 switch. For instructions about connecting a management device to the console (**CON**) port, see *Connect a Device to a Management Console Using an RJ-45 Connector*.

- You can shut down the EX4600 switch from a management device on your out-of-band management network. For instructions about connecting a management device to the management (**CO** or **C1**) port, see Connecting an EX4600 Switch to a Network for Out-of-Band Management.

2. Shut down Junos OS from the external management device by issuing the `request system halt` operational mode CLI command. This command shuts down the switch gracefully and preserves system state information. A message appears on the console, confirming that the operating system has halted.

   You see the following output (or something similar, depending on the hardware being shut down) after entering the command:

```
Shutdown NOW!
System going down IMMEDIATELY


Terminated
Poweroff for hypervisor to respawn
Oct 25 10:35:05 init: event-processing (PID 1114) exited with status=1
Oct 25 10:35:05 init: packet-forwarding-engine (PID 1424) exited with status=8
.
Waiting (max 60 seconds) for system process `vnlru_mem' to stop...done
Waiting (max 60 seconds) for system process `vnlru' to stop...done
Waiting (max 60 seconds) for system process `bufdaemon' to stop...done
Waiting (max 60 seconds) for system process `syncer' to stop...
Syncing disks, vnodes remaining...0 0 0 0 done

syncing disks... All buffers synced.
Uptime: 11h0m30s
Normal shutdown (no dump device defined)
unloading fpga driver
unloading fx-scpld
Powering system off using ACPI
kvm: 28646: cpu0 disabled perfctr wrmsr: 0xc1 data 0xabcd
pci-stub 0000:01:00.2: transaction is not cleared; proceeding with reset anyway
pci-stub 0000:01:00.1: transaction is not cleared; proceeding with reset anyway
hub 1-1:1.0: over-current change on port 1
Stopping crond: [  OK  ]
Stopping libvirtd daemon: [  OK  ]
Shutting down ntpd: [  OK  ]
Shutting down system logger: [  OK  ]
Shutting down sntpc: [  OK  ]
Stopping sshd: [  OK  ]
```

```
Stopping vehostd: [  OK  ]
Stopping watchdog: [  OK  ]
Stopping xinetd: [  OK  ]
Sending all processes the TERM signal... [  OK  ]
Sending all processes the KILL signal... [  OK  ]
Saving random seed:  [  OK  ]
Syncing hardware clock to system time [  OK  ]
Turning off swap:  [  OK  ]
Unmounting file systems:  [  OK  ]
init: Re-executing /sbin/init
Halting system...
System halted.
```

CAUTION: The final output of any version of the `request system halt` command is the "The operating system has halted." Wait at least 60 seconds after first seeing this message before following the instructions in Step 4 and Step 5 to power off the switch.

3. Attach the grounding strap to your bare wrist and to a site ESD point.
4. Disconnect power to the switch by performing one of the following tasks:
   - AC power supply—If the AC power source outlet has a power switch, set it to the OFF (O) position. If the AC power source outlet does not have a power switch, gently pull out the plug end of the power cord connected to the power source outlet.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the OFF position.
5. Remove the power source cable from the power supply faceplate:
   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the socket end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.
6. Uncable the switch before removing it from the rack or cabinet.

Removing an EX4600 Switch from a Rack or Cabinet

Before removing an EX4600 switch from a rack:

Ensure that you have the following parts and tools available:

- A Phillips (+) screwdriver, number 2 or number 3, depending on the size of your rack mounting screws, for mounting the EX4600 switch on the rack.

If you need to relocate an installed EX4600 switch, use the procedure described in this topic. (The remainder of this topic uses “rack” to mean “rack or cabinet.”)

NOTE: When you remove multiple devices from a rack, remove the device in the top of the rack first and proceed to remove the rest of the devices from top to bottom.

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed EX4600 switch in its new location and along the path to the new location.
- Read *General Safety Guidelines and Warnings*.
- Ensure that the EX4600 switch has been safely powered off (see "Powering Off an EX4600 Switch" on page 122) and that you have unplugged (disconnected) the power cords.
- Ensure that you have disconnected any cables or wires attached to the EX4600 switch ports.

To remove a EX4600 switch from a rack or cabinet:

1. Have one person support the weight of the switch while another person uses the screwdriver to remove the front mounting screws that attach the chassis mounting brackets to the rack or cabinet.
2. Remove the EX4600 switch from the rack or cabinet.
3. Use the screwdriver to remove the mounting screws that attach the mounting blades attached to the rear of the rack or cabinet.
4. Place the removed screws and mounting blades in a labeled bag. You will need them when you reinstall the chassis.
5. Transport the EX4600 switch to your desired new location.

CHAPTER 6

Troubleshooting Hardware

IN THIS CHAPTER

Troubleshooting the EX4600 Components

IN THIS SECTION

Understand Alarm Types and Severity Levels on EX Series Switches

NOTE: This topic applies only to the J-Web Application package.

Alarms alert you to conditions that might prevent normal operation of the switch. Before monitoring alarms on a Juniper Networks EX Series Ethernet switch, become familiar with the terms defined in Table 34 on page 127.

Table 34: Alarm Terms

Term	Definition
alarm	Signal alerting you to conditions that might prevent normal operation. On a switch, the alarm signal is the **ALM** LED lit on the front of the chassis.
alarm condition	Failure event that triggers an alarm.
alarm severity	Seriousness of the alarm. If the Alarm (**ALM**) LED is red, this indicates a major alarm. If the Alarm LED is yellow or amber, this indicates a minor alarm. If the Alarm LED is unlit, there is no alarm or the switch is halted.
chassis alarm	Preset alarm triggered by a physical condition on the switch such as a power supply failure, excessive component temperature, or media failure.

Table 34: Alarm Terms *(Continued)*

Term	Definition
system alarm	Preset alarm triggered by a missing rescue configuration or failure to install a license for a licensed software feature. **NOTE**: On EX6200 switches, a system alarm can be triggered by an internal link error.

Alarm Types

The switch supports these alarms:

- Chassis alarms indicate a failure on the switch or one of its components. Chassis alarms are preset and cannot be modified.
- System alarms indicate a missing rescue configuration. System alarms are preset and cannot be modified, although you can configure them to appear automatically in the J-Web interface display or the CLI display.

Alarm Severity Levels

Alarms on switches have two severity levels:

- Major (red)—Indicates a critical situation on the switch that has resulted from one of the following conditions. A red alarm condition requires immediate action.
  - One or more hardware components have failed.
  - One or more hardware components have exceeded temperature thresholds.
  - An alarm condition configured on an interface has triggered a critical warning.
- Minor (yellow or amber)—Indicates a noncritical condition on the switch that, if left unchecked, might cause an interruption in service or degradation in performance. A yellow or amber alarm condition requires monitoring or maintenance.

  A missing rescue configuration generates a yellow or amber system alarm.

SEE ALSO

Dashboard for EX Series Switches

Interface Alarm Messages

Interface alarms are alarms that you configure to alert you when an interface is down.

To configure an interface link-down condition to trigger a red or yellow alarm, or to configure the link-down condition to be ignored, use the `alarm` statement at the [`edit chassis`] hierarchy level. You can specify the `ethernet`, `fibre-channel`, or `management-ethernet` interface type.

NOTE: Fibre Channel alarms are valid only on QFX3500 devices.

NOTE: When red alarms or major alarms are issued on QFX5100 or EX4600 switches, the alarm LED glows amber instead of red.

By default, major alarms are configured for interface link-down conditions on the control plane and management network interfaces in a QFabric system. The link-down alarms indicate that connectivity to the control plane network is down. You can configure these alarms to be ignored using the `alarm` statement at the [`edit chassis`] hierarchy level.

NOTE: If you configure a yellow alarm on the QFX3008-I Interconnect device, it is handled as a red alarm.

Creating an Emergency Boot Device

Before you begin, you need to download the installation media image for your device and Junos OS release from https://www.juniper.net/customers/support/ .

If Junos OS on the device is damaged in some way that prevents the software from loading properly, you can use an emergency boot device to repartition the primary disk and load a fresh installation of Junos OS. Use the following procedure to create an emergency boot device.

NOTE: In the following procedure, we assume that you are creating the emergency boot device on a switch. You can create the emergency boot device on another Juniper Networks switch or router, or any PC or laptop that supports Linux. The steps you take to create the emergency boot device vary, depending on the device.

To create an emergency boot device:

1. Use FTP to copy the installation media image into the **/var/tmp** directory on the device.

2. Insert a USB device into the USB port.
3. From the Junos OS command-line interface (CLI), start the shell:

```
user@device> start shell
%
```

4. Switch to the root account using the `su` command:

```
% su
Password: password
```

> **NOTE**: The password is the root password for the device. If you logged in to the device as root, you do not need to perform this step.

5. Enter the following command on the device:

```
root@device% dd if=/var/tmp/filename of=/dev/da0 bs=1048576
```

The device writes the installation media image to the USB device:

```
root@device% dd if=/var/tmp/install-media-host-usb-ex-4e-flex-x86-64-18.3R1.10-secure.img
11006+1 records in
11006+1 records out
180332544 bytes transferred in 71.764266 secs (2512846 bytes/sec)
```

6. Log out of the shell:

```
root@device% exit
% exit
user@device>
```

Performing a Recovery Installation

If Junos OS on your device is damaged in some way that prevents the software from loading correctly, you may need to perform a recovery installation using an emergency boot device (for example, a USB

flash drive) to restore the default factory installation. Once you have recovered the software, you need to restore the device configuration. You can either create a new configuration as you did when the device was shipped from the factory, or if you saved the previous configuration, you can simply restore that file to the device.

If at all possible, you should try to perform the following steps before you perform the recovery installation:

1. Ensure that you have an emergency boot device to use during the installation. See "Creating an Emergency Boot Device" on page 129 for information on how to create an emergency boot device.
2. Copy the existing configuration in the file **/config/juniper.conf.gz** from the device to a remote system, such as a server, or to an emergency boot device. For extra safety, you can also copy the backup configurations (the files named **/config/juniper.conf.*n***, where *n* is a number from 0 through 9) to a remote system or to an emergency boot device.

   WARNING: The recovery installation process completely overwrites the entire contents of the internal flash storage.

3. Copy any other stored files to a remote system as desired.

To reinstall Junos OS:

1. Insert the emergency boot device into the device.
2. Power cycle the device.

   The emergency boot device (external USB install media) is detected. At this time, you can load the Junos OS from the emergency boot device onto the internal flash storage.

3. The software prompts you with the following options:

```
Junos Snapshot Installer - (c) Juniper Networks 2013
Reboot
Install Junos Snapshot
[13.2-20131115_x_132_x51_vjunos.0Boot to host shell [debug]
```

4. Select **Install Junos** to format the internal flash storage and install the Junos OS on the emergency boot device onto the internal flash storage.
5. The device copies the software from the emergency boot device, occasionally displaying status messages. Copying the software can take up to 12 minutes.

When the software is finished being copied from the emergency device to the device, the device then reboots from the internal flash storage on which the software was just installed. When the reboot is complete, the device displays the Junos OS login prompt:

```
root@device#
```

6. Create a new configuration as you did when the switch was shipped from the factory, or restore the previously saved configuration file to the device.
7. Remove the emergency boot device.

CHAPTER 7

Contacting Customer Support and Returning the Chassis or Components

IN THIS CHAPTER

Returning an EX4600 Chassis or Components

IN THIS SECTION

Returning an EX4600 Switch or Component for Repair or Replacement

If you need to return an EX4600 switch or component to Juniper Networks for repair or replacement, follow this procedure:

1. Determine the serial number of the component. For instructions, see "Locating the Serial Number on an EX4600 Switch or Component" on page 135.
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) as described in *Contact Customer Support to Obtain Return Material Authorization*.

   NOTE: Do not return any component to Juniper Networks unless you have first obtained an RMA number. Juniper Networks reserves the right to refuse shipments that do not have an RMA. Refused shipments are returned to the customer through collect freight.

3. Pack the switch or component for shipping as described in "Packing an EX4600 Switch or Component for Shipping" on page 138.

For more information about return and repair policies, see the customer support page at https://www.juniper.net/support/guidelines.html .

Locating the Serial Number on an EX4600 Switch or Component

IN THIS SECTION

If you are returning a switch or component to Juniper Networks for repair or replacement, you must locate the serial number of the switch or component. You must provide the serial number to the Juniper Networks Technical Assistance Center (JTAC) when you contact them to obtain a Return Materials Authorization (RMA). See *Contact Customer Support to Obtain Return Material Authorization*.

If the switch is operational and you can access the command-line interface (CLI), you can list serial numbers for the switch and for some components with a CLI command. If you do not have access to the CLI or if the serial number for the component does not appear in the command output, you can locate the serial number ID label on the switch or component.

NOTE: If you want to find the serial number ID label on a component, you need to remove the component from the switch chassis, for which you must have the required parts and tools available.

Listing the Chassis and Component Details Using the CLI

To list the EX4600 switch and components and their serial numbers, use the `show chassis hardware` CLI operational mode command.

```
user@device> show chassis hardware

{master:0}
root@RIDGE_IEEE> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                TC3113520021      EX4600-40F
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           EX4600-40F
FPC 0            REV 11   650-049940   TC3113520021      EX4600-40F
```

```
  CPU                   BUILTIN     BUILTIN          FPC CPU
  PIC 0                 BUILTIN     BUILTIN          24x10G-4x40G
    Xcvr 2      REV 01  740-011614  C09K04908        SFP-LX10
    Xcvr 12     REV 01  740-038152  MOC12301520030   SFP+-10G-CU1M
    Xcvr 13     REV 01  740-038152  MOC12301520030   SFP+-10G-CU1M
    Xcvr 14     REV 01  740-038152  MOC12301520030   SFP+-10G-CU1M
    Xcvr 15     REV 01  740-038152  MOC12301520030   SFP+-10G-CU1M
    Xcvr 20     REV 01  740-038153  MOC13461530030   SFP+-10G-CU3M
    Xcvr 21     REV 01  740-038153  MOC13461530030   SFP+-10G-CU3M
    Xcvr 22     REV 01  740-038153  MOC13461530030   SFP+-10G-CU3M
    Xcvr 23     REV 01  740-038153  MOC13461530030   SFP+-10G-CU3M
    Xcvr 24     REV 01  740-038153  MOC13461530030   QSFP+-40G-CU3M
  PIC 1         REV 02  611-049556  RS3113520027     EX4600-EM-8F
  PIC 2         REV 02  611-049555  RR3113310086     QFX-EM-4Q
    Xcvr 0      REV 01  740-038152  MOC12301520030   QSFP+-40G-CU1M
Power Supply 1  REV 03  740-041741  1GA23381854      JPSU-650W-AC-AFO
Fan Tray 0                                           QFX5100 Fan Tray 0, Front to Back
Airflow - AFO
Fan Tray 1                                           QFX5100 Fan Tray 1, Front to Back
Airflow - AFO
Fan Tray 2                                           QFX5100 Fan Tray 2, Front to Back
Airflow - AFO
Fan Tray 3                                           QFX5100 Fan Tray 3, Front to Back
Airflow - AFO
Fan Tray 4                                           QFX5100 Fan Tray 4, Front to Back
Airflow - AFO

{master:0}
root@RIDGE_IEEE>

root@RIDGE_IEEE> show version
fpc0:
```

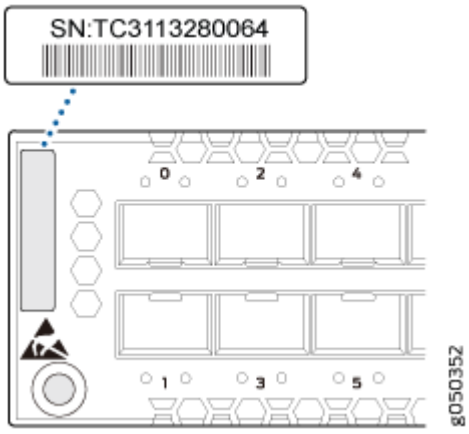
NOTE: The EX4600 and QFX5100 use the same fan modules. These modules are represented in CLI output as QFX5100 fan trays.

NOTE: You must remove the fan module to read the fan serial number from the serial number ID label. The fan module serial number cannot be viewed through the CLI. **Fan Tray 2** refers to the third module from the left, counting from 0.

Locating the Chassis Serial Number ID Label on an EX4600 Switch

The location for the chassis serial number ID label is found to the right of the 40 Gigabit Ethernet ports. See Figure 50 on page 137 for an example of where to find the serial number ID on the EX4600 switch.

Figure 50: Location of the Serial Number ID Label on an EX4600 Switch



Locating the Serial Number ID Labels on FRU Components

The power supplies, fan module, and expansion modules installed in EX4600 switches are field-replaceable units (FRUs). For each FRU, you must remove the FRU from the switch chassis to see the FRU serial number ID label.

- AC power supply—The serial number ID label is on the top of the AC power supply.
- Fan module—The serial number ID label is on the top of the fan module.
- Expansion module–The serial number ID label is in the middle of the printed circuit board (PCB).

Contact Customer Support to Obtain a Return Material Authorization

If you need to return a device or hardware component to Juniper Networks for repair or replacement, obtain an RMA number from JTAC. You must obtain an RMA number before you attempt to return the component.

After locating the serial number of the device or hardware component you want to return, open a service request with the JTAC on the Web or by telephone.

Before you request an RMA number from JTAC, be prepared to provide the following information:

- Your existing service request number, if you have one
- Serial number of the component
- Your name, organization name, telephone number, fax number, and shipping address
- Details of the failure or problem
- Type of activity being performed on the device when the problem occurred
- Configuration data displayed by one or more `show` commands

You can contact JTAC 24 hours a day, seven days a week, on the Web or by telephone:

- Service Request Manager: https://support.juniper.net/support
- Telephone: +1-888-314-JTAC (+1-888-314-5822), toll free in U.S., Canada, and Mexico

NOTE: For international or direct-dial options in countries without toll free numbers, see https://support.juniper.net/support.

If you are contacting JTAC by telephone, enter your 12-digit service request number followed by the pound (#) key for an existing case, or press the star (*) key to be routed to the next available support engineer.

The support representative validates your request and issues an RMA number for return of the component.

Packing an EX4600 Switch or Component for Shipping

IN THIS SECTION

If you are returning an EX4600 switch or component to Juniper Networks for repair or replacement, pack the item as described in this topic.

Before you pack an EX4600 switch or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See *Prevention of Electrostatic Discharge Damage*.
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials. See *Contact Customer Support to Obtain Return Material Authorization*.

Ensure that you have the following parts and tools available:

- ESD grounding strap.
- Antistatic bag, one for each component.
- If you are returning the chassis, an appropriate screwdriver for the mounting screws used on your rack or cabinet.

Packing an EX4600 Switch for Shipping

To pack an EX4600 switch for shipping:

1. Power down the switch and remove the power cables. See "Powering Off an EX4600 Switch" on page 122.
2. Remove the cables that connect the EX4600 switch to all external devices.
3. Remove all field-replaceable units (FRUs) from the switch.
4. Have one person support the weight of the switch while another person unscrews and removes the mounting screws.
5. Remove the switch from the rack or cabinet (see Chassis Lifting Guidelines for an EX4600 Switch) and place the switch in an antistatic bag.
6. Place the switch in the shipping carton.
7. Place the packing foam on top of and around the switch.
8. If you are returning accessories or FRUs with the switch, pack them as instructed in "Packing EX4600 Switch Components for Shipping" on page 139.
9. Replace the accessory box on top of the packing foam.
10. Close the top of the cardboard shipping box and seal it with packing tape.
11. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing EX4600 Switch Components for Shipping

CAUTION: Do not stack switch components. Return individual components in separate boxes if they do not fit together on one level in the shipping box.

To pack and ship EX4600 switch components:

- Place individual FRUs in antistatic bags.
- Ensure that the components are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Close the top of the cardboard shipping box and seal it with packing tape.
- Write the RMA number on the exterior of the box to ensure proper tracking.

8
CHAPTER

Safety and Compliance Information

IN THIS CHAPTER

General Safety Guidelines and Warnings

The following guidelines help ensure your safety and protect the device from damage. The list of guidelines might not address all potentially hazardous situations in your working environment, so be alert and exercise good judgment at all times.

- Perform only the procedures explicitly described in the hardware documentation for this device. Make sure that only authorized service personnel perform other system services.
- Keep the area around the device clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which could become caught in the device.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the device only when it is properly grounded.
- Follow the instructions in this guide to properly ground the device to earth.
- Replace fuses only with fuses of the same type and rating.
- Do not open or remove chassis covers or sheet-metal parts unless instructions are provided in the hardware documentation for this device. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.
- Avoid spilling liquid onto the chassis or onto any device component. Such an action could cause electrical shock or damage the device.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.

- Some parts of the chassis, including AC and DC power supply surfaces, power supply unit handles, SFB card handles, and fan tray handles might become hot. The following label provides the warning for hot surfaces on the chassis:

- Always ensure that all modules, power supplies, and cover panels are fully inserted and that the installation screws are fully tightened.

Definitions of Safety Warning Levels

The documentation uses the following levels of safety warnings (there are two *Warning* formats):

NOTE: You might find this information helpful in a particular situation, or you might overlook this important information if it was not highlighted in a Note.

CAUTION: You need to observe the specified guidelines to prevent minor injury or discomfort to you or severe damage to the device.

Attention Veillez à respecter les consignes indiquées pour éviter toute incommodité ou blessure légère, voire des dégâts graves pour l'appareil.

LASER WARNING: This symbol alerts you to the risk of personal injury from a laser.

Avertissement Ce symbole signale un risque de blessure provoquée par rayon laser.

WARNING: This 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 familiarize yourself with standard practices for preventing accidents.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient

u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

Avertissement Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

¡Atención! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

Qualified Personnel Warning

WARNING: Only trained and qualified personnel should install or replace the device.
Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

Varoitus Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.

Avertissement Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.

Warnung Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.

Avvertenza Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.

Advarsel Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.

Aviso Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.

¡Atención! Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.

Varning! Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.

Warning Statement for Norway and Sweden

WARNING: The equipment must be connected to an earthed mains socket-outlet.
Advarsel Apparatet skal kobles til en jordet stikkontakt.

Varning! Apparaten skall anslutas till jordat nätuttag.

Fire Safety Requirements

IN THIS SECTION

In the event of a fire emergency, the safety of people is the primary concern. You should establish procedures for protecting people in the event of a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, you should establish procedures to protect your equipment in the event of a fire emergency. Juniper Networks products should be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available in the event of a fire in the vicinity of the equipment and that all local fire, safety, and electrical codes and ordinances be observed when you install and operate your equipment.

Fire Suppression

In the event of an electrical hazard or an electrical fire, you should first turn power off to the equipment at the source. Then use a Type C fire extinguisher, which uses noncorrosive fire retardants, to extinguish the fire.

Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide and Halotron™, are most effective for suppressing electrical fires. Type C fire extinguishers displace oxygen from the point of combustion to eliminate the fire. For extinguishing fire on or around equipment that draws air from the environment for cooling, you should use this type of inert oxygen displacement extinguisher instead of an extinguisher that leaves residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers). The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and

difficult to clean. In addition, in the presence of minute amounts of moisture, monoammonium phosphate can become highly corrosive and corrodes most metals.

Any equipment in a room in which a chemical fire extinguisher has been discharged is subject to premature failure and unreliable operation. The equipment is considered to be irreparably damaged.

NOTE: To keep warranties effective, do not use a dry chemical fire extinguisher to control a fire at or near a Juniper Networks device. If a dry chemical fire extinguisher is used, the unit is no longer eligible for coverage under a service agreement.

We recommend that you dispose of any irreparably damaged equipment in an environmentally responsible manner.

Installation Instructions Warning

WARNING: Read the installation instructions before you connect the device to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Avertissement Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.

Warnung Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

Avvertenza Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

Aviso Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.

¡Atención! Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.

Varning! Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.

Chassis and Component Lifting Guidelines

- Before moving the device to a site, ensure that the site meets the power, environmental, and clearance requirements.
- Before lifting or moving the device, disconnect all external cables and wires.
- As when lifting any heavy object, ensure that your legs bear most of the weight rather than your back. Keep your knees bent and your back relatively straight. Do not twist your body as you lift. Balance the load evenly and be sure that your footing is firm.
- Use the following lifting guidelines to lift devices and components:
  - Up to 39.7 lb (18 kg): One person.
  - From 39.7 lb (18 kg) to 70.5 lb (32 kg): Two or more people.
  - From 70.5 lb (32 kg) to 121.2 lb (55 kg): Three or more people.
  - Above 121.2 lb (55 kg): Use material handling systems (such as levers, slings, lifts, and so on). When this is not practical, engage specially trained persons or systems (such as riggers or movers).

Restricted Access Warning

WARNING: This unit is intended for installation in restricted access areas. A restricted access area is an area to which access can be gained only by service personnel through the use of a special tool, lock and key, or other means of security, and which is controlled by the authority responsible for the location.

Waarschuwing Dit toestel is bedoeld voor installatie op plaatsen met beperkte toegang. Een plaats met beperkte toegang is een plaats waar toegang slechts door servicepersoneel verkregen kan worden door middel van een speciaal instrument, een slot en sleutel, of een ander veiligheidsmiddel, en welke beheerd wordt door de overheidsinstantie die verantwoordelijk is voor de locatie.

Varoitus Tämä laite on tarkoitettu asennettavaksi paikkaan, johon pääsy on rajoitettua. Paikka, johon pääsy on rajoitettua, tarkoittaa paikkaa, johon vain huoltohenkilöstö pääsee jonkin erikoistyökalun, lukkoon sopivan avaimen tai jonkin muun turvalaitteen avulla ja joka on paikasta vastuussa olevien toimivaltaisten henkilöiden valvoma.

Avertissement Cet appareil est à installer dans des zones d'accès réservé. Ces dernières sont des zones auxquelles seul le personnel de service peut accéder en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout autre moyen de sécurité. L'accès aux zones de sécurité est sous le contrôle de l'autorité responsable de l'emplacement.

Warnung Diese Einheit ist zur Installation in Bereichen mit beschränktem Zutritt vorgesehen. Ein Bereich mit beschränktem Zutritt ist ein Bereich, zu dem nur Wartungspersonal mit einem Spezialwerkzeugs, Schloß und Schlüssel oder anderer Sicherheitsvorkehrungen Zugang hat, und der von dem für die Anlage zuständigen Gremium kontrolliert wird.

Avvertenza Questa unità deve essere installata in un'area ad accesso limitato. Un'area ad accesso limitato è un'area accessibile solo a personale di assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di sicurezza, ed è controllata dall'autorità responsabile della zona.

Advarsel Denne enheten er laget for installasjon i områder med begrenset adgang. Et område med begrenset adgang gir kun adgang til servicepersonale som bruker et spesielt verktøy, lås og nøkkel, eller en annen sikkerhetsanordning, og det kontrolleres av den autoriteten som er ansvarlig for området.

Aviso Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço autorizado, que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança. Esta área é controlada pela autoridade responsável pelo local.

¡Atención! Esta unidad ha sido diseñada para instalarse en áreas de acceso restringido. Área de acceso restringido significa un área a la que solamente tiene acceso el personal de servicio mediante la utilización de una herramienta especial, cerradura con llave, o algún otro medio de seguridad, y que está bajo el control de la autoridad responsable del local.

Varning! Denna enhet är avsedd för installation i områden med begränsat tillträde. Ett område med begränsat tillträde får endast tillträdas av servicepersonal med ett speciellt verktyg, lås och nyckel, eller annan säkerhetsanordning, och kontrolleras av den auktoritet som ansvarar för området.

Ramp Warning

WARNING: When installing the device, do not use a ramp inclined at more than 10 degrees.

Waarschuwing Gebruik een oprijplaat niet onder een hoek van meer dan 10 graden.

Varoitus Älä käytä sellaista kaltevaa pintaa, jonka kaltevuus ylittää 10 astetta.

Avertissement Ne pas utiliser une rampe dont l'inclinaison est supérieure à 10 degrés.

Warnung Keine Rampen mit einer Neigung von mehr als 10 Grad verwenden.

Avvertenza Non usare una rampa con pendenza superiore a 10 gradi.

Advarsel Bruk aldri en rampe som heller mer enn 10 grader.

Aviso Não utilize uma rampa com uma inclinação superior a 10 graus.

¡Atención! No usar una rampa inclinada más de 10 grados.

Varning! Använd inte ramp med en lutning på mer än 10 grader.

Rack-Mounting and Cabinet-Mounting Warnings

Ensure that the rack or cabinet in which the device is installed is evenly and securely supported. Uneven mechanical loading could lead to a hazardous condition.

WARNING: To prevent bodily injury when mounting or servicing the device in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- Install the device in a rack that is secured to the building structure.
- Mount the device at the bottom of the rack if it is the only unit in the rack.
- When mounting the device on a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.

- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

Waarschuwing Om lichamelijk letsel te voorkomen wanneer u dit toestel in een rek monteert of het daar een servicebeurt geeft, moet u speciale voorzorgsmaatregelen nemen om ervoor te zorgen dat het toestel stabiel blijft. De onderstaande richtlijnen worden verstrekt om uw veiligheid te verzekeren:

- De Juniper Networks switch moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.
- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.
- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.
- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

Varoitus Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta vältytään loukkaantumiselta. Noudata seuraavia turvallisuusohjeita:

- Juniper Networks switch on asennettava telineeseen, joka on kiinnitetty rakennukseen.
- Jos telineessä ei ole muita laitteita, aseta laite telineen alaosaan.
- Jos laite asetetaan osaksi täytettyyn telineeseen, aloita kuormittaminen sen alaosasta kaikkein raskaimmalla esineellä ja siirry sitten sen yläosaan.
- Jos telinettä varten on vakaimet, asenna ne ennen laitteen asettamista telineeseen tai sen huoltamista siinä.

Avertissement Pour éviter toute blessure corporelle pendant les opérations de montage ou de réparation de cette unité en casier, il convient de prendre des précautions spéciales afin de maintenir la stabilité du système. Les directives ci-dessous sont destinées à assurer la protection du personnel:

- Le rack sur lequel est monté le Juniper Networks switch doit être fixé à la structure du bâtiment.

- Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.
- Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l'élément le plus lourd dans le bas.
- Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l'unité en casier.

Warnung Zur Vermeidung von Körperverletzung beim Anbringen oder Warten dieser Einheit in einem Gestell müssen Sie besondere Vorkehrungen treffen, um sicherzustellen, daß das System stabil bleibt. Die folgenden Richtlinien sollen zur Gewährleistung Ihrer Sicherheit dienen:

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

Avvertenza Per evitare infortuni fisici durante il montaggio o la manutenzione di questa unità in un supporto, occorre osservare speciali precauzioni per garantire che il sistema rimanga stabile. Le seguenti direttive vengono fornite per garantire la sicurezza personale:

- Il Juniper Networks switch deve essere installato in un telaio, il quale deve essere fissato alla struttura dell'edificio.
- Questa unità deve venire montata sul fondo del supporto, se si tratta dell'unica unità da montare nel supporto.
- Quando questa unità viene montata in un supporto parzialmente pieno, caricare il supporto dal basso all'alto, con il componente più pesante sistemato sul fondo del supporto.
- Se il supporto è dotato di dispositivi stabilizzanti, installare tali dispositivi prima di montare o di procedere alla manutenzione dell'unità nel supporto.

Advarsel Unngå fysiske skader under montering eller reparasjonsarbeid på denne enheten når den befinner seg i et kabinett. Vær nøye med at systemet er stabilt. Følgende retningslinjer er gitt for å verne om sikkerheten:

- Juniper Networks switch må installeres i et stativ som er forankret til bygningsstrukturen.
- Denne enheten bør monteres nederst i kabinettet hvis dette er den eneste enheten i kabinettet.
- Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.
- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

Aviso Para se prevenir contra danos corporais ao montar ou reparar esta unidade numa estante, deverá tomar precauções especiais para se certificar de que o sistema possui um suporte estável. As seguintes directrizes ajudá-lo-ão a efectuar o seu trabalho com segurança:

- O Juniper Networks switch deverá ser instalado numa prateleira fixa à estrutura do edificio.
- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

¡Atención! Para evitar lesiones durante el montaje de este equipo sobre un bastidor, oeriormente durante su mantenimiento, se debe poner mucho cuidado en que el sistema quede bien estable. Para garantizar su seguridad, proceda según las siguientes instrucciones:

- El Juniper Networks switch debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.

- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

Varning! För att undvika kroppsskada när du installerar eller utför underhållsarbete på denna enhet på en ställning måste du vidta särskilda försiktighetsåtgärder för att försäkra dig om att systemet står stadigt. Följande riktlinjer ges för att trygga din säkerhet:

- Juniper Networks switch måste installeras i en ställning som är förankrad i byggnadens struktur.
- Om denna enhet är den enda enheten på ställningen skall den installeras längst ned på ställningen.
- Om denna enhet installeras på en delvis fylld ställning skall ställningen fyllas nedifrån och upp, med de tyngsta enheterna längst ned på ställningen.
- Om ställningen är försedd med stabiliseringsdon skall dessa monteras fast innan enheten installeras eller underhålls på ställningen.

Grounded Equipment Warning

WARNING: This device must be properly grounded at all times. Follow the instructions in this guide to properly ground the device to earth.

Waarschuwing Dit apparaat moet altijd goed geaard zijn. Volg de instructies in deze gids om het apparaat goed te aarden.

Varoitus Laitteen on oltava pysyvästi maadoitettu. Maadoita laite asianmukaisesti noudattamalla tämän oppaan ohjeita.

Avertissement L'appareil doit être correctement mis à la terre à tout moment. Suivez les instructions de ce guide pour correctement mettre l'appareil à la terre.

Warnung Das Gerät muss immer ordnungsgemäß geerdet sein. Befolgen Sie die Anweisungen in dieser Anleitung, um das Gerät ordnungsgemäß zu erden.

Avvertenza Questo dispositivo deve sempre disporre di una connessione a massa. Seguire le istruzioni indicate in questa guida per connettere correttamente il dispositivo a massa.

Advarsel Denne enheten på jordes skikkelig hele tiden. Følg instruksjonene i denne veiledningen for å jorde enheten.

Aviso Este equipamento deverá estar ligado à terra. Siga las instrucciones en esta guía para conectar correctamente este dispositivo a tierra.

¡Atención! Este dispositivo debe estar correctamente conectado a tierra en todo momento. Siga las instrucciones en esta guía para conectar correctamente este dispositivo a tierra.

Varning! Den här enheten måste vara ordentligt jordad. Följ instruktionerna i den här guiden för att jorda enheten ordentligt.

Laser and LED Safety Guidelines and Warnings

IN THIS SECTION

Juniper Networks devices are equipped with laser transmitters, which are considered a Class 1 Laser Product by the U.S. Food and Drug Administration and are evaluated as a Class 1 Laser Product per IEC/EN 60825-1 requirements.

Observe the following guidelines and warnings:

General Laser Safety Guidelines

When working around ports that support optical transceivers, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.
- Avoid direct exposure to the beam.

LASER WARNING: Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

Avertissement Les connecteurs à fibre optique sans terminaison peuvent émettre un rayonnement laser invisible. Le cristallin de l'œil humain faisant converger toute la puissance du laser sur la rétine, toute focalisation directe de l'œil sur une source laser, — même de faible puissance—, peut entraîner des lésions oculaires irréversibles.

Class 1 Laser Product Warning

LASER WARNING: Class 1 laser product.
Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Avertissement Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

LASER WARNING: Class 1 LED product.
Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Avertissement Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

LASER WARNING: Do not stare into the laser beam or view it directly with optical instruments.
Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

Varoitus Älä katso säteeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

Avertissement Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

Warnung Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

Avvertenza Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

Advarsel Stirr eller se ikke direkte p strlen med optiske instrumenter.

Aviso Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

¡Atención! No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

Varning! Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

Radiation from Open Port Apertures Warning

LASER WARNING: Because invisible radiation might be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.

Waarschuwing Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.

Varoitus Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukkoihin.

Avertissement Des radiations invisibles à l'il nu pouvant traverser l'ouverture du port lorsqu'aucun câble en fibre optique n'y est connecté, il est recommandé de ne pas regarder fixement l'intérieur de ces ouvertures.

Warnung Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!

Avvertenza Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.

Advarsel Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan emiteres fra portens åpning når det ikke er tilkoblet en fiberkabel.

Aviso Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar an

EXposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

¡Atención! Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.

Varning! Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.

Maintenance and Operational Safety Guidelines and Warnings

IN THIS SECTION

While performing the maintenance activities for devices, observe the following guidelines and warnings:

Battery Handling Warning

WARNING: Replacing a battery incorrectly might result in an explosion. Replace a battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Waarschuwing Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

Varoitus Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

Avertissement Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.

Warnung Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.

Advarsel Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.

Avvertenza Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

¡Atención! Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la baterían EXclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.

Varning! Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.

Jewelry Removal Warning

WARNING: Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or can be welded to the terminals.

Waarschuwing Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

Varoitus Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

Avertissement Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Lightning Activity Warning

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Avertissement Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning

WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

Varoitus Ettei Juniper Networks switch-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

Avertissement Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this device must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Avertissement La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

General Electrical Safety Guidelines and Warnings

WARNING: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS (Network Equipment-Building System) requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be metallically connected to interfaces that connect to the OSP or its wiring. The intrabuilding ports on the device are suitable for connection to intrabuilding or unexposed wiring or cabling only. The addition of primary protectors is not sufficient protection for connecting these interfaces metallically to OSP wiring.

Avertissement Certains ports de l'appareil sont destinés à un usage en intérieur uniquement (ports Type 2 ou Type 4 tels que décrits dans le document *GR-1089-CORE*) et doivent être isolés du câblage de l'installation extérieure exposée. Pour respecter les exigences NEBS et assurer une protection contre la foudre et les perturbations de tension secteur, les ports pour intérieur *ne doivent pas* être raccordés physiquement aux interfaces prévues pour la connexion à l'installation extérieure ou à son câblage. Les ports pour intérieur de l'appareil sont réservés au raccordement de câbles pour intérieur ou non exposés uniquement. L'ajout de protections ne constitue pas une précaution suffisante pour raccorder physiquement ces interfaces au câblage de l'installation extérieure.

CAUTION: Before removing or installing components of a device, connect an electrostatic discharge (ESD) grounding strap to an ESD point and wrap and fasten the other end of the strap around your bare wrist. Failure to use an ESD grounding strap could result in damage to the device.

Attention Avant de retirer ou d'installer des composants d'un appareil, raccordez un bracelet antistatique à un point de décharge électrostatique et fixez le bracelet à votre poignet nu. L'absence de port d'un bracelet antistatique pourrait provoquer des dégâts sur l'appareil.

- Install the device in compliance with the following local, national, and international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
  - Evaluated to the TN power system.

  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
  - Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.

    Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.

- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Make sure that you clean grounding surface and give them a bright finish before making grounding connections.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the device within marked electrical ratings and product usage instructions.
- To ensure that the device and peripheral equipment function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

You can remove and replace many device components without powering off or disconnecting power to the device, as detailed elsewhere in the hardware documentation for this device. Never install equipment that appears to be damaged.

Action to Take After an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.
2. Disconnect power from the device.
3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, and then call for help.

Prevention of Electrostatic Discharge Damage

Device components that are shipped in antistatic bags are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap when you are handling components that are subject to ESD damage, and make sure that it is in direct contact with your skin.

  If a grounding strap is not available, hold the component in its antistatic bag (see Figure 51 on page 169) in one hand and touch the exposed, bare metal of the device with the other hand immediately before inserting the component into the device.

  > **WARNING**: For safety, periodically check the resistance value of the ESD grounding strap. The measurement must be in the range 1 through 10 Mohms.
  >
  > **Avertissement** Par mesure de sécurité, vérifiez régulièrement la résistance du bracelet antistatique. Cette valeur doit être comprise entre 1 et 10 mégohms (Mohms).

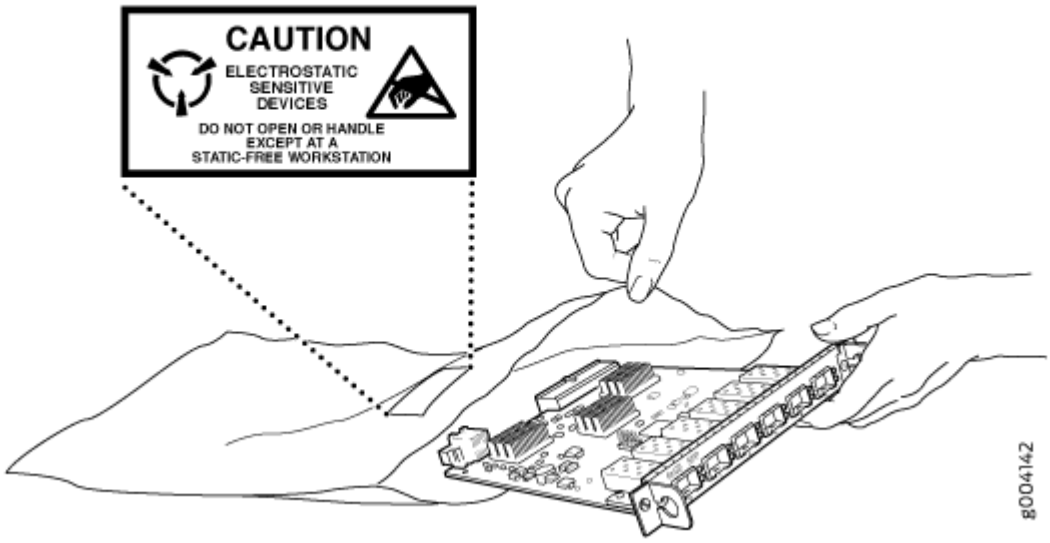
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  If no grounding strap is available, touch the exposed, bare metal of the device to ground yourself before handling the component.

- Avoid contact between the component that is subject to ESD damage and your clothing. ESD voltages emitted from clothing can damage components.

- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an antistatic bag (see Figure 51 on page 169). If you are returning a component, place it in an antistatic bag before packing it.

Figure 51: Placing a Component into an Antistatic Bag



CAUTION: ANSI/TIA/EIA-568 cables such as Category 5e and Category 6 can get electrostatically charged. To dissipate this charge, always ground the cables to a suitable and safe earth ground before connecting them to the system.

Attention Les câbles ANSI/TIA/EIA-568, par exemple Cat 5e et Cat 6, peuvent emmagasiner des charges électrostatiques. Pour évacuer ces charges, reliez toujours les câbles à une prise de terre adaptée avant de les raccorder au système.

AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to AC-powered devices:

- Note the following warnings printed on the device:

  "**CAUTION:** THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK."

  "**ATTENTION:** CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE."

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.
- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

WARNING: The attached power cable is only for this product. Do not use the cable for another product.

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

AC Power Disconnection Warning

WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Avertissement Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut på vekselstrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden.

DC Power Electrical Safety Guidelines

- A DC-powered device is equipped with a DC terminal block that is rated for the power requirements of a maximally configured device.
- For permanently connected equipment, a readily accessible disconnect device shall be incorporated external to the equipment.
- For pluggable equipment, the socket-outlet shall be installed near the equipment and shall be easily accessible.
- Be sure to connect the ground wire or conduit to a solid central office earth ground.
- A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC.
- A DC-powered device that is equipped with a DC terminal block is intended only for installation in a restricted-access location. In the United States, a restricted-access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker must protect against excess currents, short circuits, and earth grounding faults in accordance with NEC ANSI/NFPA 70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- The marked input voltage of –48 VDC for a DC-powered device is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the device is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled –48 VDC, and the earth ground to the device grounding points.

DC Power Disconnection Warning

WARNING: Before performing any of the DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the device handle of the circuit breaker in the OFF position.

Waarschuwing Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

Avertissement Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le

disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

Warnung Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

Avvertenza Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

Advarsel Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

Aviso Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF (Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

¡Atención! Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

Varning! Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejpa fast överspänningsskyddets omkopplare i FRÅN-läget.

DC Power Grounding Requirements and Warning

An insulated grounding conductor that is identical in size to the grounded and ungrounded branch circuit supply conductors but is identifiable by green and yellow stripes is installed as part of the branch

circuit that supplies the device. The grounding conductor is a separately derived system at the supply transformer or motor generator set.

WARNING: When you install the device, the ground connection must always be made first and disconnected last.

Waarschuwing Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.

Varoitus Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.

Avertissement Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

Warnung Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

DC Power Wiring Sequence Warning

WARNING: Wire the DC power supply using the appropriate lugs. When connecting power, the proper wiring sequence is ground to ground, +RTN to +RTN, then –48 V to –48 V. When disconnecting power, the proper wiring sequence is –48 V to –48 V, +RTN to +RTN, then ground to ground. Note that the ground wire must always be connected first and disconnected last.

Waarschuwing De juiste bedradingsvolgorde verbonden is aarde naar aarde, +RTN naar +RTN, en −48 V naar − 48 V. De juiste bedradingsvolgorde losgemaakt is en −48 naar − 48 V, +RTN naar +RTN, aarde naar aarde.

Varoitus Oikea yhdistettava kytkentajarjestys on maajohto maajohtoon, +RTN varten +RTN, −48 V varten − 48 V. Oikea irrotettava kytkentajarjestys on −48 V varten − 48 V, +RTN varten +RTN, maajohto maajohtoon.

Avertissement Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis −48 V à −48 V. En débranchant la puissance, l'ordre approprié de câblage est −48 V à −48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, −48 V til − 48 V. Riktig frakoples tilkoplingssekvens er −48 V til − 48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces −48 V a −48 V. Al desconectar potencia, la secuencia apropiada del cableado es −48 V a −48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

¡Atención! Wire a fonte de alimentação de DC Usando os talões apropriados nan EXtremidade da fiação. Ao conectar a potência, a seqüência apropriada da fiação é moída para moer, +RTN a +RTN, então −48 V a −48 V. Ao desconectar a potência, a seqüência

apropriada da fiação é –48 V a –48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

Varning! Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, –48 V till –48 V. Korrekt kopplas kopplingssekvens ar –48 V till –48 V, +RTN till +RTN, jord till jord.

DC Power Wiring Terminations Warning

WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

Avertissement Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. für einen geschlossenen Regelkreis oder gabelförmig, mit nach oben gerichteten Kabelschuhen zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

Multiple Power Supplies Disconnection Warning

WARNING: The network device has more than one power supply connection. All connections must be removed completely to remove power from the unit completely.

Waarschuwing Deze eenheid heeft meer dan één stroomtoevoerverbinding; alle verbindingen moeten volledig worden verwijderd om de stroom van deze eenheid volledig te verwijderen.

Varoitus Tässä laitteessa on useampia virtalähdekytkentöjä. Kaikki kytkennät on irrotettava kokonaan, jotta virta poistettaisiin täysin laitteesta.

Avertissement Cette unité est équipée de plusieurs raccordements d'alimentation. Pour supprimer tout courant électrique de l'unité, tous les cordons d'alimentation doivent être débranchés.

Warnung Diese Einheit verfügt über mehr als einen Stromanschluß; um Strom gänzlich von der Einheit fernzuhalten, müssen alle Stromzufuhren abgetrennt sein.

Avvertenza Questa unità ha più di una connessione per alimentatore elettrico; tutte le connessioni devono essere completamente rimosse per togliere l'elettricità dall'unità.

Advarsel Denne enheten har mer enn én strømtilkobling. Alle tilkoblinger må kobles helt fra for å eliminere strøm fra enheten.

Aviso Este dispositivo possui mais do que uma conexão de fonte de alimentação de energia; para poder remover a fonte de alimentação de energia, deverão ser desconectadas todas as conexões existentes.

¡Atención! Esta unidad tiene más de una conexión de suministros de alimentación; para eliminar la alimentación por completo, deben desconectarse completamente todas las conexiones.

Varning! Denna enhet har mer än en strömförsörjningsanslutning; alla anslutningar måste vara helt avlägsnade innan strömtillförseln till enheten är fullständigt bruten.

TN Power Warning

WARNING: The device is designed to work with a TN power system.
Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Avertissement Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Agency Approvals for EX Series Switches

IN THIS SECTION

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

These hardware devices comply with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1 Information Technology Equipment
  - CAN/CSA-C22.2 No. 62368-1 Information Technology Equipment
  - UL 60950-1 Information Technology Equipment
  - UL 62368-1 Second Edition
  - EN 60950-1 Information Technology Equipment
  - EN 62368-1 Second Edition
  - IEC 60950-1 Information Technology Equipment
  - IEC 62368-1 Second Edition
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment classification and requirements
- EMC
  - FCC 47CFR Part 15 Class A (USA)
  - EN 55022 Class A Emissions (Europe)
  - ICES-003 Class A
  - VCCI Class A (Japan)
  - AS/NZS CISPR 22 Class A (Australia/New Zealand)
  - CISPR 22 Class A

- EN 55024
- EN 300386
- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common Immunity
- EN 61000-4-11 Voltage Dips and Sags

Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

Compliance Statements for EMC Requirements for EX Series Switches

IN THIS SECTION

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

This topic describes the EMC requirements for these hardware devices.

Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the users' satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect the equipment to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single line individual service can be extended by means of a certified connector assembly. The customer should be aware that compliance with the above conditions might not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, might give the telecommunications company cause to request the user to disconnect the equipment.

CAUTION: Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution might be particularly important in rural areas.

Taiwan

此為甲類資訊技術設備。於一般家居環境使用時，本設備可能導致射頻干擾，用□請採取相應措施。

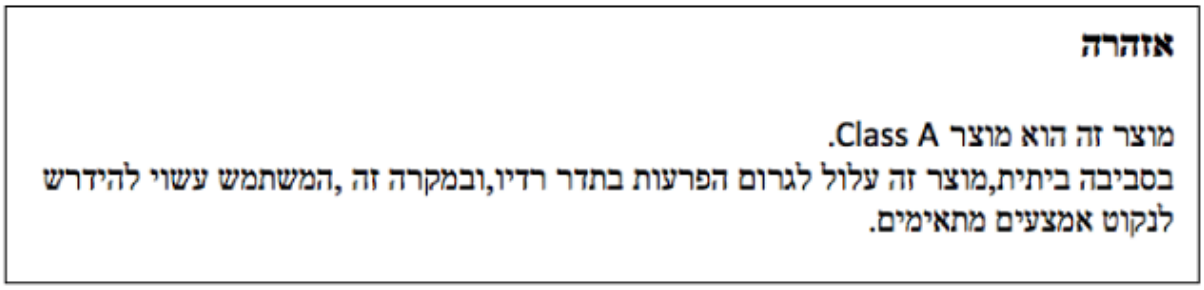
The preceding translates as follows:

This is a Class A device. In a domestic environment, this device might cause radio interference, in which case the user needs to take adequate measures.

European Community

This is a Class A device. In a domestic environment this device might cause radio interference, in which case the user needs to take adequate measures.

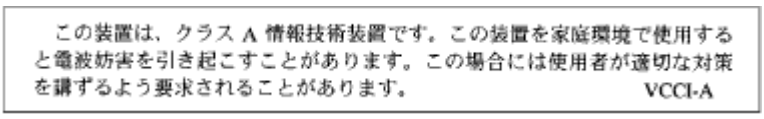
Israel



The preceding translates as follows:

Warning: This product is Class A. In residential environments, the product may cause radio interference, and in such a situation, the user may be required to take adequate measures.

Japan



The preceding translates as follows:

This is a Class A device. In a domestic environment this device might cause radio interference, in which case the user needs to take adequate measures.

VCCI-A

Korea

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

Korean Class A Warning g040913

The preceding translates as follows:

This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home

United States

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

FCC Part 15 Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency

energy and, if not installed and used in accordance with the instructions, might cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

Compliance Statements for Acoustic Noise for EX Series Switches

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäss EN ISO 7779

Translation: The emitted sound pressure is below 70 dB(A) per EN ISO 7779.

Statements of Volatility for Juniper Network Devices

A *statement of volatility (SoV)*—sometimes known as *letter of volatility (LoV)*—identifies the volatile and non-volatile storage components in Juniper Networks devices, and describes how to remove non-volatile storage components from the device.

NOTE: Individual FRUs do not have separate SoV or LoV documents. They are covered in the SoV or LoV of the Juniper Networks device in which they are installed.

NOTE: Statements of volatility are not available for all Juniper Networks devices.

CTP Series:

- CTP150
- CTP2000

EX Series:

- EX2200 and EX2200-C
- EX2300-24P, EX2300-24T, and EX2300-24T-DC
- EX2300-48P and EX2300-48T
- EX2300-C
- EX3300
- EX3400-24P, EX3400-24T, EX3400-24T-DC
- EX3400-48P, EX3400-48T, EX3400-48T-AFI
- EX4200
- EX4300
- EX4300-48MP
- EX4400
    1. EX4400-24T
    2. EX4400-24P
    3. EX4400-24MP
    4. EX4400-48T
    5. EX4400-48P
    6. EX4400-48MP

7. EX4400-48F

- EX4500
- EX4550
- EX4600
- EX8200
- EX9251
- EX9253
- XRE200 External Routing Engine

LN Series:

- LN1000–CC

MX Series:

- M7i
- M7i Compact Forwarding Engine Board (CFEB)
- M40e and M10i
- M320
- MX5, MX10, MX40, and MX80
- MX104
- MX204
- MX304
- MX240, MX480, and MX960
- MX10003
- RE-A-2000 Route Engine
- RE-S-X6-64G Routing Engine

NFX Series:

- NFX250

QFX Series:

- QFX3008-I
- QFX3100
- QFX3500
- QFX3600
- QFX5100-24Q
- QFX5100-48S
- QFX5100-48T
- QFX5110-32Q
- QFX5110-48S
- QFX5120
    1. QFX5120-32C
    2. QFX5120-48T
    3. QFX5120-48Y
    4. QFX5120-48YM
- QFX5200
- QFX5200-32C
- QFX10008 and QFX10016

SRX Series:

- SRX100
- SRX110
- SRX210B
- SRX210H-POE
- SRX210H-P-MGW
- SRX220
- SRX240H
- SRX240H-POE

- SRX300
- SRX320
- SRX340 and SRX345
- SRX380
- SRX550
- SRX650
- SRX1400
- SRX1500
- SRX3400 and SRX3600
- SRX4200
- SRX4600
- SRX5400, SRX5600, and SRX5800
- SRX-MP-1SERIAL
- SSG-520M

T Series:

- RE-A-2000 Route Engine