

# EX4650 Switch Hardware Guide

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*EX4650 Switch Hardware Guide*

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# About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the EX4650 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

| [EX4650 Quick Start](#)



# 1

CHAPTER

## Overview

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# EX4650 Switches System Overview

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## EX4650 Switches Hardware Overview

### IN THIS SECTION

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Juniper Networks EX4650 Ethernet Switches provide connectivity for high-density environments, scalability for growing networks, and redundancy. The EX4650 provides the flexibility to support mixed 1-Gigabit Ethernet, 10-Gigabit Ethernet, 25-Gigabit Ethernet, 40-Gigabit Ethernet, and 100-Gigabit Ethernet environments.

You can interconnect EX4650 switches to form a Virtual Chassis. You can operate these interconnected switches as a single, logical device with a single IP address. You can use EX4650 as a distribution switch with virtual chassis capability, as a satellite device for Junos Fusion Enterprise, and as an aggregation switch.

The EX4650 switch is available as a fixed-configuration switch with the following built-in ports:

- Forty-eight 25-Gigabit Ethernet ports that can operate at 1-Gbps, 10-Gbps, or 25-Gbps speed and support SFP, SFP+, or SFP28 transceivers.
- Eight 100-Gigabit Ethernet ports that can operate at 40-Gbps or 100-Gbps speed and support QSFP+ or QSFP28 transceivers. When these ports operate at 40-Gbps speed, you can configure four 10-Gbps interfaces and connect breakout cables, increasing the total number of supported 10-Gbps ports to 80. When these ports operate at 100-Gbps speed, you can configure four 25-Gbps interfaces and connect breakout cables, increasing the total number of supported 25-Gbps ports to 80.

Four models are available: two featuring AC power supplies and front-to-back or back-to-front airflow and two featuring DC power supplies and front-to-back or back-to-front airflow.

## Benefits of the EX4650 Switch

EVPN-VXLAN campus architecture—The EX4650 switch extends EVPN-VXLAN beyond the data center, thus providing customers the building blocks for an enterprise-wide fabric. The EVPN-VXLAN protocol is suitable for campus architectures because it provides Layer 3 transport with Layer 2 capabilities that allow enterprises to evolve, while also taking into consideration legacy applications. EX4650 also offers core aggregation capabilities aimed at enterprises with campus networks that want a compact and highly scalable solution.

Industry-leading 25-Gbps and 100-Gbps wire speeds: The EX4650 Switch offers industry-leading high density 25-Gbps and 100-Gbps wire speeds that support 48 ports at 100-Gbps or 48 ports at 25-Gbps, and 8 100-Gbps uplink ports.

Support for Virtual Chassis—EX4650 switches support virtual chassis technology. You can interconnect up to four EX4650 switches in a EX4650 virtual chassis.

Common data center protocols: Like the EX9000 series, the EX4650 also uses data center network protocols. The network protocols used in the EX4650 are the Ethernet VPN (EVPN) and the Virtual Extensible LAN (VXLAN). Engineers typically use it with the Border Gateway Protocol and the VXLAN encapsulation protocol which creates an overlay network on an existing Layer 3 infrastructure. As a result, the same engineering team can manage the data center and the campus.

## Software

Juniper Networks EX Series Ethernet Switches run Junos OS™, which provides Layer 2 and Layer 3 switching, routing, and security services. The same Junos OS code base that runs on EX Series switches also runs on all Juniper Networks M Series, MX Series, and T Series routers, and SRX Series Services Gateways.

## EX4650 Switch First View

The EX4650 switch has a 1 U form factor and is shipped with redundant fans (4+1) and redundant power supplies (1+1).

The EX4650 switch is a 25-Gigabit Ethernet enhanced small form-factor (SFP28) switch with 48 SFP28 ports and 8 100-Gbps quad small form-factor (QSFP28) pluggable ports. Each SFP28 port can operate as a native 25-Gigabit Ethernet port, 10-Gigabit Ethernet port, and can act as a 1-Gbps port based on the transceivers inserted. Each of the eight uplink ports can operate as either 100-G or 40-G based on the optics used. They can also be used as 25-Gbps ports or 10-Gbps ports using breakout cables or channelization.

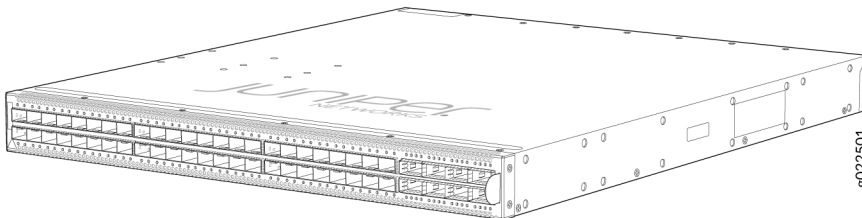


**CAUTION:** Do not install 1GbE copper transceivers (such as QFX-SFP-1GE-T) directly above or below another 1GbE copper transceiver. Use only the top row or bottom row to avoid damage to the device caused by some types of copper transceivers when the transceivers are installed above or below each other. However, if you are using copper transceivers with the OEM part number FCLF8521P2BTL-J1 printed on the transceiver label, you can install the transceivers in any port with no restrictions. For devices that support 10GbE copper transceivers, there is no similar restriction.

For more information on how to channelize interfaces on EX4650-48Y switches, see [Channelizing Interfaces on EX4650-48Y Switches](#).

[Figure 1 on page 4](#) and [Figure 2 on page 5](#) show the front panel of an EX4650 switch.

**Figure 1: Front Panel of an EX4650 Switch**



[Figure 2 on page 5](#) shows the components on the front panel of an EX4650 switch.

**Figure 2: Components on the Front Panel of an EX4650 Switch**

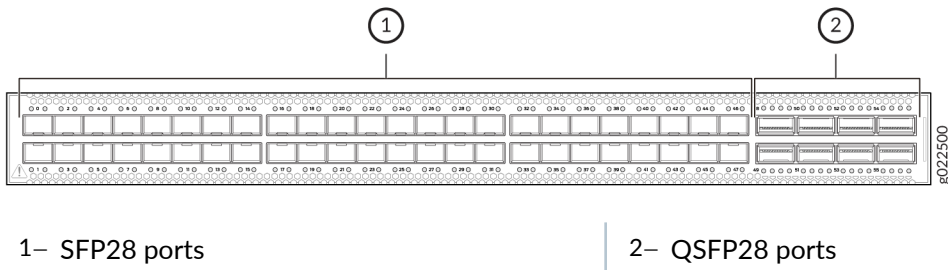


Figure 3 on page 5 shows the rear panel of an EX4650 Switch with AC power supplies.

**Figure 3: Rear Panel of an AC-Powered EX4650 Switch**

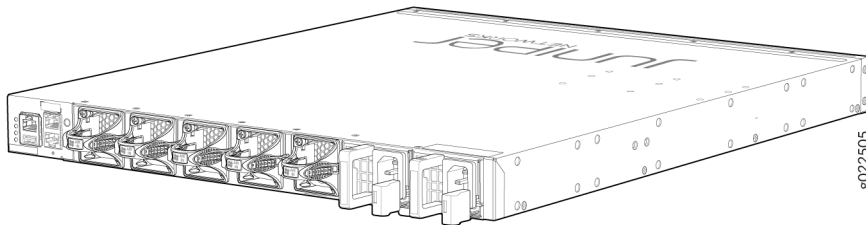


Figure 4 on page 5 shows the rear view of an EX4650 Switch with DC power supplies.

**Figure 4: Rear Panel of a DC-Powered EX4650 Switch**

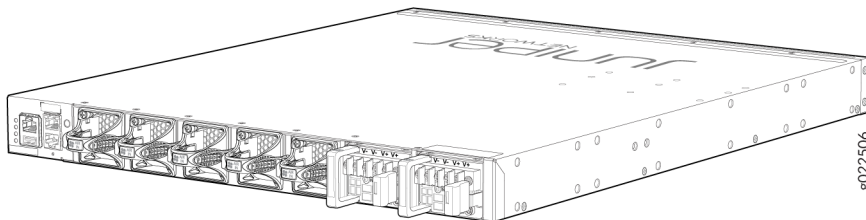
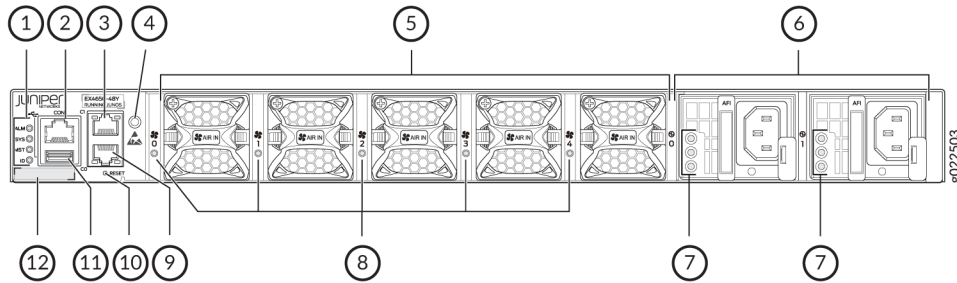


Figure 5 on page 6 shows the components on the rear panel of an EX4650 Switch with AC power supplies.

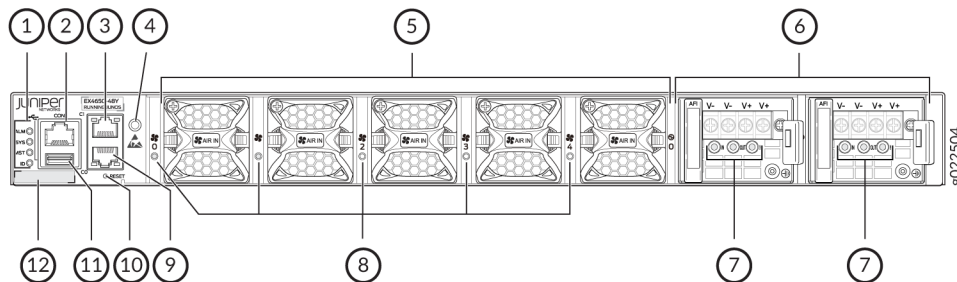
Figure 5: Components on the Rear Panel of an AC-Powered EX4650 Switch



1– Chassis status LEDs (ALM, SYS, MST, ID)	7– Power Supply LEDs
2– Console port	8– Fan module LEDs
3– RJ-45 management port (C1)	9– RJ-45 management port (C0)
4– ESD point	10– RESET button
5– Fan module	11– USB port
6– Power supplies	12– CLEI label

Figure 6 on page 6 shows the components on the rear panel of an EX4650 with DC power supplies.

Figure 6: Components on the Rear Panel of a DC-Powered EX4650 Switch



1– Chassis status LEDs (ALM, SYS, MST, ID)	7– Power supply LEDs
2– Console port	8– Fan module LEDs
3– RJ-45 management port (C1)	9– RJ-45 management port (C0)
4– ESD point	10– RESET button
5– Fan module	11– USB port
6– Power supplies	12– CLEI label

**NOTE:** When you press and immediately release the 'Reset' button, the switch reboots immediately. When you press the 'Reset' button for more than ten seconds, the Switch reboots with an option for manual BIOS recovery.

Table 1 on page 7 lists the EX4650 switch models and their components.

**Table 1: Components in EX4650 Switches**

Switch Model	Built-in Ports	Fan Modules Shipped by Default	Power Supply Shipped by Default
EX4650-48Y-AFO	48x25G SFP28 ports and 8x100G QSFP28 ports	Five fan modules; each with an <b>AFO</b> label	Two 650 W AC power supplies (1+1 redundancy)
EX4650-48Y-AFI	48x25G SFP28 ports and 8x100G QSFP28 ports	Five fan modules; each with an <b>AFI</b> label	Two 650 W AC power supplies (1+1 redundancy)
EX4650-48Y-DC-AFO	48x25G SFP28 ports and 8x100G QSFP28 ports	Five fan modules; each with an <b>AFO</b> label	Two 650 W DC power supplies (1+1 redundancy)
EX4650-48Y-DC-AFI	48x25G SFP28 ports and 8x100G QSFP28 ports	Five fan modules; each with an <b>AFI</b> label	Two 650 W DC power supplies (1+1 redundancy)

## Virtual Chassis

The EX4650 switch can be used as a member in an all EX4650 virtual chassis.

- Starting with Junos OS Release 19.3R1, you can interconnect up to two EX4650 switches in an EX4650 Virtual Chassis. The two-member switches must be in the primary and backup routing engine roles.
- Starting with Junos OS Release 20.1R1, you can interconnect up to four EX4650 switches in an EX4650 Virtual Chassis. You should configure two member switches into the primary and backup Routing Engine roles, and the remaining member switches into the linecard role.

EX4650 switches can't be combined with any other type of switches in a virtual chassis (mixed mode). EX4650 switches do not have dedicated or default-configured VCPs, but you can set any of the 40-Gbps QSFP+ or 100-Gbps QSFP28 uplink ports on the front panel (non-channelized ports 48 through 55) as VCPs. You can't use any of the other ports (network ports 0 through 47) as VCPs. You can configure, monitor, and maintain it the same way as a EX Series virtual chassis. See the following topics for more details on how to configure and change the members in a EX4650 virtual chassis:

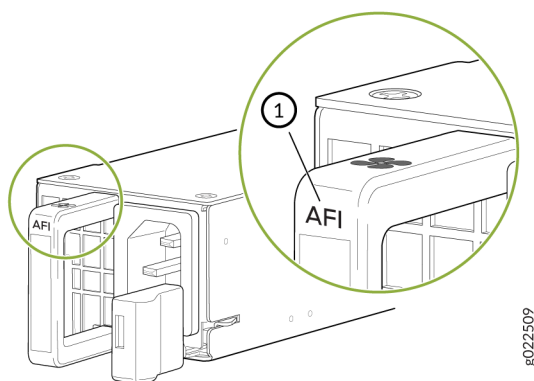
- [Understanding Virtual Chassis Components](#)
- [Removing or Replacing a Member Switch of a Virtual Chassis Configuration](#)
- [Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis](#)
- [Virtual Chassis Fabric Overview](#)

## Power Supplies

Each EX4650 switch supports two AC or two DC power supplies with either front-to-back or back-to-front airflow. Power supplies for the EX4650 switch are fully redundant, load-sharing, and hot-removable and hot-insertable field-replaceable units (FRUs). The EX4650 switch models are shipped with two power supplies preinstalled in the rear panel of the chassis.

The power supplies either have labels on the handles that indicate the airflow direction or they have color-coded handles with a fan icon. An **AFI** label or a blue-colored handle indicates back-to-front airflow while an **AFO** label or a gold-colored handle indicates front-to-back airflow. See [Figure 7 on page 8](#)

**Figure 7: Power Supply Handle Detail**



1– AFI label



**CAUTION:** Do not mix:



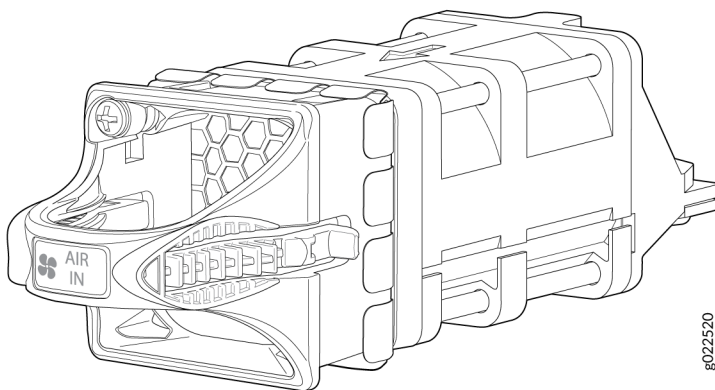
- AC and DC power supplies in the same chassis.
- Power supplies with different airflow labels (**AFI** and **AFO**) in the same chassis.
- Power supplies and fan modules with different airflow labels (**AFI**) and (**AFO**) in the same chassis.
- Verify that the airflow direction on the power supply 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.
- If you need to convert the airflow pattern on a chassis, you must replace all the fans and power supplies at one time to use the new direction.

## Cooling System

EX4650 switches are shipped with five fan modules (4+1 redundancy) located at the rear of the chassis. These fan modules are designed for one of the two available airflow directions. The fan modules are also color-coded to indicate the airflow direction.

Figure 8 on page 9 shows the EX4650 fan module.

**Figure 8: EX4650 Fan Module**



The five fan modules are numbered 0 through 4 counting from left to right. Each fan module slot has a fan icon and an LED next to it.



**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.
- Power supplies and fan modules with different airflow labels (**AFI**) and (**AFO**) in the same chassis.

## EX4650 Switch Models

The EX4650 switch is available with 48 ports and supports AC and DC power supplies depending on the switch model. All models of the EX4650 ship with two power supplies and five fans installed by default. [Table 2 on page 10](#) lists the components shipped with EX4650 switch models.

**Table 2: EX4650 Switch Models and Shipped Components**

Switch Model	Ports	Power Supply	Airflow
EX4650-48Y-AFO	48 SFP28 8 QSFP28	AC	Front-to-back—air intake to cool the chassis is through the vents on the front panel of the chassis, and hot air exhausts through the vents on the rear panel of the chassis.
EX4650-48Y-AFI	48 SFP28 8 QSFP28	AC	Back-to-front—air intake to cool the chassis is through the vents on the rear panel of the chassis, and hot air exhausts through the vents on the front panel of the chassis.

Table 2: EX4650 Switch Models and Shipped Components *(Continued)*

Switch Model	Ports	Power Supply	Airflow
EX4650-48Y-DC-AFO	48 SFP28 8 QSFP28	DC	Front-to-back—air intake to cool the chassis is through the vents on the front panel of the chassis, and hot air exhausts through the vents on the rear panel of the chassis.
EX4650-48Y-DC-AFI	48 SFP28 8 QSFP28	DC	Back-to-front—air intake to cool the chassis is through the vents on the rear panel of the chassis, and hot air exhausts through the vents on the front panel of the chassis.



**CAUTION:** Mixing different types (AC and DC) of power supplies in the same chassis is not supported. Mixing different airflow modules in the same chassis is not supported.

## Identifying EX4650 Switch Models

### IN THIS SECTION

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- Action | 12
- Meaning | 12

## Purpose

Identify the model number of your EX4650 switch.

## Action

Check the value of the FRU Model Number field in the Routing Engine section in the output of the **show chassis hardware extensive** CLI command.

```
user@switch> show chassis hardware extensive
```

```
....
Routing Engine 1 REV D   650-044930   PD3113060024   EX4650-48Y
  Jedec Code:   0x7fb0           EEPROM Version:   0x02
  P/N:          650-044930       S/N:              PD3113060024
  Assembly ID:  0x0b5e           Assembly Version: 03.19
  Date:         02-19-2013       Assembly Flags:   0x00
  Version:      REV D            CLEI Code:
  ID: EX4650-48Y                FRU Model Number: EX4650-48Y-AFO
....
```

The model number of your switch is one of the following:

- EX4650-48Y-AFO
- EX4650-48Y-AFI
- EX4650-48Y-DC-AFO
- EX4650-48Y-DC-AFI

In the sample output, the switch model is EX4650-48Y-AFO.

## Meaning

In EX4650 switch model numbers:

- The 48Y in the model number indicates that the number of network ports on the switch:
- AFI indicates that the switch is shipped with two fan modules and a power supply, each bearing an **AIR IN (AFI)** label. Switches that do not have AFI in their model numbers ship with two fan modules and a power supply, each bearing an **AIR OUT (AFO)** label.

The labels on the fan modules and the power supplies indicate the direction of airflow they provide within the chassis when installed in the switch. **AIR IN (AFI)** labels indicate back-to-front airflow, and **AIR OUT (AFO)** labels indicate front-to-back airflow.

- The DC in the model number indicates that the switch model works on DC power supply. Switches that do not have DC in their model numbers work on AC power supply.

## Chassis Physical Specifications for EX4650 Switches

The EX4650 switch chassis is a rigid sheet-metal structure that houses all components of the switch. [Table 3 on page 13](#) summarizes the physical specifications of the EX4650 switch chassis.

**Table 3: Physical Specifications of the EX4650 Switch Chassis**

Description	Value
Chassis height	1.72 in. (4.37 cm)
Chassis width	<ul style="list-style-type: none"> <li>• 17.36 in. (44.09 cm)</li> <li>• The outer edges of the front-mounting brackets extend the width to 19 in. (48.2 cm)</li> </ul>
Chassis depth	20.48 in. (52.02 cm) excluding fan and power supply handles
Weight	23.69 lbs (10.75 kg) with two power supplies and fans installed

## Field-Replaceable Units in EX4650 Switches

Field-replaceable units (FRUs) are components that you can replace at your site. The FRUs in EX4650 switches are hot-removable and hot-insertable – you can remove and replace them without powering off the switch. The FRUs in EX4650 switches are:

- Power supplies
- Fan modules

- Transceivers

**NOTE:** Transceivers are not part of the shipping configuration. If you want to purchase transceivers, you must order them separately.

**NOTE:** If you have a Juniper J-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.

## EX4650 Chassis

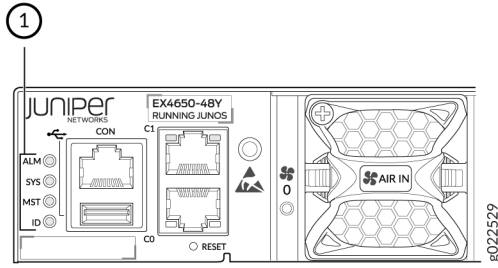
### IN THIS SECTION

- Chassis Status LEDs on EX4650 Switches | 14
- Management Port LEDs on EX4650 Switches | 16
- Access Port and Uplink Port LEDs on EX4650 Switches | 17

### Chassis Status LEDs on EX4650 Switches

EX4650 switches have four chassis status LEDs (labeled **ALM**, **SYS**, **MST**, and **ID**) (see [Figure 9 on page 15](#)).

Figure 9: Chassis Status LEDs in EX4650



1– Chassis status LEDs

Table 4 on page 15 describes the chassis status LEDs on an EX4650 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 led`.

Table 4: Chassis Status LEDs on an EX4650 Switch

LED Label	Color	State and Description
<b>ALM</b> (Alarm)	Unlit	There is no alarm or the switch is halted.
	Red	There is a major alarm.  <b>NOTE:</b> A major hardware fault has occurred, such as a temperature alarm or power failure, and the switch has halted. Power off the unit 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 unit switch and monitor the power supply and fan LEDs to help determine where the error is occurring. s the network link and turns off the <b>ALM</b> LED..)
	Amber	There is a minor alarm.  <b>NOTE:</b> The Alarm ( <b>ALM</b> ) LED glows yellow if you commit a configuration to make it active on the switch and do not also create a rescue configuration to back it up. To save the most recently committed configuration as the rescue configuration, enter the operational mode command <code>request system configuration rescue save</code> .

**Table 4: Chassis Status LEDs on an EX4650 Switch (Continued)**

LED Label	Color	State and Description
<b>SYS</b> (System)	Unlit	<ul style="list-style-type: none"> <li>The switch is powered off or halted.</li> </ul>
	Green(On steadily)	Junos OS for EFX Series is loaded on the switch.
<b>MST</b> (Primary)	Green(On steadily)	Indicates a standalone EX4650 switch.
<b>ID</b> (Identification)	Unlit	<p>The beacon feature is not enabled on the switch. This feature is enabled using the request chassis beacon command.</p> <p>Blinking—The beacon feature is enabled.</p>
	Blinking	The beacon feature is enabled on the switch. This feature is enabled using the request chassis beacon command

A major alarm (red) indicates a critical error condition that requires immediate action.

A minor alarm (yellow) indicates a noncritical condition that requires monitoring or maintenance. A minor alarm that is left unchecked might cause interruption in service or performance degradation.

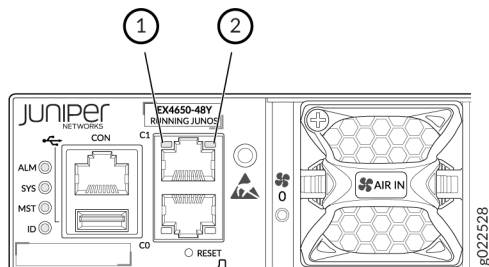
All three LEDs can be lit simultaneously.

## Management Port LEDs on EX4650 Switches

The two management ports on the rear panel of an EX4650 switch have two LEDs that indicate Link/Activity and status of the management port. [Figure 10 on page 17](#) shows the location of the management port.



Figure 10: LEDs on the Management Port



1– Status LED

2– Link/Activity LED

Table 5 on page 17 describes the Link/Activity LED.

Table 5: Link/Activity LED on the management port on an EX4650 Switch

LED	Color	State and Description
Link/Activity	Green	<ul style="list-style-type: none"> <li>Blinking—The port and the link are active, and there is link activity.</li> <li>On steadily—The port and the link are active, but there is no link activity.</li> <li>Off—The port is not active.</li> </ul>
Status	Green/Amber	<p>Indicates the speed.</p> <ul style="list-style-type: none"> <li>Off—Either the port speed is 10 M or the link is down.</li> <li>Amber—Link speed is 100 Mbps.</li> <li>Green—Link speed is 1000 Mbps.</li> </ul>

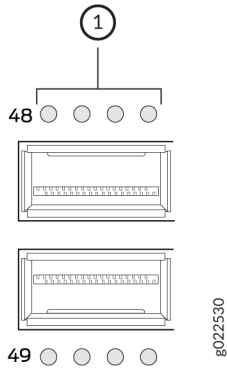
## Access Port and Uplink Port LEDs on EX4650 Switches

Each network port and SFP+ uplink port has two LEDs that show the link activity and status of the port. The built-in QSFP+ port on a EX4650 switch has one LED that shows both the link activity and status of the port.

The following figures in this topic shows the location of those LEDs:

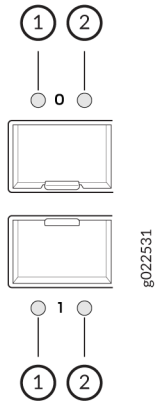
- [Figure 11 on page 18](#) shows the location of the LEDs on the QSFP uplink ports.
- [Figure 12 on page 18](#) shows the location of the LEDs on the SFP network ports.

**Figure 11: LEDs on Network Ports**



1– Network Port LEDs.

**Figure 12: LEDs on the SFP+ Network Ports**



1– Link/Activity LED

2– Status LED

The [Table 6 on page 19](#) describes the link activity LED on network ports, SFP+ uplink ports, and built-in QSFP+ ports.

**Table 6: Link/Activity LED**

LED	Color	State and Description
Link activity	Green	<ul style="list-style-type: none"> <li>• Blinking—The port and the link are active, and there is link activity.</li> <li>• On steadily—The port and the link are active, but there is no link activity.</li> <li>• Off—The port is not active.</li> </ul>

[Table 7 on page 19](#) describes the Status LED on SFP+ uplink ports.

**Table 7: Status LED on SFP+ Uplink Ports**

LED	LCD Indicator	State and Description
Status	Green	Indicates the speed. The speed indicators are: <ul style="list-style-type: none"> <li>• Blinking green—1 Gbps and 10 Gbps</li> <li>• Stable green—25 Gbps</li> </ul>

[Table 8 on page 19](#) describes the Status LED on QSFP+ ports in EX4650 switches.

**Table 8: Status LED on QSFP+ Ports**

LED	LCD Indicator	State and Description
Status	Green	Indicates the status. The status indicators are: <ul style="list-style-type: none"> <li>• Unlit—40-Gigabit port/100-Gigabit port is down.</li> <li>• Steadily green—40-Gigabit port is up.</li> </ul>

# EX4650 Cooling System

## IN THIS SECTION

- Fan Modules | 20
- Airflow Direction in EX4650 Switch Models | 22
- Front-to-Back Airflow | 24
- Back-to-Front Airflow | 24
- Do Not Mix AIR IN (AFI) and AIR OUT (AFO) Components in the Switch | 25
- Positioning the Switch | 26
- Fan Module Status | 26

The cooling system in an EX4650 switch consists of five fan modules and each power supply has its own fans. The switch can be set up to work in one of two airflow directions depending on the fan modules and power supplies installed in the switch.

- Back-to-front airflow (air enters through the back of the switch), indicated by the label **AIR IN (AFI)**
- Front-to-back (air exhausts through the back of the switch), indicated by the label **AIR OUT (AFO)**



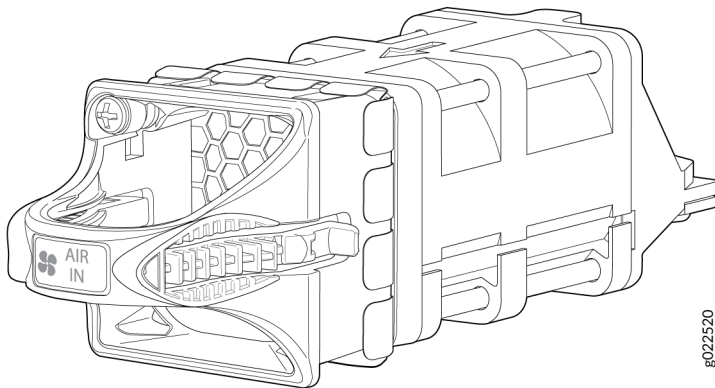
**CAUTION:** Do not mix AFI and AFO fans and power supplies in the same chassis.

## Fan Modules

The fan modules in EX4650 switches are hot-insertable and hot-removable FRUs. These fan modules are designed for one of the two available airflow directions (Airflow In or Airflow Out). The fan modules are also color-coded to indicate the airflow direction. The fan modules are installed in the fan module slots between the management panel and the power supplies.

[Figure 13 on page 21](#) shows the EX4650 fan module.

Figure 13: EX4650 Fan Module



The five fan modules are numbered 0 through 4 counting from left to right. Each fan module slot has a fan icon and an LED next to it.

You must remove only one fan module at a time for replacement from the rear panel 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 the five fan modules must be installed for optimal functioning of the switch.

The fan modules are available in four models that have different airflow directions—back-to-front (air enters through the back of the switch), indicated by the label **AFI** and azure blue color, and front-to-back (air exhausts through the back of the switch), indicated by label **AFO** and gold color. [Table 9 on page 22](#) lists the available fan module models and the direction of airflow in them.

Table 9: Fan Modules in EX4650 Switches

Fan Module	Label on the Fan Module	Color of the Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5110-FANAFO	<b>AFO</b>	Juniper Gold	Front-to-back—air intake to cool the chassis is through the vents on the front panel of the chassis, and hot air exhausts through the vents on the rear panel of the chassis.	You must install only power supplies that have <b>AIR OUT(AFO)</b> labels in switches that have fan modules with <b>AIR OUT</b> labels.
QFX5110-FANAFI	<b>AFI</b>	Juniper Azure Blue	Back-to-front—air intake to cool the chassis is through the vents on the rear panel of the chassis, and hot air exhausts through the vents on the front panel of the chassis.	You must install only power supplies that have <b>AIR IN(AFI)</b> labels in switches that have fan modules with <b>AIR IN</b> labels.

## Airflow Direction in EX4650 Switch Models

Table 10 on page 23 shows the direction of airflow in EX4650 switch models as shipped.

Table 10: Airflow Direction in EX4650 Switch Models

Model Number	Fan Modules and Power Supply	Direction of Airflow
EX4650-48Y-AFO	The switch ships with five fan modules and two AC power supplies, each with a label <b>AIR OUT (AFO)</b> .	Front-to-back—that is, air intake to cool the chassis is through the vents on the front panel of the chassis and hot air exhausts through the vents on the rear panel of the chassis.
EX4650-48Y-AFI	The switch ships with five fan modules and two AC power supplies, each with a label <b>AIR IN (AFI)</b> .	Back-to-front—that is, air intake to cool the chassis is through the vents on the rear panel of the chassis and hot air exhausts through the vents on the front panel of the chassis.
EX4650-48Y-DC-AFO	The switch ships with five fan modules and two DC power supplies, each with a label <b>AIR OUT (AFO)</b> .	Front-to-back—that is, air intake to cool the chassis is through the vents on the front panel of the chassis and hot air exhausts through the vents on the rear panel of the chassis.
EX4650-48Y-DC-AFI	The switch ships with five fan modules and two DC power supplies, each with a label <b>AIR IN (AFI)</b> .	Back-to-front—that is, air intake to cool the chassis is through the vents on the rear panel of the chassis and hot air exhausts through the vents on the front panel of the chassis.

**CAUTION:** Do not mix:

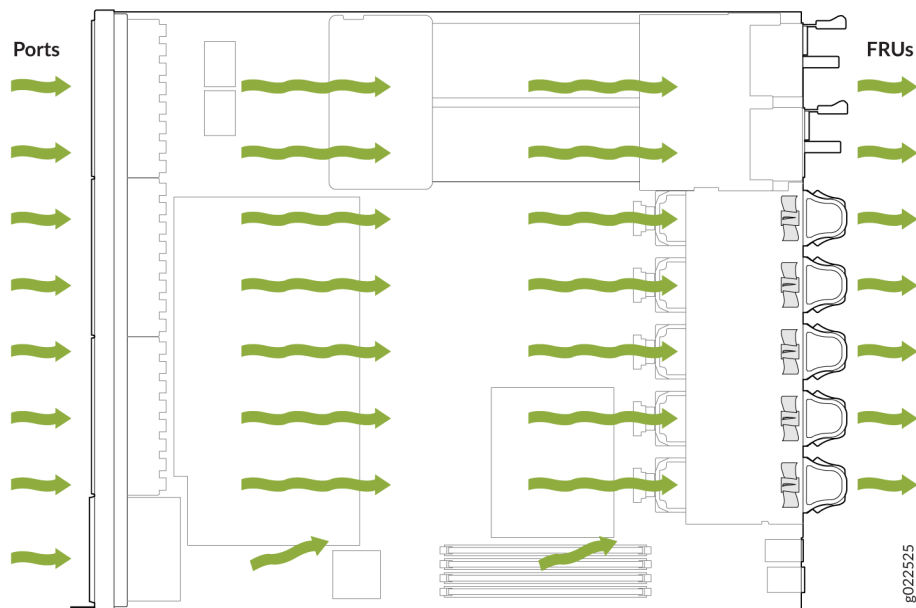
- Do not mix:
  - AC and DC power supplies in the same chassis.
  - Power supplies with different airflow labels (**AFI** and **AFO**) in the same chassis.

- Power supplies and fan modules with different airflow labels (**AFI**) and (**AFO**) in the same chassis.

## Front-to-Back Airflow

In the EX4650 switch models that have front-to-back airflow, the air intake to cool the chassis is through the vents on the front panel of the switch and hot air exhausts through the vents on the rear panel (See [Figure 14 on page 24](#)).

**Figure 14: Front-to-Back Airflow Through EX4650 Switch Chassis**



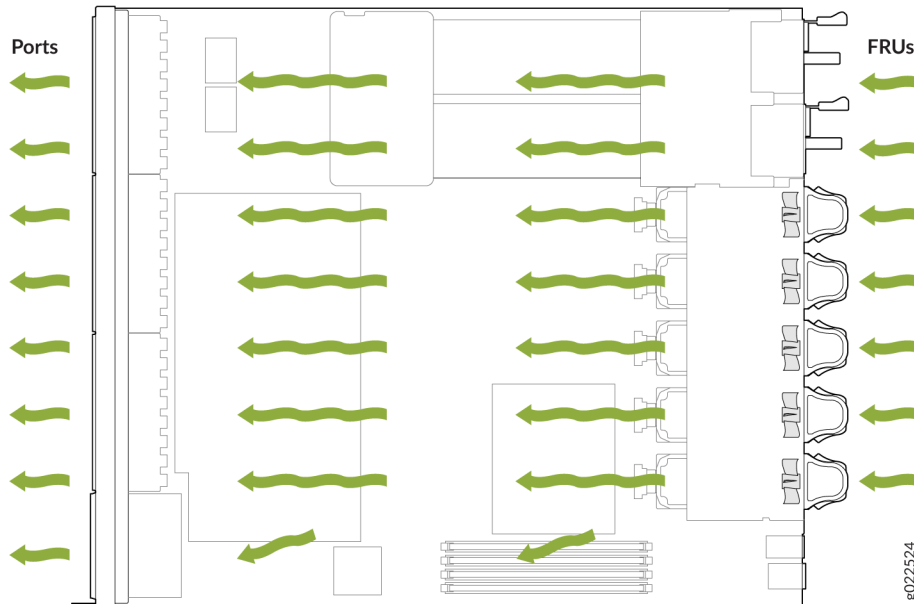
You must install only power supplies that have **AIR OUT (AFO)** labels in switches that have fan modules with **AIR OUT (AFO)** labels.

## Back-to-Front Airflow

In the EX4650 switch models that have back-to-front airflow, the air intake to cool the chassis is through the vents on the rear panel and hot air exhausts through the vents on the front panel of the switch. See [Figure 15 on page 25](#).



Figure 15: Back-to-Front Airflow Through EX4650 Switch Chassis



You must install only power supplies that have **AIR IN (AFI)** labels in switches in which the fan modules have **AIR IN (AFI)** labels.

## Do Not Mix AIR IN (AFI) and AIR OUT (AFO) Components in the Switch

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

The labels on the power supplies and fan modules should match the labels on the switch chassis.

Mixing components with **AIR IN (AFI)** and **AIR OUT (AFO)** labels 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.

## Positioning the Switch

In front-to-back airflow, indicated by the label **AIR OUT (AFO)** on the fan modules and power supplies, hot air exhausts through the vents on the rear panel of the switch. In back-to-front airflow, indicated by the label **AIR IN (AFI)** on the fan modules and power supplies, hot air exhausts through the vents on the front panel of the switch.

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

## Fan Module Status

Each fan module in the switch has a status LED next to the fan module slot on the rear panel of the chassis, which indicated the fan module status. [Table 11 on page 26](#) describes the status LED on the fan module in an EX4650 switch.

**Table 11: Fan Module Status LED**

LED	Color	State	Description
Status	Green	On steadily	The fan module is functioning normally.
	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.

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.

# EX4650 Power System

## IN THIS SECTION

- AC Power Supply in EX4650 Switches | 27
- AC Power Supply Specifications for EX4650 Switches | 31
- AC Power Cord Specifications for EX4650 Switches | 31
- AC Power Supply LEDs in EX4650 Switches | 33
- DC Power Supply in EX4650 Switches | 35
- DC Power Supply in EX4650 Switches | 38
- EX4650 DC Power Specifications | 41
- DC Power Supply LEDs in EX4650 Switches | 41

## AC Power Supply in EX4650 Switches

### IN THIS SECTION

- AC Power Supply in EX4650 Switches | 27
- DC Power Supply in EX4650 Switches | 28
- Airflow Direction in Power Supplies | 29

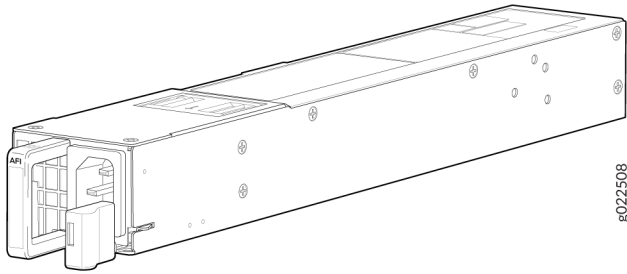
EX4650 switches support two AC or DC power supplies with different airflow directions. Power supplies for the EX4650 switch are fully redundant, load-sharing, and hot-removable and hot-insertable FRUs. The EX4650 switch models are shipped with two power supplies pre-installed in the rear panel of the chassis.

### AC Power Supply in EX4650 Switches

EX4650 switch supports two 650 W AC power supplies.

[Figure 16 on page 28](#) shows an AC power supply for an EX4650 switch.

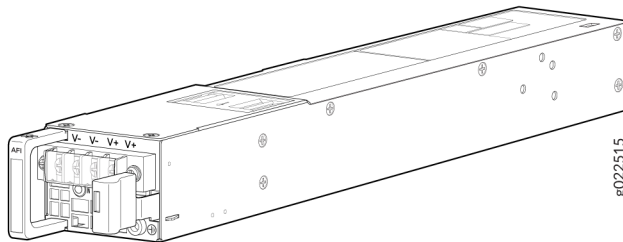
**Figure 16: AC Power Supply for an EX4650 Switch**



### DC Power Supply in EX4650 Switches

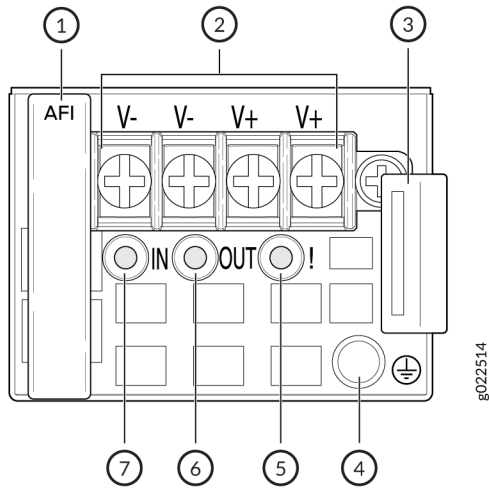
The DC power supply in EX4650 is 650 W with dual feeds for power resiliency. [Figure 17 on page 28](#) shows a DC power supply for an EX4650 switch.

**Figure 17: DC Power Supply for an EX4650 Switch**



**NOTE:** The DC power supply in the switch has four terminals labeled V-, V-, V+, and V+ for connecting DC power source cables labeled and negative (-) and positive (+). See [Figure 18 on page 29](#).

Figure 18: DC Power Supply Faceplate of an EX4650 Switch



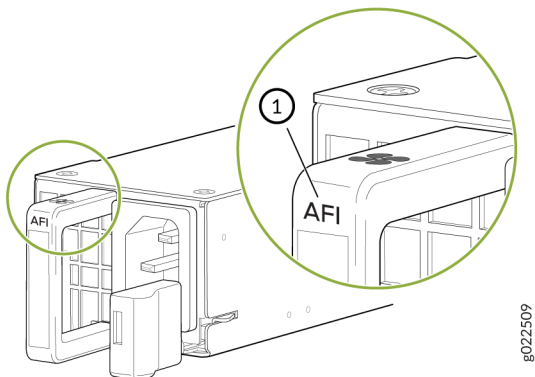
1– AFI	5– Fault LED
2– Input terminals	6– Output LED
3– Ejector lever	7– Input LED
4– ESD grounding point	

### Airflow Direction in Power Supplies

Each power supply has two fan supplies and is cooled by its own internal cooling system.

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. **AFI** label or a blue-colored handle indicates back-to-front airflow while **AFO** label or a gold-colored handle indicates front-to-back airflow. See [Figure 19 on page 29](#)

Figure 19: Power Supply Handle Detail



## 1– AIR IN (AFI) label

Be sure to use the correct power supply for your chassis product SKU (see [Table 12 on page 30](#)).



**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.
- Power supplies and fan modules with different airflow labels (**AFI** and **AFO**) in the same chassis.



**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. If you need to convert the airflow pattern on a chassis, you must replace all the fans and power supplies at one time to use the new direction.

[Table 12 on page 30](#) lists the AC and DC power supplies used in EX4650 switches and the direction of airflow in them.

**Table 12: Airflow Direction in Power Supplies for EX4650 Switches**

Product Number	Direction of Airflow	Color of Power Supply Handle
EX4650-48S-AFO	Back to front	Juniper Gold
EX4650-48S-AFI	Front to back	Juniper Azure Blue
EX4650-48S-DC-AFO	Back to front	Juniper Gold
EX4650-48S-DC-AFI	Front to back	Juniper Azure Blue

## AC Power Supply Specifications for EX4650 Switches

EX4650 switches support 650 W AC power supplies.

The table in this topic provides power supply specification of AC power supplies used in an EX4650 switch:

**Table 13: Power Supply Specifications of 650 W AC Power Supplies for EX4650 Switches**

Item	650 W AC Specification
Model Number	<ul style="list-style-type: none"> <li>• JPSU-650W-AC-AI</li> <li>• JPSU-650W-AC-AO</li> </ul>
AC input voltage	Operating range: 100 VAC to 240 VAC
AC input line frequency	50–60 Hz
AC input current rating	7.8A at 100-120 VAC 3.8A at 200-240 VAC
Typical Power Consumption	260W
Maximum power	450W

## AC Power Cord Specifications for EX4650 Switches

A detachable AC power cord is supplied with the AC power supplies. 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.



**CAUTION:** The AC power cord provided with each power supply is intended for use with that power supply only and not for any other use.

**NOTE:** In North America, AC power cords must not exceed 4.5 meters 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 supplied with the switch are in compliance.

Table 14 on page 32 gives the AC power cord specifications for the countries and regions listed in the table.

**Table 14: AC Power Cord Specifications**

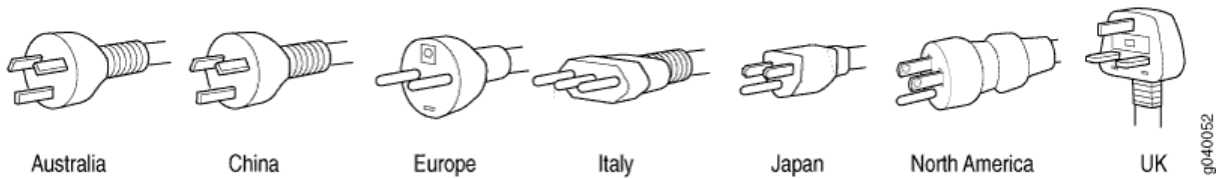
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
Argentina	250 VAC, 10 A, 50 Hz	IRAM 2073 Type RA/3	CBL-EX-PWR-C13-AR
Australia	250 VAC, 10 A, 50 Hz	AS/NZZS 3112 Type SAA/3	CBL-EX-PWR-C13-AU
Brazil	250 VAC, 10 A, 50 Hz	NBR 14136 Type BR/3	CBL-EX-PWR-C13-BR
China	250 VAC, 10 A, 50 Hz	GB 1002-1996 Type PRC/3	CBL-EX-PWR-C13-CH
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII Type VIIG	CBL-EX-PWR-C13-EU
India	250 VAC, 10 A, 50 Hz	IS 1293 Type IND/3	CBL-EX-PWR-C13-IN
Israel	250 VAC, 10 A, 50 Hz	SI 32/1971 Type IL/3G	CBL-EX-PWR-C13-IL
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16 Type I/3G	CBL-EX-PWR-C13-IT
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	SS-00259 Type VCTF	CBL-EX-PWR-C13-JP
Korea	250 VAC, 10 A, 50 Hz or 60 Hz	CEE (7) VII Type VIIGK	CBL-EX-PWR-C13-KR



**Table 14: AC Power Cord Specifications (Continued)**

Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
North America	125 VAC, 13 A, 60 Hz	NEMA 5-15 Type N5-15	CBL-EX-PWR-C13-US
South Africa	250 VAC, 10 A, 50 Hz	SABS 164/1:1992 Type ZA/13	CBL-EX-PWR-C13-SA
Switzerland	250 VAC, 10 A, 50 Hz	SEV 6534-2 Type 12G	CBL-EX-PWR-C13-SZ
Taiwan	125 VAC, 11 A and 15 A, 50 Hz	NEMA 5-15P Type N5-15P	CBL-EX-PWR-C13-TW
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A Type BS89/13	CBL-EX-PWR-C13-UK

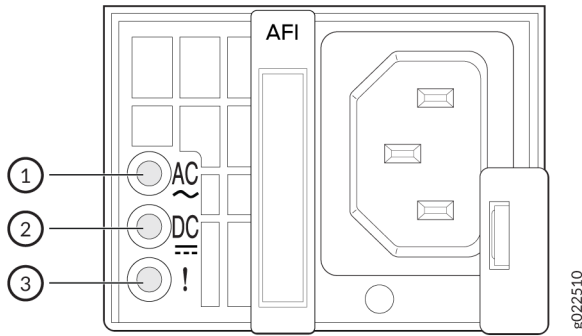
Figure 20 on page 33 illustrates the plug on the power cord for some of the countries or regions listed in Table 14 on page 32.

**Figure 20: AC Plug Types**

## AC Power Supply LEDs in EX4650 Switches

Figure 21 on page 34 shows the location of the LEDs on an AC power supply for EX4650 switches.

Figure 21: LEDs on AC power supply for EX4650 switches



1- AC OK	3- Fault
2- DC OK	

Table 15 on page 34 describes the AC power supply LEDs.

Table 15: AC Power Supply LEDs in EX4650 Switches

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 power is not coming into the power supply.
	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 **AC OK** LED are not lit green, either the AC power cord is not installed properly or the power input voltage is not within normal operating range.

If the **AC OK** LED is lit green and the **AC OK** LED is unlit or lit red, the AC power supply is installed properly, but the power supply has an internal failure.

## DC Power Supply in EX4650 Switches

### IN THIS SECTION

- [Characteristics of a DC Power Supply | 36](#)
- [DC Power Supply Airflow | 37](#)

The DC power supply in EX4650 switches is a hot-insertable and hot-removable field-replaceable unit (FRU): You can install it without powering off the switch or disrupting the switching function.

All the EX4650 switches that are powered by DC power supplies are shipped with one DC power supply pre-installed in the rear panel of the switches.



**CAUTION:** Do not mix:

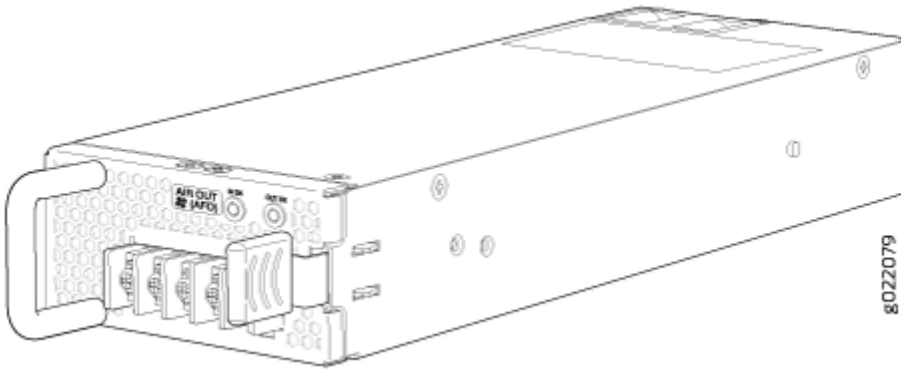
- AC and DC power supplies in the same chassis
- Power supplies with different airflow labels (**AIR IN (AFI)** and **AIR OUT (AFO)**) in the same chassis.
- Fan modules with different airflow labels (**AIR IN (AFI)** and **AIR OUT (AFO)**) in the same chassis.
- Power supplies and fan modules with different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

This topic includes:

## Characteristics of a DC Power Supply

EX4650 switches support 650 W DC power supply (see [Figure 22 on page 36](#)).

**Figure 22: DC Power Supply for an EX4650 Switch**



You can install up to two DC power supplies in an EX4650 switch. Power supplies are installed in the power supply slots labeled **PSU 0** and **PSU 1** in the rear panel of the chassis.

[Table 16 on page 36](#) lists the details of the 650 W DC power supplies used in EX4650 switches.

**Table 16: Details of the DC Power Supplies in EX4650 Switches**

Details	650 W DC Power Supply
Model number	<ul style="list-style-type: none"> <li>• JPSU-650W-DC-AFO</li> <li>• JPSU-650W-DC-AFI</li> </ul>
Field-replaceable unit (FRU) type	Hot-insertable and hot-removable
Power supply weight	2.43 lb (1.1 kg)
Minimum installed in chassis	1
Maximum installed in chassis	2

**Table 16: Details of the DC Power Supplies in EX4650 Switches (Continued)**

Details	650 W DC Power Supply
Power supply slots	Install in power supply slots labeled <b>PSU 0</b> and <b>PSU 1</b> in the rear panel of the chassis.
Fans	Internal
Airflow	<ul style="list-style-type: none"> <li>• Front-to-back, indicated by label <b>AIR OUT (AFO)</b></li> <li>• Back-to-front, indicated by label <b>AIR IN (AFI)</b></li> </ul>
Power supply status LEDs	<b>AC OK</b> and <b>DC OK</b>
DC input current rating	4 A
Operating range	<p>-38 through -60 VDC</p> <p><b>NOTE:</b> The minimum input power required to power on the switch is -43.5 +/- 0.5 VDC. After the switch is powered on, the operating range is -38 through -60 VDC.</p>

## DC Power Supply Airflow

Each power supply has its own fan and is cooled by its own internal cooling system.

Each power supply has a label **AIR OUT (AFO)** or **AIR IN (AFI)** on the faceplate of the power supply that indicates the direction of airflow in the power supply.

[Table 17 on page 38](#) lists the DC power supply models and the direction of airflow in them.

**Table 17: Airflow Direction in DC Power Supply Models for EX4650 Switches**

Model	Label on Power Supply	Direction of Airflow
JPSU-650W-DC-AFO	<b>AIR OUT (AFO)</b>	Front-to-back—that is, air intake to cool the chassis is through the vents on the front panel of the chassis and hot air exhausts through the vents on the rear panel of the chassis.
JPSU-650W-DC-AFO	<b>AIR IN (AFI)</b>	Back-to-front—that is, air intake to cool the chassis is through the vents on the rear panel of the chassis and hot air exhausts through the vents on the front panel of the chassis.

## DC Power Supply in EX4650 Switches

### IN THIS SECTION

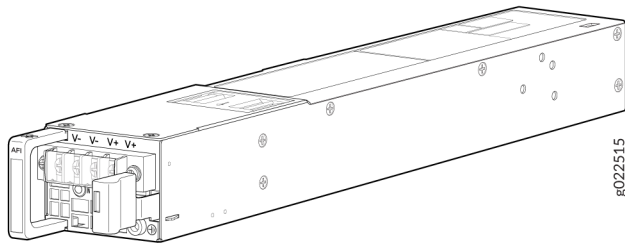
- [DC Power Supply in EX4650 Switches | 38](#)
- [Airflow Direction in Power Supplies | 39](#)

EX4650 switches support two DC power supplies with either front-to back or back-to-front airflow. Power supplies for the EX4650 switch are fully redundant, load-sharing, and hot-removable and hot-insertable FRUs. The EX4650 switch models are shipped with two power supplies preinstalled in the rear panel of the chassis.

### DC Power Supply in EX4650 Switches

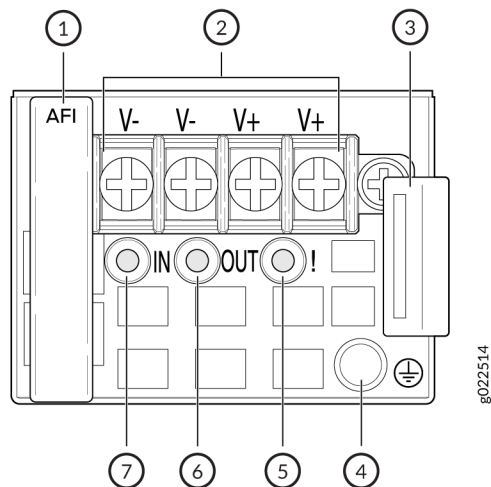
The DC power supply in EX4650 is 650 W with dual feeds for power resiliency. [Figure 23 on page 39](#) shows a DC power supply for an EX4650 switch.

Figure 23: DC power supply for an EX4650 switch



**NOTE:** The DC power supply in the switch has four terminals labeled V-, V-, V+, and V+ for connecting DC power source cables labeled positive (+) and negative (-) as shown in [Figure 24](#) on page 39.

Figure 24: DC power supply faceplate of an EX4650 switch



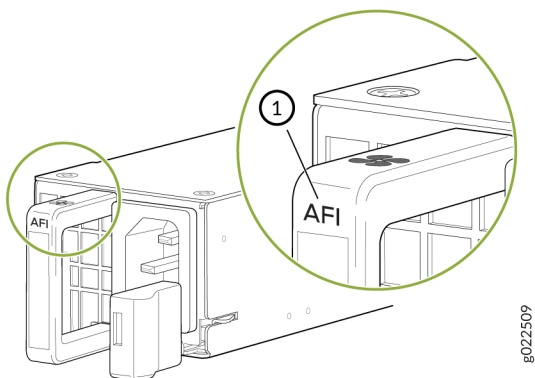
1– AFI	5– Fault LED
2– Input terminals	6– Output LED
3– Ejector lever	7– Input LED
4– ESD grounding point	

### Airflow Direction in Power Supplies

Each power supply has two fan supplies and is cooled by its own internal cooling system.

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. **AIR IN (AFI)** label or a blue-colored handle indicates back-to-front airflow while **AIR OUT (AFO)** label or a gold-colored handle indicates front-to-back airflow. See [Figure 25 on page 40](#)

**Figure 25: Power supply handle detail**



1– AIR IN (AFI) label

Be sure to use the correct power supply for your chassis product SKU (see [Table 18 on page 41](#)).



**CAUTION:** Do not mix:

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



**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. If you need to convert the airflow pattern on a chassis, you must replace all the fans and power supplies at one time to use the new direction.

[Table 18 on page 41](#) lists the AC power supplies used in EX4650 switches and the direction of airflow in them.



**Table 18: Airflow direction in AC power supplies for EX4650 switches**

Product Number	Direction of Airflow	Color of Power Supply Handle
JPSU-650W-AC-AFO	Front to back	Juniper Gold
JPSU-650W-AC-AFI	Back to front	Juniper Azure Blue

## EX4650 DC Power Specifications

[Table 19 on page 41](#) describes the EX4650 DC power specifications. The typical and maximum power consumption values are calculated using dummy transceivers on all ports. Traffic is run at 25° C ambient temperature.

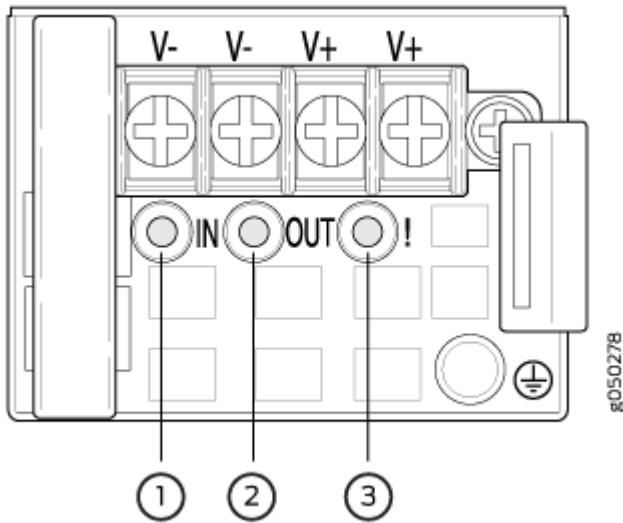
**Table 19: DC Power Specifications for EX4650**

Item	Specifications
DC input voltage	<ul style="list-style-type: none"> <li>Rated operating voltage: -48 VDC to -60 VDC</li> <li>Operating voltage range: -40.8 VDC through -72 VDC</li> </ul>
DC input current rating	20 A maximum
Typical power consumption	260 W
Maximum power consumption	450 W

## DC Power Supply LEDs in EX4650 Switches

[Figure 26 on page 42](#) shows the location of the LEDs on the DC power supply.

Figure 26: DC Power Supply Faceplate on an EX4650 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 20 on page 42 describes the LEDs on the DC power supplies.

Table 20: DC Power Supply LEDs on an EX4650 Switch

LED	Color	State	Description
In	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.
Out	Unlit	Off	The power supply is disconnected from power, or the power supply is not sending out power correctly.

**Table 20: DC Power Supply LEDs on an EX4650 Switch (Continued)**

LED	Color	State	Description
	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.

# 2

CHAPTER

## Site Planning, Preparation, and Specifications

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Site Preparation Checklist for EX4650 Switches | 45

EX4650 Site Guidelines and Requirements | 46

EX4650 Network Cable and Transceiver Planning | 56

EX4650 Management Cable Specifications and Pinouts | 63

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# Site Preparation Checklist for EX4650 Switches

The checklist in [Table 21 on page 45](#) summarizes the tasks you need to perform to prepare a site for installing an EX4650 switch.

**Table 21: Site Preparation Checklist**

Item or Task	For More Information	Performed by	Date
<b>Environment</b>			
Verify that environmental factors such as temperature and humidity do not exceed switch tolerances.	<a href="#">Environmental Requirements and Specifications for EX Series Switches</a>		
<b>Power</b>			
Measure the distance between external power sources and the switch installation site.			
Locate sites to connect system grounding.			
Calculate the power consumption and requirements.	<a href="#">"EX4650 Power System" on page 27</a>		
<b>Hardware Configuration</b>			
Choose the number and types of switches you want to install.	<a href="#">"EX4650 Switches Hardware Overview" on page 2</a>		
<b>Rack or Cabinet</b>			
Verify that the rack meets the minimum requirements for installing the switch.	<ul style="list-style-type: none"> <li>• <a href="#">"Rack Requirements for EX4650 Switches" on page 50</a></li> <li>• </li> </ul>		

**Table 21: Site Preparation Checklist (Continued)**

Item or Task	For More Information	Performed by	Date
Plan rack or cabinet location, including required space clearances.			
Secure the rack or cabinet to the floor and building structure.			
<b>Cables</b>			
<p>Acquire cables and connectors:</p> <ul style="list-style-type: none"> <li>• Determine the number of cables needed based on your planned configuration.</li> <li>• Review the maximum distance allowed for each cable. Choose the length of the cable based on the distance between the hardware components being connected.</li> </ul>			
Plan the cable routing and management.			

## EX4650 Site Guidelines and Requirements

### IN THIS SECTION

- [Environmental Requirements and Specifications for EX4650 Switches | 47](#)
- [General Site Guidelines | 48](#)
- [Site Electrical Wiring Guidelines | 49](#)
- [Rack Requirements for EX4650 Switches | 50](#)
- [Cabinet Requirements for EX4650 Switches | 52](#)

## Environmental Requirements and Specifications for EX4650 Switches

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

Follow these environmental guidelines:

- 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 device to protect the hardware components.

[Table 22 on page 47](#) provides the required environmental conditions for normal switch operation for all EX4650 models.

**Table 22: EX4650 Environmental Tolerances**

Description	Tolerance
Altitude	No performance degradation to 6562 feet (2000 meters)
Relative humidity	<p>Normal operation ensured in relative humidity range of 5% through 90%, noncondensing</p> <ul style="list-style-type: none"> <li>• Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing</li> </ul> <p><b>NOTE:</b> As defined in NEBS GR-63-CORE, Issue 3, short-term events can be up to 96 hours in duration but not more than 15 days per year.</p>

Table 22: EX4650 Environmental Tolerances (*Continued*)

Description	Tolerance
Temperature	<ul style="list-style-type: none"> <li>• Normal operation ensured in temperature range of 32° F through 104° F (0° C through 45° C)</li> <li>• Nonoperating storage temperature in shipping container: -40° F through 158° F (-40° C through 70° C)</li> </ul>
Seismic	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 3.

**NOTE:** Install EX4650 devices 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 and maintenance. It also requires 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 prescribed airflow guidelines to ensure that the cooling system functions properly. Ensure that 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 23 on page 49 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 23: Site Electrical Wiring Guidelines**

Site Wiring Factor	Guidelines
Signaling limitations	<p>If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding:</p> <ul style="list-style-type: none"> <li>• Improperly installed wires cause radio frequency interference (RFI).</li> <li>• Damage from lightning strikes occurs when wires exceed recommended distances or pass between buildings.</li> <li>• Electromagnetic pulses (EMPs) caused by lightning damage unshielded conductors and electronic devices.</li> </ul>
Radio frequency interference	<p>To reduce or eliminate RFI from your site wiring, do the following:</p> <ul style="list-style-type: none"> <li>• Use a twisted-pair cable with a good distribution of grounding conductors.</li> <li>• If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal, when applicable.</li> </ul>
Electromagnetic compatibility	<p>If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, seek expert advice.</p> <p>Strong sources of electromagnetic interference (EMI) can cause:</p> <ul style="list-style-type: none"> <li>• Destruction of the signal drivers and receivers in the device,</li> <li>• Electrical hazards as a result of power surges conducted over the lines into the equipment.</li> </ul>

## Rack Requirements for EX4650 Switches

EX4650 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 24 on page 50](#) provides the rack requirements and specifications for the EX4650.

**Table 24: Rack Requirements for the EX4650**

Rack Requirement	Guidelines
Rack type	<p>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.</p> <p>A U is the standard rack unit defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310-D) published by the Electronics Industry Association.</p>
Mounting bracket hole spacing	<p>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.</p>

Table 24: Rack Requirements for the EX4650 (Continued)

Rack Requirement	Guidelines
Rack size and strength	<ul style="list-style-type: none"> <li>• Ensure that the rack is a 19-in. rack as defined in Cabinets, Racks, Panels, and Associated Equipment (document number EIA-310-D) published by the Electronics Components Industry Association (<a href="http://www.ecianow.org/">http://www.ecianow.org/</a>).</li> <li>• Ensure that the rack is one of the following standard lengths: <ul style="list-style-type: none"> <li>• 23.6 in. (600 mm)</li> <li>• 30.0 in. (762 mm)</li> <li>• 31.5 in. (800 mm)</li> </ul> </li> <li>• 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).</li> <li>• Either side of the switch needs to be mounted flush with the rack and still adjustable for racks with different depths. The front and rear rack rails must be spaced between 23.62 in. (600 mm) and 31.5 in. (800 mm) front to back.</li> <li>• The rack must be strong enough to support the weight of the switch.</li> <li>• Ensure that the spacing of rails and adjacent racks allows for proper clearance around the switch and rack.</li> </ul>
Rack connection to building structure	<ul style="list-style-type: none"> <li>• Secure the rack to the building structure.</li> <li>• If earthquakes are a possibility in your geographical area, secure the rack to the floor.</li> <li>• Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.</li> </ul>

## Cabinet Requirements for EX4650 Switches

You can mount the EX4650 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 25 on page 52](#) provides the cabinet requirements and specifications for the EX4650 switch.

**Table 25: Cabinet Requirements for the EX4650 Switch**

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a EX4650 switch is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet clearance	<ul style="list-style-type: none"> <li>• The outer edges of the front-mounting brackets extend the width of the chassis to 19 in. (48.2 cm)</li> <li>• The minimum total clearance inside the cabinet is 30.7 in. (780 mm) between the inside of the front door and the inside of the rear door.</li> </ul>

**Table 25: Cabinet Requirements for the EX4650 Switch (Continued)**

Cabinet Requirement	Guidelines
Cabinet airflow requirements	<p>When you mount the switch in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating.</p> <ul style="list-style-type: none"> <li>• Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the switch (or switches).</li> <li>• 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.</li> <li>• The EX4650 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.</li> <li>• Route and dress all cables to minimize the blockage of airflow to and from the chassis.</li> <li>• Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the switch and cabinet.</li> </ul>

## Clearance Requirements for Airflow and Hardware Maintenance for EX4650 Switches

When planning the site for installing an EX4650 switch, you must ensure sufficient clearance around the switch.

Follow these clearance requirements:

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See [Figure 27 on page 54](#), [Figure 28 on page 55](#), and [Figure 29 on page 56](#) for reference.

Figure 27: Front-to-Back Airflow

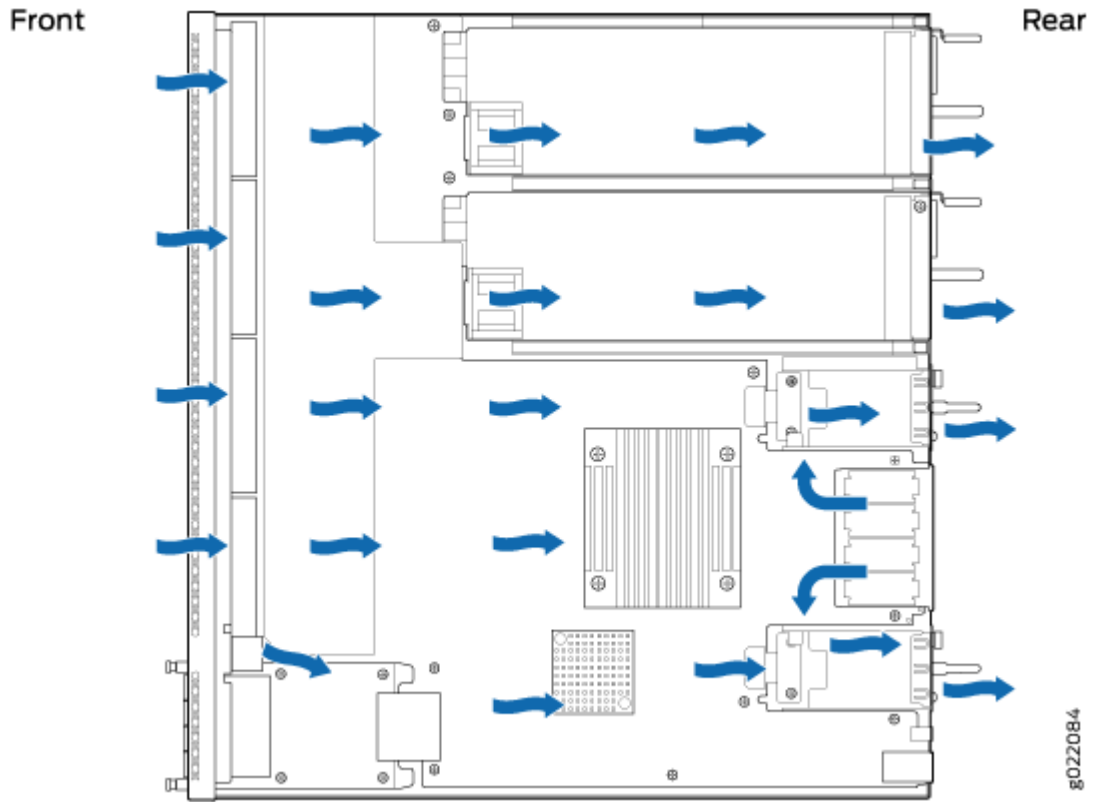
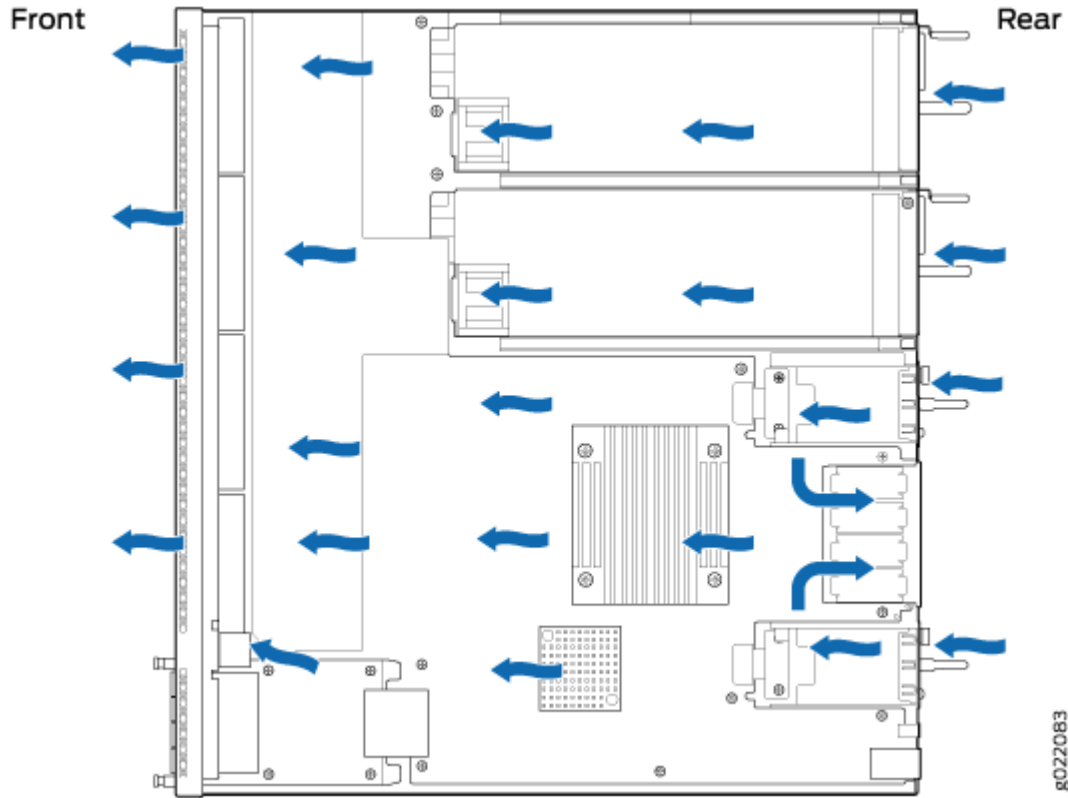
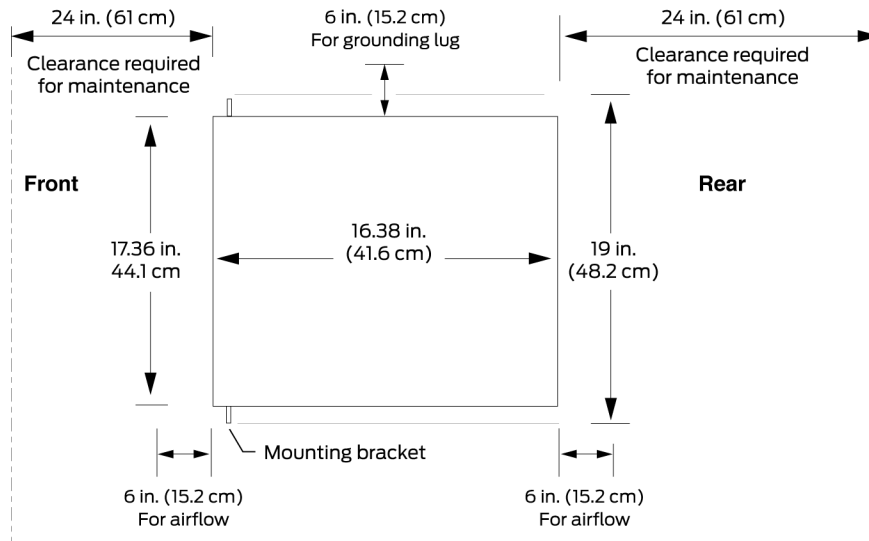


Figure 28: Back-to-Front Airflow



- If you are mounting the switch on a rack or cabinet along with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- Leave at least 6 in. (15.2 cm) clearance in front of and behind the chassis for airflow.
- Leave at least 6 in. (15.2 cm) clearance on the left of the chassis for installing the grounding lug.
- Leave at least 24 in. (61 cm) clearance in front of and behind the switch for service personnel to remove and install hardware components.

Figure 29: Clearance Requirements for Airflow and Hardware Maintenance for an EX4650 Switch



## EX4650 Network Cable and Transceiver Planning

### IN THIS SECTION

- Pluggable Transceivers Supported on EX4650 Switches | 56
- SFP28 Direct Attach Copper Cables for EX4650 Switches | 57
- QSFP28 Direct Attach Copper Cables for EX4650 Switches | 59
- Calculate the Fiber-Optic Cable Power Budget for EX Series Devices | 60
- Calculating the Fiber-Optic Cable Power Margin for EX Series Devices | 61

### Pluggable Transceivers Supported on EX4650 Switches

EX4650 switches support SFP, SFP+, and QSFP+ transceivers. You can find the list of transceivers supported on EX4650 switches and information about those transceivers at the [Hardware Compatibility Tool](#) page for EX4650.



**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.

The Gigabit Ethernet SFP+, and QSFP+ transceivers installed in EX4650 switches support digital optical monitoring (DOM): You can view the diagnostic details for these transceivers by issuing the operational mode CLI command `show interfaces diagnostics optics`.

**NOTE:** The transceivers support DOM even if they are installed in the SFP+ uplink module ports.

## SFP28 Direct Attach Copper Cables for EX4650 Switches

### IN THIS SECTION

- [Cable Specifications | 58](#)
- [Standards Supported by These Cables | 59](#)

Small form-factor pluggable transceiver (SFP28) direct attach copper (DAC) cables, also known as Twinax cables, are suitable for in-rack connections between servers and switches. They are suitable for short distances, making them ideal for highly cost-effective networking connectivity within a rack and between adjacent racks.

**NOTE:** We recommend that you use only SFP28 DAC cables purchased from Juniper Networks with your Juniper Networks device.



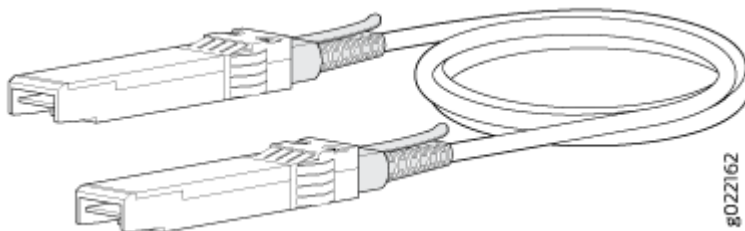
**CAUTION:** The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem 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.

## Cable Specifications

EX4650 switches support SFP28 passive DAC cables. The passive Twinax cable is a straight cable with no active electronic components. EX4650 switches support 1 m, 3 m, and 5 m long SFP28 passive DAC cables. See [Figure 30 on page 58](#).

**Figure 30: SFP28 Direct Attach Copper Cables for EX4650 Switches**



The cables are hot-removable and hot-insertable: You can remove and replace them without powering off the switch or disrupting switch functions. A cable comprises a low-voltage cable assembly that connects directly into two 25-Gigabit Ethernet ports, one at each end of the cable. The cables use high-performance integrated duplex serial data links for bidirectional communication and are designed for data rates of up to 25 Gbps.

## Standards Supported by These Cables

The cables comply with the following standards:

- SFP mechanical standard SFF-8431— see <ftp://ftp.seagate.com/sff/SFF-8431.PDF>.
- Electrical interface standard SFF-8432— see <ftp://ftp.seagate.com/sff/SFF-8432.PDF>.
- SFP+ Multi-Source Alliance (MSA) standards

## QSFP28 Direct Attach Copper Cables for EX4650 Switches

### IN THIS SECTION

- [Cable Specifications | 60](#)

Quad small form-factor pluggable (QSFP28) direct attach copper (DAC) cables are suitable for in-rack connections between QSFP28 ports on EX4650 switches. They are suitable for short distances, making them ideal for highly cost-effective networking connectivity within a rack and between adjacent racks.

**NOTE:** We recommend that you use only QSFP28 DAC cables 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

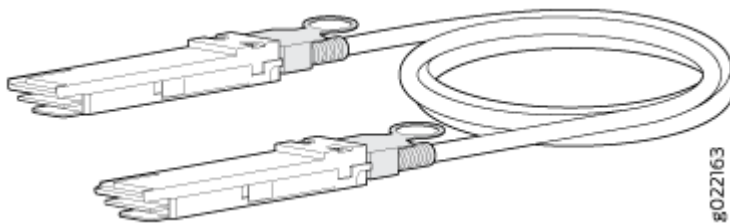
the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

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.

## Cable Specifications

QSFP28 passive DAC cables are hot-removable and hot-insertable. A cable consists of a cable assembly that connects directly into two QSFP28 modules, one at each end of the cable. The cables use integrated duplex serial data links for bidirectional communication and are designed for data rates up to 100 Gbps. Passive DAC cables have no signal amplification built into the cable assembly. See [Figure 31 on page 60](#).

**Figure 31: QSFP28 Direct Attach Copper Cables**



## 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).

$$P_T = -15 \text{ dBm}$$

$$P_R = -28 \text{ dBm}$$

**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 ( $P_T$ ):
 
$$-15 \text{ dBm} - (-28 \text{ dBm}) = 13 \text{ dBm}$$

## 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 26 on page 62](#) (here, the link is 2 km long and multimode, and the ( $P_B$ ) is 13 dBm):

Table 26: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value	Sample (LL) Calculation Values
Higher-order mode losses (HOL)	<ul style="list-style-type: none"> <li>• Multimode—0.5 dBm</li> <li>• Single mode—None</li> </ul>	<ul style="list-style-type: none"> <li>• 0.5 dBm</li> <li>• 0 dBm</li> </ul>
Modal and chromatic dispersion	<ul style="list-style-type: none"> <li>• Multimode—None, if product of bandwidth and distance is less than 500 MHz/km</li> <li>• Single mode—None</li> </ul>	<ul style="list-style-type: none"> <li>• 0 dBm</li> <li>• 0 dBm</li> </ul>
Connector	0.5 dBm	This example assumes 5 connectors. Loss for 5 connectors: $(5) * (0.5 \text{ dBm}) = 2.5 \text{ dBm}$
Splice	0.5 dBm	This example assumes 2 splices. Loss for two splices: $(2) * (0.5 \text{ dBm}) = 1 \text{ dBm}$
Fiber attenuation	<ul style="list-style-type: none"> <li>• Multimode—1 dBm/km</li> <li>• Single mode—0.5 dBm/km</li> </ul>	This example assumes the link is 2 km long. Fiber attenuation for 2 km: <ul style="list-style-type: none"> <li>• <math>(2 \text{ km}) * (1.0 \text{ dBm/km}) = 2 \text{ dBm}</math></li> <li>• <math>(2 \text{ km}) * (0.5 \text{ dBm/km}) = 1 \text{ dBm}</math></li> </ul>
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 ( $P_B$ ):

$$P_B - LL = P_M$$

$$(13 \text{ dBm}) - (0.5 \text{ dBm [HOL]}) - ((5) * (0.5 \text{ dBm})) - ((2) * (0.5 \text{ dBm})) - ((2 \text{ km}) * (1.0 \text{ dBm/km})) - (1 \text{ dB [CRM]}) = P_M$$

$$13 \text{ dBm} - 0.5 \text{ dBm} - 2.5 \text{ dBm} - 1 \text{ dBm} - 2 \text{ dBm} - 1 \text{ dBm} = P_M$$

$$P_M = 6 \text{ dBm}$$

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.

## EX4650 Management Cable Specifications and Pinouts

### IN THIS SECTION

- [Console Port Connector Pinout Information | 63](#)
- [RJ-45 Management Port Connector Pinout Information | 64](#)
- [RJ-45 to DB-9 Serial Port Adapter Pinout Information | 65](#)
- [QSFP+, QSFP28, SFP, SFP+, and SFP28 Port Connector Pinout Information | 66](#)

### 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 27 on page 64](#) provides the pinout information for the RJ-45 console connector.

**NOTE:** If your laptop or PC does not have a DB-9 plug connector pin and you want to connect your laptop or 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 27: Console Port Connector Pinout Information**

Pin	Signal	Description
1	NC	No Connection
2	NC	No Connection
3	TxD Output	Transmit data
4	Signal Ground	Signal ground
5	Signal Ground	Signal ground
6	RxD Input	Receive data
7	NC	No Connection
8	NC	No Connection

## RJ-45 Management Port Connector Pinout Information

[Table 28 on page 64](#) provides the pinout information for the RJ-45 connector for the management port on Juniper Networks devices.

**Table 28: RJ-45 Management Port Connector Pinout Information**

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1
2	TRP1-	Transmit/receive data pair 1



**Table 28: RJ-45 Management Port Connector Pinout Information (Continued)**

Pin	Signal	Description
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

## RJ-45 to DB-9 Serial Port Adapter 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 management device such as a laptop or a desktop PC. 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 to the device, use a combination of the RJ-45 to DB-9 socket adapter along with a USB to DB-9 plug adapter.

[Table 29 on page 65](#) provides the pinout information for the RJ-45 to DB-9 serial port adapter.

**Table 29: RJ-45 to DB-9 Serial Port Adapter Pinout Information**

RJ-45 pin	Signal	DB-9 pin	Signal
1	RTS	8	CTS
2	DTR	6	DSR
3	TxD	2	RxD

**Table 29: RJ-45 to DB-9 Serial Port Adapter Pinout Information (Continued)**

RJ-45 pin	Signal	DB-9 pin	Signal
4	GND	5	GND
6	RxD	3	TxD
7	DSR	4	DTR
8	CTS	7	RTS

## QSFP+, QSFP28, SFP, SFP+, and SFP28 Port Connector Pinout Information

- [Table 30 on page 66](#)—SFP network port connector pinout information
- [Table 31 on page 68](#)—SFP+ network port connector pinout information
- [Table 32 on page 69](#)—QSFP+ and QSFP28 network module ports connector pinout information

**Table 30: SFP Network Port Connector Pinout Information**

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock

**Table 30: SFP Network Port Connector Pinout Information (Continued)**

Pin	Signal	Description
6	MOD_ABS	Module absent
7	RS	Rate select
8	RX_LOS	Receiver loss of signal indication
9	VeeR	Module receiver ground
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3 V supply
16	VccT	Module transmitter 3.3 V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

**Table 31: SFP+ and SFP28 Network Port Connector Pinout Information**

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent
7	RS0	Rate select 0, optionally controls SFP+ module receiver
8	RX_LOS	Receiver loss of signal indication
9	RS1	Rate select 1, optionally controls SFP+ transmitter
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3 V supply

**Table 31: SFP+ and SFP28 Network Port Connector Pinout Information (Continued)**

Pin	Signal	Description
16	VccT	Module transmitter 3.3 V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

**Table 32: QSFP+ and QSFP28 Network Port Connector Pinout Information**

Pin	Signal
1	GND
2	TX2n
3	TX2p
4	GND
5	TX4n
6	TX4p
7	GND
8	ModSelL
9	LPMODE_Reset

Table 32: QSFP+ and QSFP28 Network Port Connector Pinout Information (Continued)

Pin	Signal
10	VccRx
11	SCL
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n
22	RX2p
23	GND
24	RX4n

Table 32: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
25	RX4p
26	GND
27	ModPrsL
28	IntL
29	VccTx
30	Vcc1
31	Reserved
32	GND
33	TX3p
34	TX3n
35	GND
36	TX1p
37	TX1n
38	GND

# 3

CHAPTER

## Initial Installation and Configuration

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Unpacking and Mounting the EX4650 Switch | 73

Connecting the EX4650 to Power | 78

Connecting the EX4650 to the Network | 88

Connecting the EX4650 to External Devices | 93

Configuring Junos OS on the EX4650 | 96

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# Unpacking and Mounting the EX4650 Switch

## IN THIS SECTION

- [Unpacking the Switch | 73](#)
- [Parts Inventory \(Packing List\) for an EX4650 Switch | 73](#)
- [Register Products—Mandatory to Validate SLAs | 75](#)
- [Mounting an EX4650 Switch on Four Posts of a Rack or Cabinet | 75](#)

## Unpacking the Switch

EX4650 switches are shipped in a cardboard carton, secured with foam packing material. The carton has an accessory compartment and contains the quick start instructions.



**CAUTION:** EX4650 switches are maximally protected inside the shipping carton. Do not unpack the switches until you are ready to begin installation.

To unpack the 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 marked on the carton are pointing up.
3. Open the top flaps on the shipping carton.
4. Pull out the packing material holding the switch in place.
5. Verify the parts received against the inventory on the label attached to the carton.
6. Save the shipping carton and packing materials in case you need to move or ship the switch later.

## Parts Inventory (Packing List) for an EX4650 Switch

The switch shipment includes a packing list. Check the parts you receive with the switch against the items in the packing list. The packing list specifies the part number and provides a description of each part in your order. The parts shipped depend on the switch model you order.

If any part in the packing list is missing, contact your customer service representative or contact Juniper customer care from within the U.S. or Canada by telephone at 1-888-314-5822. For international-dial or direct-dial options in countries without toll-free numbers, see <https://www.juniper.net/support/requesting-support.html>.

Table 33 on page 74 lists the parts and their quantities as listed in the standard packing list for an EX4650 switch.

**Table 33: Inventory of Components Provided with an EX4650 Switch**

Component		Quantity
Switch		1
Fan modules	EX4650	5 preinstalled
Power supplies	EX4650	2 (AC or DC) preinstalled
AC power cord appropriate for your geographical location	EX4650	2
Mounting brackets		<ul style="list-style-type: none"> <li>• Rear mounting blades - 2</li> <li>• Front mounting brackets - 2</li> <li>• Extension brackets - 2</li> <li>• Mounting screws - 12</li> </ul>
Quick Start installation instructions		1
Juniper Networks Product Warranty		1
End User License Agreement		1

**NOTE:** You must provide the appropriate mounting screws for mounting the switch on a rack.

## Register Products—Mandatory to Validate SLAs

Register all new Juniper Networks hardware products and changes to an existing installed product using the Juniper Networks website to activate your hardware replacement service-level agreements (SLAs).



**CAUTION:** Register product serial numbers on the Juniper Networks website. Update the installation base data if any addition or change to the installation base occurs or if the installation base is moved. Juniper Networks is not responsible for not meeting the hardware replacement service-level agreement for products that do not have registered serial numbers or accurate installation base data.

Register your product(s) at <https://tools.juniper.net/svcreg/SRegSerialNum.jsp>.

Update your installation base at <https://www.juniper.net/customers/csc/management/updateinstallbase.jsp>.

## Mounting an EX4650 Switch on Four Posts of a Rack or Cabinet

Before mounting the switch on four posts of a rack:

- Verify that the site meets the requirements described in "[Site Preparation Checklist for EX4650 Switches](#)" on page 45
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
- Read "[General Safety Guidelines and Warnings](#)" on page 138, with particular attention to "[Chassis and Component Lifting Guidelines](#)" on page 144.
- Remove the switch from the shipping carton (see "[Unpacking the Switch](#)" on page 73).

Ensure that you have the following parts and tools available:

- Phillips (+) screwdriver, number 2 (not provided)
- 6 flat-head 4-40 Phillips mounting screws (provided with the four-post rack-mount kit)

- 12 flat-head 4x6-mm Phillips mounting screws (provided with the four-post rack-mount kit)
- One pair each of flush or 2-in.-recess front-mounting brackets (provided with the four-post rack-mount kit)
- One pair of side mounting-rails (provided with the four-post rack-mount kit)
- One pair of rear mounting-blades (provided with the four-post rack-mount kit)
- Screws to secure the chassis and the rear mounting-blades to the rack (not provided)

You can mount an EX4650 switch on four posts of a 19-in. rack or a 19-in. cabinet by using the separately orderable four-post rack-mount kit. (The remainder of this topic uses *rack* to mean *rack* or *cabinet*.)

**NOTE:** To ensure that the protective earthing terminal is accessible through the opening in the rear mounting-blade:

- Ensure that the rack is 27.5 in. (70 cm) through 30.5 in. (77.5 cm) deep if you are mounting the switch flush with the rack front on four posts of a rack.
- Ensure that the rack is 29.5 in. (75 cm) through 32.5 in. (82.5 cm) deep if you are mounting the switch 2 in. recessed from the rack front.

**NOTE:** One person must be available to lift the switch while another secures it to the rack.



**CAUTION:** If you are mounting multiple units on a rack, mount the heaviest unit at the bottom of the rack and mount the other units from the bottom of the rack to the top in decreasing order of the weight of the units.

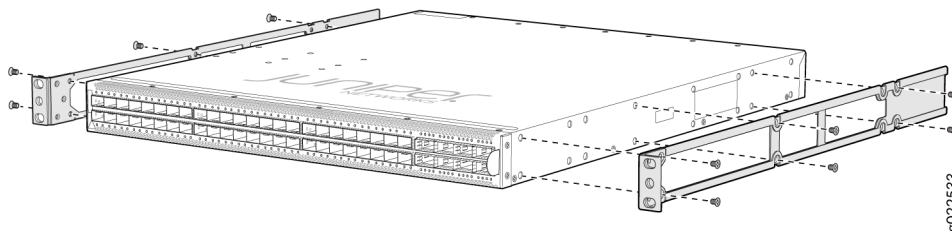
To mount the switch on four posts of a rack:

1. Place the switch on a flat, stable surface.

**NOTE:** The four-post rack-mount kit ships with the short front-mounting brackets attached to the side mounting-rails. If you want to recess the switch in the rack, you must unscrew the short front-mounting brackets from the side mounting-rails by using the Phillips (+) screwdriver and attach the long front-mounting brackets to the side mounting-rails.

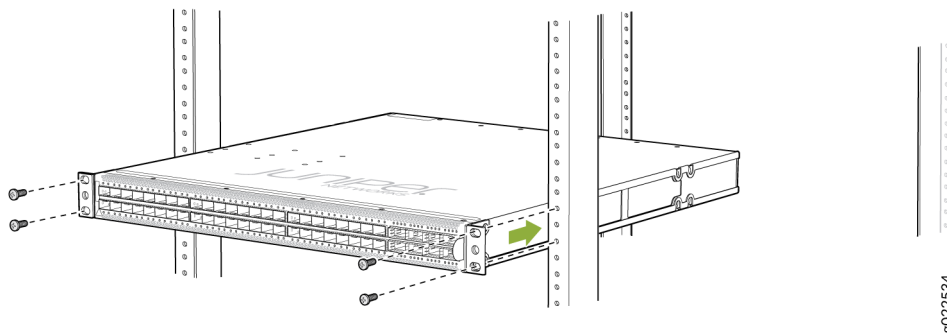
2. Align the side mounting-rails along the side panels of the switch chassis. Align the two holes in the rear of the side mounting-rails with the two holes on the rear of the side panels.
3. Insert 4x6-mm Phillips flat-head mounting screws into the two aligned holes and tighten the screws by using the screwdriver. Ensure that the remaining four holes in the side mounting-rails are aligned with the four holes in the side panel. See [Figure 32 on page 77](#).

**Figure 32: Attaching the Side Mounting-Rail to the Switch Chassis**



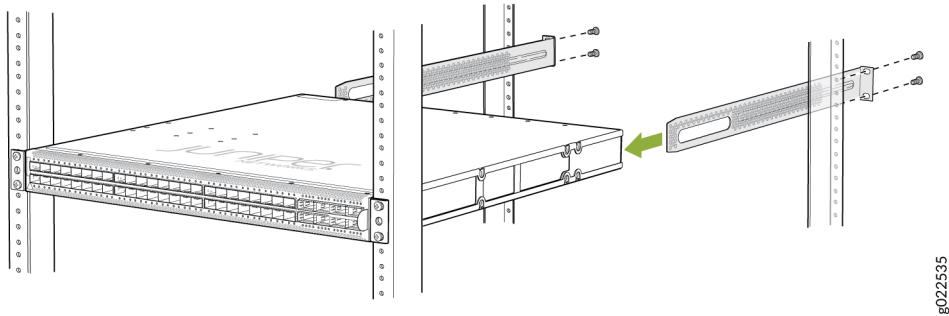
4. Insert the 4x6-mm Phillips flat-head mounting screws into the remaining four holes in the side mounting-rails and tighten the screws by using the screwdriver.
5. Have one person grasp both sides of the switch, lift the switch, and position it in the rack, aligning the side mounting-rail holes with the threaded holes in the front post of the rack. Align the bottom hole in both the front-mounting brackets with a hole in each rack rail, making sure the chassis is level. See [Figure 33 on page 77](#).

**Figure 33: Mounting the Switch on Front Posts of a Rack**



6. Have a second person secure the front of the switch to the rack by using the appropriate screws for your rack.
7. Slide the rear mounting-blades into the side mounting-rails. See [Figure 34 on page 78](#).

Figure 34: Sliding the Rear Mounting-Blades into the Side Mounting-Rails



8. Attach the rear mounting-blades to the rear post by using the appropriate screws for your rack. Tighten the screws.
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.

**NOTE:** We recommend that you install cover panels in the unused power supply slots.

## Connecting the EX4650 to Power

### IN THIS SECTION

- [Connect the EX4650 Switch to Earth Ground | 78](#)
- [Connecting AC Power to an EX4650 Switch | 80](#)
- [Connecting DC Power to an EX4650 Switch | 82](#)

### Connect the EX4650 Switch to Earth Ground

Before you connect earth ground to a EX4650 switch, ensure that you have the following parts and tools available:

- Grounding cable:
  - 14 AWG (1.5 mm<sup>2</sup>), minimum 90° C wire, or as permitted by the local code—not provided

- Grounding lug:
  - Panduit LCD10-10A-L or equivalent—not provided
- Screws to secure the grounding lug:
  - Two 10-32 x .25-in. screws with #10 split-lock washers—not provided
- Number 2 Phillips (+) screwdriver—not provided
- ESD grounding strap—not provided

To ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements, you must connect the switch to earth ground before you connect power to the switch. You must install the switch in a restricted-access location and ensure that the chassis is properly grounded at all times.

EX4650 switches have one two-hole protective earthing terminal on the left panel. 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.



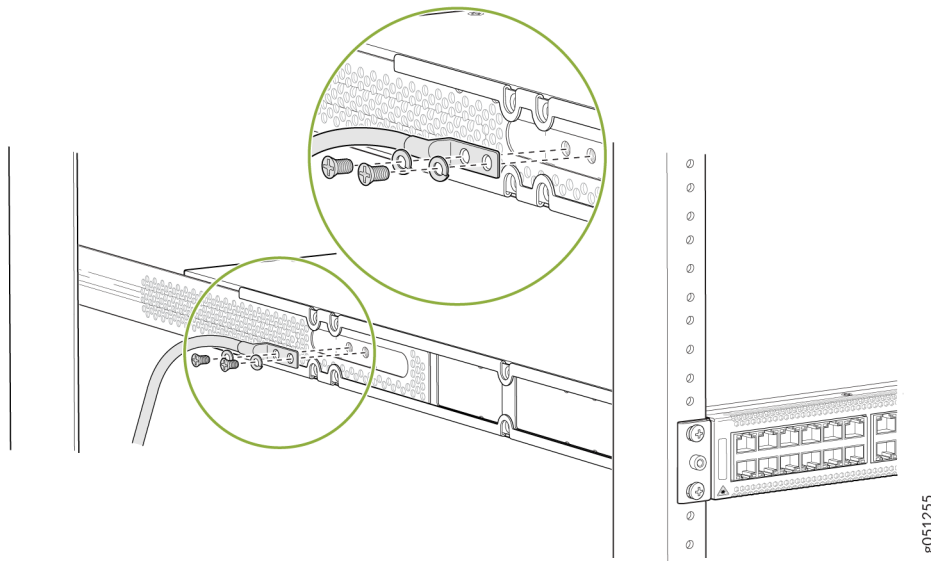
**CAUTION:** Ensure that a licensed electrician has attached the appropriate grounding lug to the grounding cable that you supply. Using a grounding cable with an incorrectly attached lug can damage the switch.

**NOTE:** The protective earthing terminal on EX4650 switches mounted flush with the front posts of a rack is accessible through the slot on the left rear bracket only if the distance between the front posts and the rear posts is 23 in. (58.5 cm) through 30.25 in. (76.8 cm). The protective earthing terminal on EX4650 switches mounted in a recessed position from the front posts of a rack is accessible through the slot on the left rear bracket only if the distance between the front posts and the rear posts is 25 in. (63.5 cm) through 32.25 in. (81.9 cm). AC-powered switches gain additional grounding when you plug the power supply in the switch into a grounded AC power outlet by using the AC power cord appropriate for your geographical location.

To ground the EX4650:

1. Connect one end of the grounding cable to a proper earth ground, such as the rack in which the switch is mounted.
2. Place the grounding lug attached to the grounding cable over the protective earthing terminal. The protective earthing terminal is located on the left panel (see [Figure 35 on page 80](#)).

Figure 35: Connect a Grounding Cable to the EX4650



3. Secure the grounding lug to the protective earthing terminal with the screws.
4. Dress the grounding cable and ensure that it does not touch or block access to other switch components.



**WARNING:** Ensure that the cable does not drape where people could trip over it.

## Connecting AC Power to an EX4650 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](#)" on page 163).
- 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 safety and 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 EX4650](#). The switch gains additional grounding when you plug the power supply in the switch into a grounded AC power outlet by using the AC power cord appropriate for your geographical location.

The EX4650 is shipped with two 650 W 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 switch functions.

To connect AC power to an EX4650:

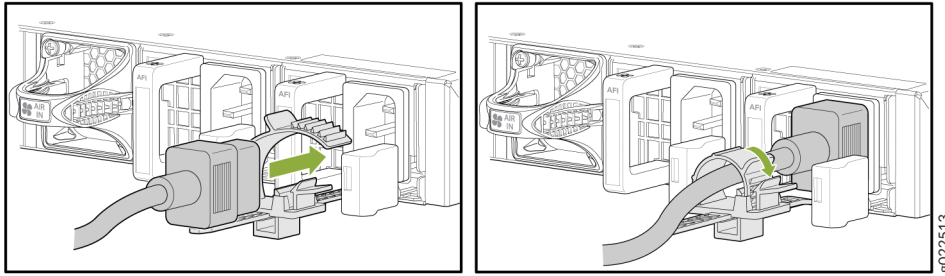
1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure. If only one power supply is installed, ensure that a blank cover panel is installed over the second power supply slot.
3. Locate the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



**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 36 on page 82](#)).

Figure 36: Connecting an AC Power Cord to an AC Power Supply in an EX4650



1– Power cord retainer

6. 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. 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. 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 one minute of removal to prevent chassis overheating.

## Connecting DC Power to an EX4650 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](#)" on page 163).
- 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 safety and 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 EX4650](#).

- Install the power supply in the chassis.

Ensure that you have the following parts and tools available. Also, the grounding cable must be 14 AWG (2 mm<sup>2</sup>), minimum 90° C wire, or as permitted by the local code.

- Grounding lug for your grounding cable—The grounding lug required is a Panduit LCD10-10A-L or equivalent.
- • Two M4 HEX nuts with integrated washers—Two nuts and washers are used to secure the grounding lug to the grounding lug bracket protective earthing terminal. Four nuts are provided in the accessory kit.
- • 7-mm wrench or a socket with driver to attach the two nuts.

The EX4650 is shipped from the factory with two 650 W 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:** A DC-powered EX4650 is intended for installation only in a restricted access location.

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

To connect DC power to a EX4650:

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.

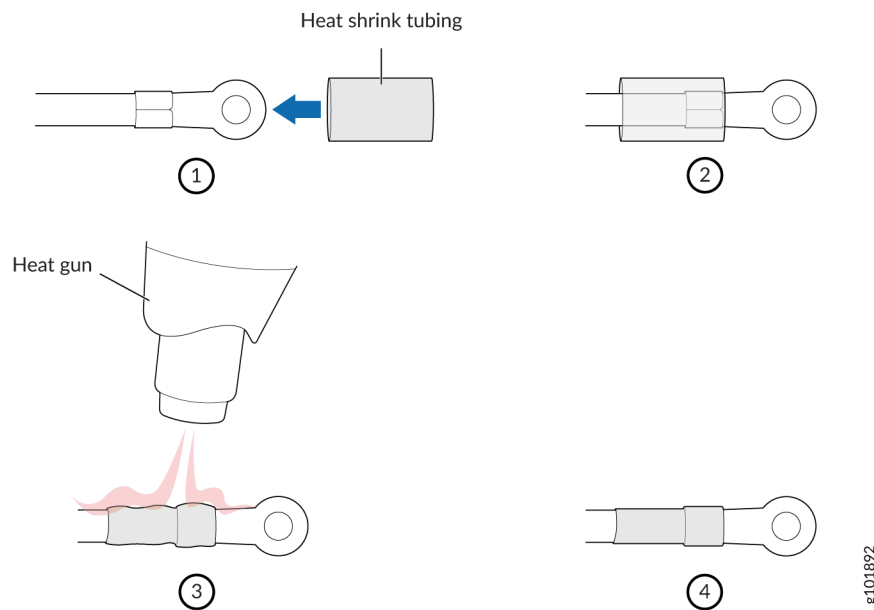
To install heat-shrink tubing:

- 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 37 on page 85 shows the steps to install heat-shrink tubing.

**NOTE:** Do not overheat the tubing.

Figure 37: 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" on page 169 and "DC Power Electrical Safety Guidelines" on page 166.

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 38 on page 87](#)).
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 38 on page 87](#) and [Figure 39 on page 88](#)).

The EX4650 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 the EX4650; 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.

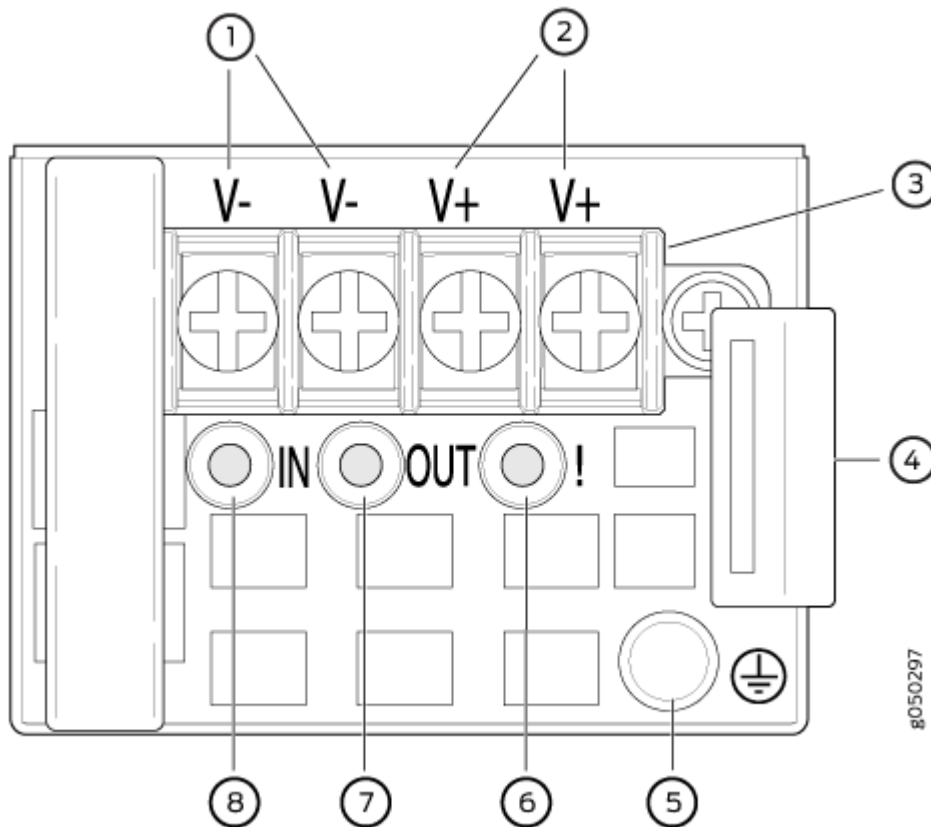


**CAUTION:** The connection between each power source and power supply must include a circuit breaker.

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 38: DC Power Supply Faceplate for an EX4650

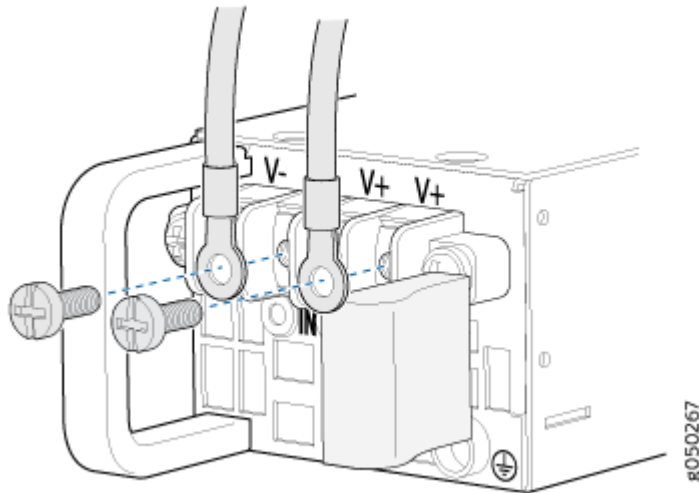


1– Shunt negative input terminals (+RTN)	5– ESD grounding point
2– Shunt positive input terminals (-48V)	6– Fault LED
3– Terminal block	7– Output LED
4– Ejector lever	8– Input LED



**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 39: Securing Ring Lugs to the Terminals on the EX4650 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.

## Connecting the EX4650 to the Network

### IN THIS SECTION

- [Install a Transceiver | 89](#)
- [Connect a Fiber-Optic Cable | 92](#)



## 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 40 on page 91](#) 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 the ESD point on the switch.
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.

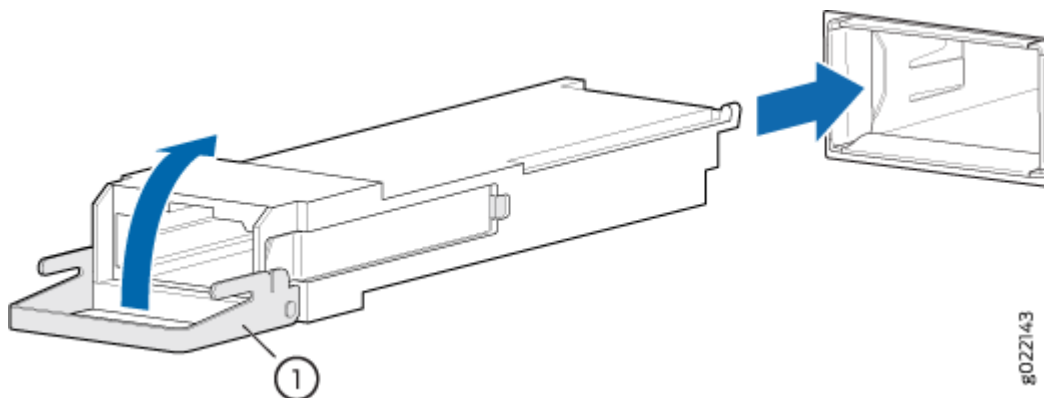
**CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

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 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.

Figure 40: Install a Transceiver



1– Ejector lever

8022143

## Connect a Fiber-Optic Cable

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

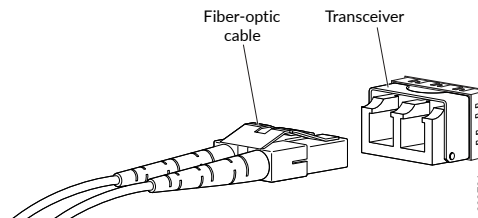
To connect a fiber-optic cable to an optical transceiver installed in a device:



**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 (see [Figure 41 on page 92](#)).

**Figure 41: Connect a Fiber-Optic Cable to an Optical Transceiver Installed in a Device**



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.

# Connecting the EX4650 to External Devices

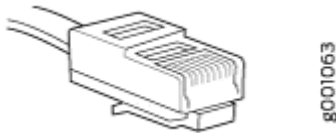
## IN THIS SECTION

- [Connect a Device to a Network for Out-of-Band Management | 93](#)
- [Connect a Device to a Management Console Using an RJ-45 Connector | 94](#)

## 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 42 on page 93](#) shows the RJ-45 connector of the Ethernet cable.

**Figure 42: RJ-45 Connector on an Ethernet Cable**

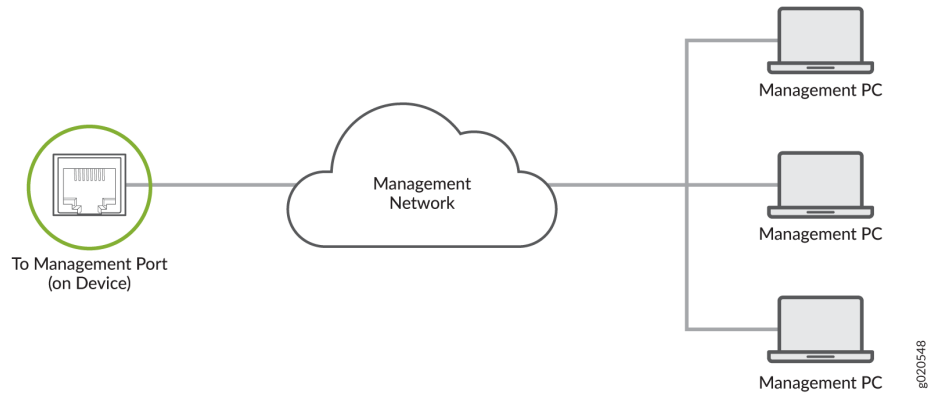


You can monitor and manage these devices by using a dedicated management channel. Each device has a management port to which you can connect an Ethernet cable with an RJ-45 connector. Use the management port to connect the device to the management device.

To connect a device to a network for out-of-band management (see [Figure 43 on page 94](#)):

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.

**Figure 43: Connect a Device to a Network for Out-of-Band Management**

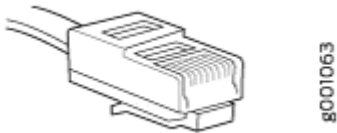


## Connect a Device to a Management Console Using an RJ-45 Connector

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 44 on page 94 shows the RJ-45 connector on the Ethernet cable.

**Figure 44: RJ-45 Connector on an Ethernet Cable**



**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.

**NOTE:** We no longer include a DB-9 to RJ-45 cable or a DB-9 to RJ-45 adapter with a CAT5E copper cable as part of the device package. If you require a console cable, you can order it

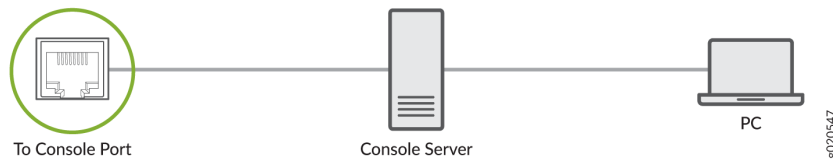
separately with the part number JNP-CBL-RJ45-DB9 (DB-9 to RJ-45 adapter with a CAT5E copper cable).

You can configure and manage 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.

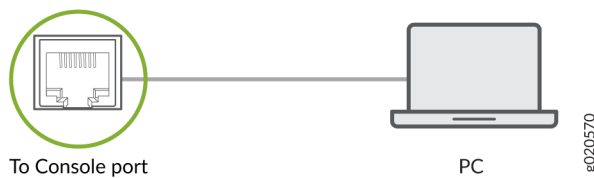
To connect the device to a management console (see [Figure 45 on page 95](#) and [Figure 46 on page 95](#)):

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 45 on page 95](#)) or management console (see [Figure 46 on page 95](#)).

**Figure 45: Connect a Device to a Management Console Through a Console Server**



**Figure 46: Connect a Device Directly to a Management Console**



# Configuring Junos OS on the EX4650

## IN THIS SECTION

- EX4650 Switch Default Configuration | 96
- Connecting and Configuring an EX4650 Switch | 97

## EX4650 Switch Default Configuration

Each EX4650 switch is programmed with a factory default configuration that contains the values set for each configuration parameter when a switch is shipped. The default configuration file sets values for system parameters such as the system log and file messages.

When you commit changes to the configuration, a new configuration file is created that becomes the active configuration. You can always revert to the factory default configuration. See [Reverting to the Default Factory Configuration for the EX Series Switch](#).

A factory default configuration file of an EX4650 switch looks like this:

```
system {
  syslog {
    user * {
      any emergency;
    }
    file messages {
      any notice;
      authorization info;
    }
    file interactive-commands {
      interactive-commands any;
    }
  }
  commit {
    factory-settings;
  }
}
```



## Connecting and Configuring an EX4650 Switch

Before you begin connecting and configuring an EX4650 switch, gather the following information:

- Name the switch will use on the network
- Domain name the switch will use
- IP address and prefix length information for the Ethernet interface
- IP address of a default switch
- IP address of a DNS server
- Password for the root user

The EX4650 switch is shipped with the Junos OS preinstalled and ready to be configured when the switch is powered on. There is a 64-MB internal NAND Flash memory device located on the baseboard for BIOS storage. You can insert the USB storage device into the USB slot on the front panel. EX4650 comes with a single SSD. There are two copies of the software: one on the SSD drive and one on a USB flash drive that can be inserted into the slot in the faceplate of the RE module.

When the switch boots, it first attempts to start the image on the SSD drive by default. If you wish to boot from the USB, you need to manually choose the option accordingly.

You configure the switch by issuing Junos OS command-line interface (CLI) commands, either on a console device attached to the console (**CON**) port on the front panel, or over a telnet connection to a network connected to the Ethernet management (**C0** or **C1**) port on the front panel.

This procedure connects the switch to the network, but does not enable it to forward traffic. For complete information about enabling the switch to forward traffic, including examples, see the Junos OS configuration guides.

To configure the software:

1. Verify that the switch is powered on.
2. Log in as the *root* user. There is no password.
3. Start the CLI.

```
root# cli
root@>
```

4. Enter configuration mode.

```
cli> configure  
[edit]  
root@#
```

5. Set the root authentication password by entering either a clear-text password, an encrypted password, or an SSH public key string (DSA or RSA).

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

or

```
[edit]  
root@# set system root-authentication encrypted-password encrypted-password
```

or

```
[edit]  
root@# set system root-authentication ssh-dsa public-key
```

or

```
[edit]  
root@# set system root-authentication ssh-rsa public-key
```

6. Configure the name of the switch. If the name includes spaces, enclose the name in double quotation marks (" ").

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

7. Create a user account.

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

8. Set the user account class to super-user.

```
[edit]
root@# set system login user user-name class super-user
```

9. Configure the switch's domain name.

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

10. Configure the IP address and prefix length for the switch's Ethernet interface.

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

11. Configure the IP address of a backup router, which is used only while the routing protocol is not running.

```
[edit]
root@# set system backup-router address
```

12. Configure the IP address of a DNS server.

```
[edit]
root@# set system name-server address
```

13. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. For more information about static routes, see the [Junos OS Administration Library for Routing Devices](#).

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

14. Configure the telnet service at the [edit system services] hierarchy level.

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

15. (Optional) Display the configuration to verify that it is correct.

```
[edit]
root@# show
system {
  host-name host-name;
  domain-name domain-name;
  root-authentication {
    authentication-method (password | public-key);
  }
  name-server {
    address;
  }
}
interfaces {
  em0 {
    unit 0 {
      family inet {
        address address/prefix-length;
      }
    }
  }
}
}
```

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

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

17. (Optional) Configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the switch.

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

18. When you have finished configuring the switch, exit configuration mode.

```
[edit]  
root@switch# exit  
root@switch>
```

# 4

CHAPTER

## Maintaining Components

---

Maintaining the EX4650 Cooling System | 103

Maintaining the EX4650 Power System | 106

Maintain Transceivers | 109

Maintain Fiber-Optic Cables | 119

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# Maintaining the EX4650 Cooling System

## IN THIS SECTION

- [Removing a Fan Module from an EX4650 Switch | 103](#)
- [Installing a Fan Module in an EX4650 Switch | 104](#)

## Removing a Fan Module from an EX4650 Switch

Ensure that you have the following parts and tools available:

- Phillips (+) screwdriver, number 2
- An antistatic bag or an antistatic mat
- A replacement fan module

The fan module in EX4650 switches is a hot-removable and hot-insertable field-replaceable unit (FRU) installed in the rear panel of the switch: You can remove and replace it without powering off the switch or disrupting switch functions.

**NOTE:** The fan module slots are at the left side of the rear panel. [Figure 47 on page 104](#) shows how to remove a fan module.

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Loosen the captive screws on the front faceplate of the fan module by using your fingers. If you are unable to loosen the captive screws by using your fingers, use the screwdriver.

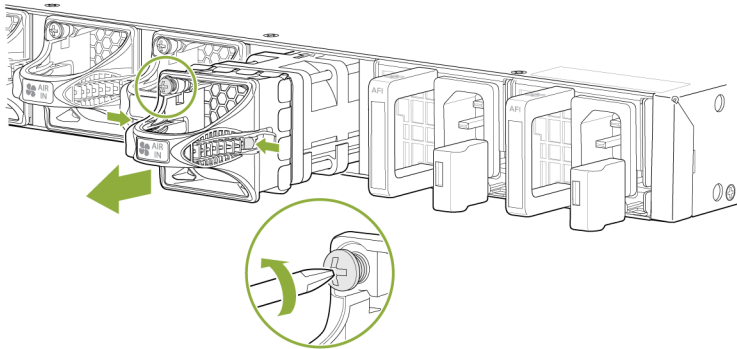


**WARNING:** To prevent injury, do not touch the fan with your hands or any tools as you slide the fan module out of the chassis—the fan might still be running.

3. Grasp the handle on the fan module and pull it firmly to slide the fan module out of the chassis.
4. Place the fan module in the antistatic bag or on the antistatic mat placed on a flat, stable surface.
5. Install the replacement fan.

6. Tighten the captive screws on the faceplate of the fan module by using your fingers. If you are unable to tighten the captive screws by using your fingers, use the screwdriver.

**Figure 47: Removing a Fan Module from an EX4650 Switch**



**NOTE:** Both the fan modules must be installed and operational for optimal functioning of the switch.

## Installing a Fan Module in an EX4650 Switch

Before you install a fan module in the switch:

- Ensure you understand how to prevent electrostatic discharge (ESD) damage. See "[Prevention of Electrostatic Discharge Damage](#)" on page 163.

Ensure that you have the following parts and tools available to install a fan module in the switch chassis:

- ESD grounding strap
- Phillips (+) screwdriver, number 2 (not provided)

EX4650 is shipped with redundant fans (4+1). Each fan module is a hot-removable and hot-insertable field-replaceable unit (FRU) installed in the rear panel of the switch. You can remove and replace it without powering off the switch or disrupting switch functions.



**CAUTION:** Do not mix:



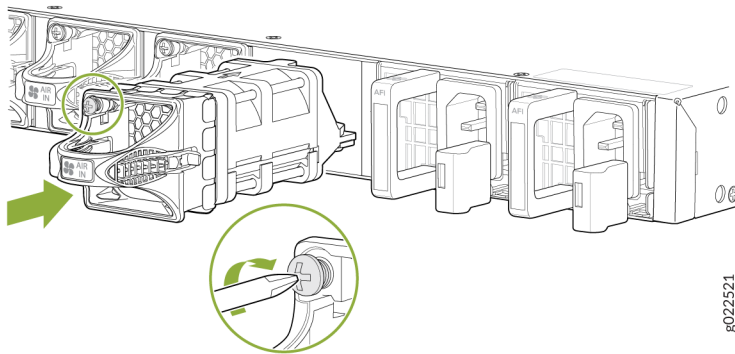
- Fan modules with different airflow labels (**AIR IN (AFI)** and **AIR OUT (AFO)**) in the same chassis.
- Power supplies with different airflow labels (**AIR IN (AFI)** and **AIR OUT (AFO)**) in the same chassis.
- Power supplies and fan modules with different airflow labels (**AIR IN (AFI)** and **AIR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

**NOTE:** The fan module slots are located between the management ports and power supply units.

**NOTE:** If you have a Juniper J-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 could 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.

1. Ensure that you have the correct fan module. The label **AFI** or **AFO** on the fan module must match the label **AFI** or **AFO** on the installed power supply.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
3. Remove the fan module from its bag.
4. Hold the handle of the fan module with one hand and support the weight of the module with the other hand. Place the fan module in the fan module slot on the rear panel of the switch and slide it in until it is fully seated and latched.
5. Tighten the captive screws on the faceplate of the fan module by using the screwdriver. The recommended torque value is 4.34 in-lb (0.49 Nm).

Figure 48: Installing a Fan Module in an EX4650 Switch



## Maintaining the EX4650 Power System

### IN THIS SECTION

- [Removing a Power Supply from an EX4650 Switch | 106](#)
- [Installing an AC Power Supply in an EX4650 Switch | 108](#)

### Removing a Power Supply from an EX4650 Switch

Before you remove a power supply from an EX4650, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "[Prevention of Electrostatic Discharge Damage](#)" on page 163).

Ensure that you have the following parts and tools available to remove a power supply from an EX4650:

- ESD grounding strap
- Antistatic bag or antistatic mat
- Phillips (+) screwdriver, number 2 (not provided)

All EX4650 switches are 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.

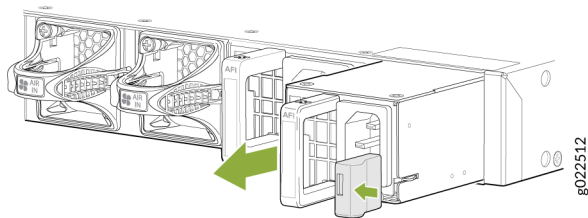
To remove a power supply from an EX4650:

1. Place the antistatic bag or 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 EX4650, you need to power off the switch before removing the power supply.

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 ejector 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 the 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 49: Removing a Power Supply from an EX4650



## Installing an AC Power Supply in an EX4650 Switch

Before you install an AC power supply in the switch:

- Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See "[Prevention of Electrostatic Discharge Damage](#)" on page 163.

Ensure that you have the following parts and tools available to install the power supply:

**NOTE:** Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running

- ESD grounding strap
- Phillips (+) screwdriver, number 2(not provided)

The AC power supply in EX4660 switches is a hot-removable and hot-insertable field-replaceable unit (FRU) installed in the rear panel of the switch: You can remove and replace a power supply without powering off the switch or disrupting switch functions.



**CAUTION:** Do not mix:

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

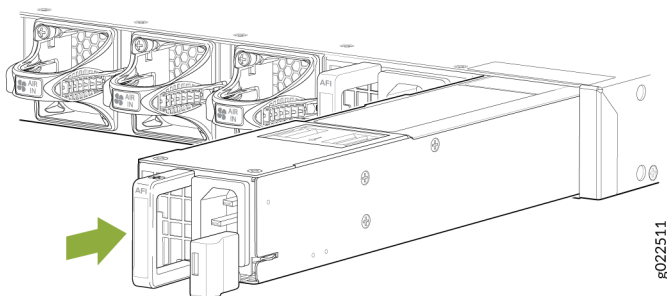
- Power supplies and fan modules with different airflow labels (**AIR IN (AFI)** and **AIR OUT (AFO)**) in the same chassis.

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

To install an AC power supply in the switch, see [Figure 50 on page 109](#) shows how to install an AC power supply. The power supply slots are at the right end of the rear panel.

1. Ensure that you have the correct power supply. The label on the power supply must match the label **AFI** or **AFO** on the installed fan module.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
3. Taking care not to touch the power supply pins, leads, or solder connections, remove the power supply from the bag.
4. Using both hands, place the power supply in the power supply slot on the rear panel of the switch, and slide it in until it is fully seated and the ejector lever fits into place.

**Figure 50: Installing an AC Power Supply in an EX4650 Switch**



## Maintain Transceivers

### IN THIS SECTION

- [Remove a Transceiver | 110](#)

- [Remove a QSFP28 Transceiver | 112](#)
- [Install a Transceiver | 114](#)
- [Install a QSFP28 Transceiver | 117](#)

## 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 51 on page 112](#) shows how to remove a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and 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 switch.
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.



**CAUTION:** Do not bend 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.

6. To remove an SFP, SFP+, XFP, or a QSFP+ transceiver:
  - a. Using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.



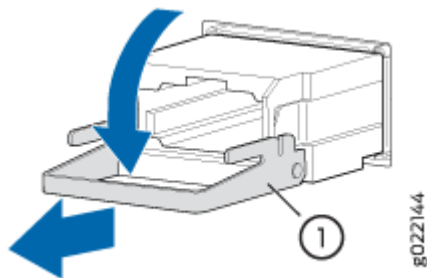
**CAUTION:** Before removing the transceiver, make sure that you open the ejector lever completely until you hear it click. This prevents damage to the transceiver.

- 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 51: 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.

## Remove a QSFP28 Transceiver

Before you remove a transceiver from 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 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 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.

To remove a QSFP28 transceiver (see [Figure 52 on page 114](#)):

1. Place an antistatic bag or antistatic mat on a flat, stable surface to receive the QSFP28 transceiver. Have a rubber safety cap ready for the QSFP28 transceiver and the cable.
2. Wrap and fasten one end of an ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the switch.
3. Label the cable connected to the QSFP28 transceiver so that you can later reconnect it to the correct QSFP28 transceiver.
4. Disconnect the cable from the transceiver. Immediately cover the transceiver and the end of the cable with a rubber safety cap.



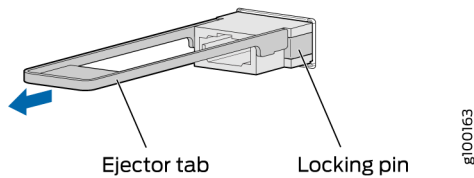
**CAUTION:** Do not leave a fiber-optic transceiver uncovered, except when inserting or removing a cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.

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.



**CAUTION:** Do not bend 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.

Figure 52: Remove a QSFP28 Transceiver



6. Pull the ejector tab straight back. The locking pins on the transceiver automatically release the transceiver.
7. Place the transceiver on the antistatic mat or in the antistatic bag.
8. 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 53 on page 117 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 the ESD point on the switch.
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.

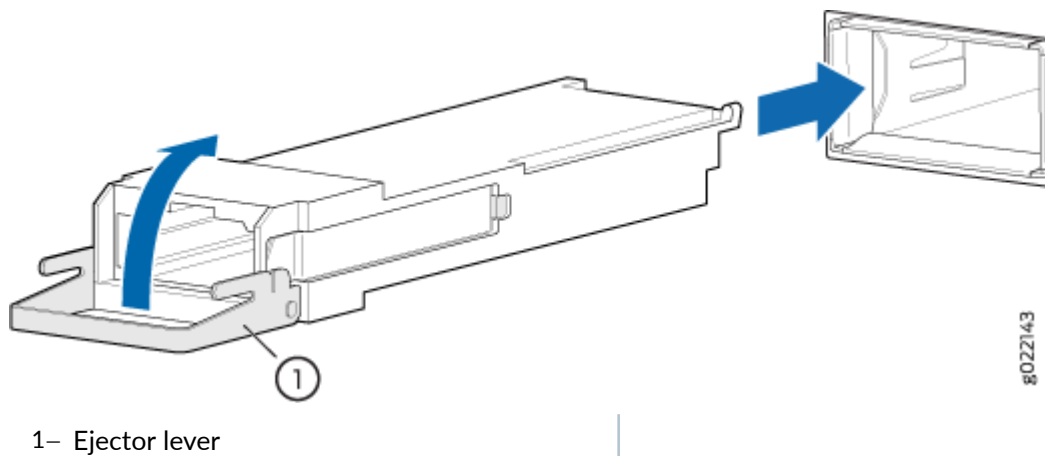


**CAUTION:** Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.



**CAUTION:** Avoid bending 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.

Figure 53: Install a Transceiver



## Install a QSFP28 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

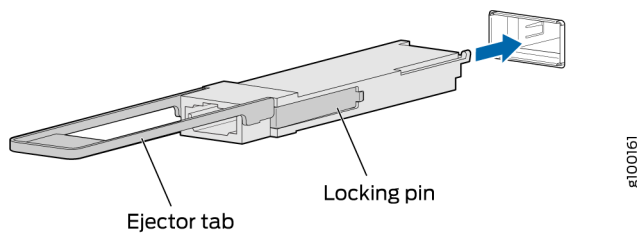
the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

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.

To install a QSFP28 transceiver (see [Figure 54 on page 118](#)):

1. Wrap and fasten one end of an ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the switch.
2. Verify that a rubber safety cap covers the QSFP28 transceiver.
3. Position the transceiver in front of the port on the device so that the QSFP28 connector faces the port.

**Figure 54: Install a QSFP28 Transceiver**



4. Slide the transceiver into the port until the locking pins lock in place. If there is resistance, remove the transceiver and flip it so that the connector faces the other direction.
5. 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.

6. 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 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.



**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 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.

## Maintain Fiber-Optic Cables

### IN THIS SECTION

- [Connect a Fiber-Optic Cable | 120](#)
- [Disconnect a Fiber-Optic Cable | 121](#)
- [How to Handle Fiber-Optic Cables | 121](#)

## Connect a Fiber-Optic Cable

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

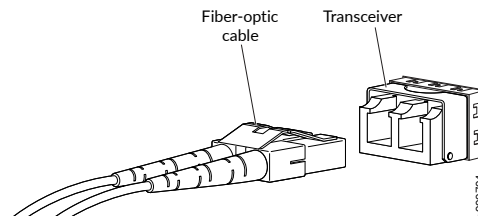
To connect a fiber-optic cable to an optical transceiver installed in a device:



**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 (see [Figure 55 on page 120](#)).

**Figure 55: Connect a Fiber-Optic Cable to an Optical Transceiver Installed in a Device**



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 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, which is easier and less expensive to replace than 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.

# 5

CHAPTER

## Troubleshooting Hardware

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Troubleshooting the EX4650 Components | 124

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# Troubleshooting the EX4650 Components

## IN THIS SECTION

- Alarm Types and Severity Levels | 124
- Interface Alarm Messages | 126
- Create an Emergency Boot Device | 126

## Alarm Types and Severity Levels

The QFX Series switches support different alarm types and severity levels. [Table 34 on page 124](#) provides a list of alarm terms and definitions that may help you in monitoring the device.

**Table 34: Alarm Terms and Definitions**

Term	Definition
Alarm	Signal that alerts you to conditions that might prevent normal operation. On the device, alarm indicators might include an LCD panel and LEDs on the device. The LCD panel (if present on the device) displays the chassis alarm message count. Blinking amber or yellow LEDs indicate yellow alarm conditions for chassis components.
Alarm condition	Failure event that triggers an alarm.

Table 34: Alarm Terms and Definitions (*Continued*)

Term	Definition
Alarm severity levels	<p>Seriousness of the alarm. The level of severity can be either major (red) or minor (yellow).</p> <ul style="list-style-type: none"> <li>• Major (red)—Indicates a critical situation on the device that has resulted from one of the following conditions. A red alarm condition requires immediate action. <ul style="list-style-type: none"> <li>• One or more hardware components have failed.</li> <li>• One or more hardware components have exceeded temperature thresholds.</li> <li>• An alarm condition configured on an interface has triggered a critical warning.</li> </ul> </li> <li>• Minor (yellow or amber)—Indicates a noncritical condition on the device that, if left unchecked, might cause an interruption in service or a degradation in performance. A yellow alarm condition requires monitoring or maintenance. For example, a missing rescue configuration generates a yellow system alarm.</li> </ul>
Alarm types	<p>Alarms include the following types:</p> <ul style="list-style-type: none"> <li>• Chassis alarm—Predefined alarm triggered by a physical condition on the device such as a power supply failure or excessive component temperature.</li> <li>• Interface alarm—Alarm that you configure to alert you when an interface link is down. Applies to ethernet, fibre-channel, and management-ethernet interfaces. You can configure a red (major) or yellow (minor) alarm for the link-down condition, or have the condition ignored.</li> <li>• System alarm—Predefined alarm that might be triggered by a missing rescue configuration, failure to install a license for a licensed software feature, or high disk usage.</li> </ul>

## 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.

## Create 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 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>
```



CHAPTER

# Contacting Customer Support and Returning the Chassis or Components

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[Returning an EX4650 Chassis or Components](#) | 129

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# Returning an EX4650 Chassis or Components

## IN THIS SECTION

- [Returning an EX4650 Switch or Component for Repair or Replacement | 129](#)
- [Locating the Serial Number on an EX4650 Switch or Component | 130](#)
- [Contact Customer Support to Obtain a Return Material Authorization | 132](#)
- [Packing an EX4650 Switch or Component for Shipping | 133](#)

## Returning an EX4650 Switch or Component for Repair or Replacement

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

1. Determine the serial number of the chassis if you need to return the switch. If you need to return one or more components, determine the serial number for each component. For instructions, see "[Locating the Serial Number on an EX4650 Switch or Component](#)" on page 130.
2. Obtain an RMA number from JTAC as described in "[Contact Customer Support to Obtain a Return Material Authorization](#)" on page 132.

**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.

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 EX4650 Switch or Component

### IN THIS SECTION

- [Listing the Switch and Components Details using the CLI | 130](#)
- [Locating the Chassis Serial Number ID Label on an EX4650 Switch | 130](#)
- [Locating the Serial Number ID Labels on FRUs in an EX4650 Switch | 131](#)

If you are returning a switch or hardware 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 Return Materials Authorization (RMA).

If the switch is operational and you can access the CLI, you can list the serial numbers for the switch and for some components using 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 physical switch or component.

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

### Listing the Switch and Components Details using the CLI

To list the switch and switch components and their serial numbers, enter the following CLI command:

```
show chassis hardware
```

The following output lists the switch components and serial numbers for an EX4650 switch:

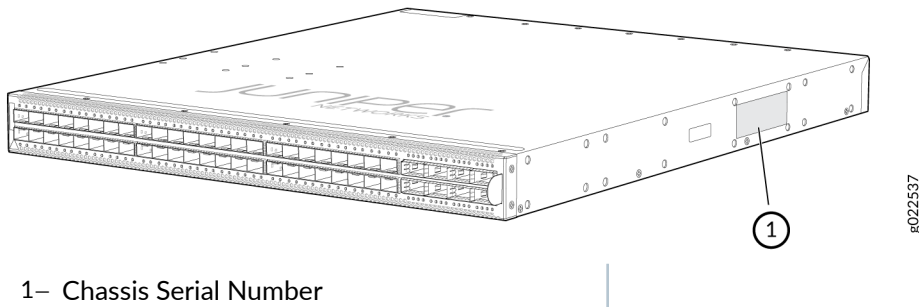
```
user@switch> show chassis hardware
```

For information about the `show chassis hardware` command, see [show chassis hardware](#).

### Locating the Chassis Serial Number ID Label on an EX4650 Switch

The serial number ID label is located on the rear panel of the chassis on EX4650 switches. [Figure 56 on page 131](#) shows the location of the serial number ID label on EX4650 switches

Figure 56: Location of the Serial Number ID Label on EX4650 Switches



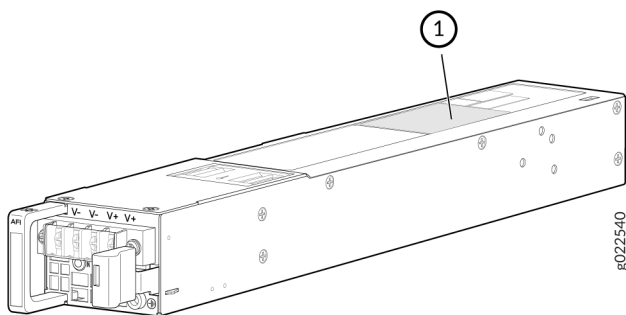
### Locating the Serial Number ID Labels on FRUs in an EX4650 Switch

The power supplies and fan modules installed in EX4650 switches are field-replaceable units (FRUs).

For each of these FRUs, you must remove the FRU from the switch chassis to view the serial number ID label of the FRU.

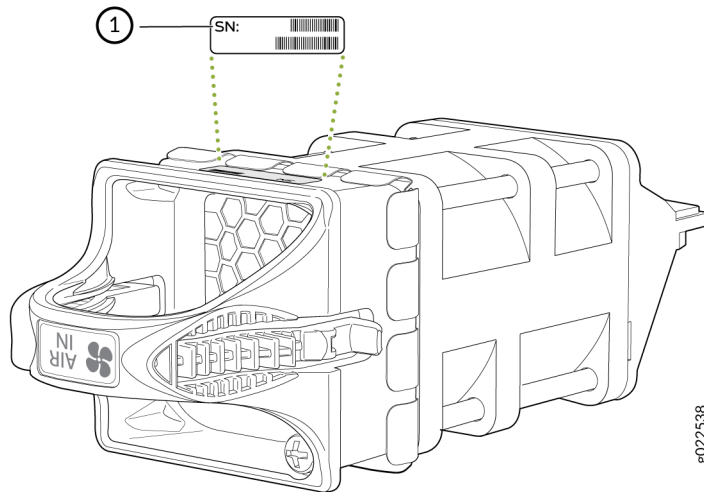
- *Power Supply*—The serial number ID label is on the top of the power supply. [Figure 57 on page 131](#) shows the location of the serial number ID label on a DC power supply.

Figure 57: Location of the Serial Number ID Label on a DC Power Supply Used in EX4650 Switches



- *Fan module*—[Figure 58 on page 132](#) shows the location of the serial number ID label on a fan module for EX4650 switches.

Figure 58: Location of the Serial Number ID Label on the Fan Module Used in an EX4650 Switch



1– Location of the serial number ID label on the fan module

## 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 a Return Material Authorization (RMA) number from Juniper Networks Technical Assistance Center (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 Juniper Networks Technical Assistance Center (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 EX4650 Switch or Component for Shipping

### IN THIS SECTION

- [Packing an EX4650 Switch for Shipping | 134](#)
- [Packing EX4650 Switch Components for Shipping | 135](#)

If you are returning an EX4650 switch or component to Juniper Networks for repair or replacement, pack the item as described below.

Before you begin packing the switch or its component:

- Ensure that you have followed all the steps listed in "[Contact Customer Support to Obtain a Return Material Authorization](#)" on page 132.
- Ensure that you have retrieved 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 a Return Material Authorization](#)" on page 132.
- Ensure you understand how to prevent electrostatic discharge (ESD) damage. See "[Prevention of Electrostatic Discharge Damage](#)" on page 163.

## Packing an EX4650 Switch for Shipping

Before you pack the switch:

1. On the console or other management device connected to the switch, enter the CLI operational mode, and issue the following command to shut down the switch software:

```
user@switch> request system halt
```

Wait until a message appears on the console confirming that the operating system has halted.

2. Disconnect power from the switch by performing one of the following:
  - If the power source outlet has a power switch, set it to the OFF (0) position. If the power source outlet does not have a power switch, gently pull out the plug end of the power cord that is connected to the power source outlet.
3. Remove the cables that connect the switch to all external devices. See [Disconnect a Fiber-Optic Cable](#).
4. Remove all optical transceivers installed in the switch. See [Remove a Transceiver](#).

If you need to transport the switch to another location or return the switch to Juniper Networks, you must pack the switch securely in its original packaging to prevent damage during transportation.

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

- Phillips (+) screwdriver, number 2 (not provided)
- The original switch packing material (cardboard box, accessory box and its contents, and foam padding)
- ESD grounding strap
- Antistatic bag



**CAUTION:** Do not pack the switch in anything except its original container to prevent damage during transit.

To pack the switch:

1. If the switch is installed in a rack or cabinet, have one person support the weight of the switch while another person unscrews and removes the mounting screws.
2. Remove the switch from the rack or cabinet, and place the switch on a flat, stable surface.
3. Use the screwdriver to remove the rack-mounting brackets from the switch chassis.
4. Place the switch in an antistatic bag.
5. Place the bottom portion of the packaging foam in the shipping carton.

6. Place the switch inside the cavity in the bottom packaging foam.
7. Place the top portion of the packaging foam on top of the switch.
8. If you are returning accessories or field-replaceable units (FRUs) with the switch, pack them as instructed in "[Packing EX4650 Switch Components for Shipping](#)" on page 135.
9. Place the accessory box vertically by the rear end of the chassis in the shipping carton.
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 EX4650 Switch Components for Shipping

Ensure that you have the following parts and tools available:

- Antistatic bag, one for each component
- ESD grounding strap



**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 the switch components:

1. Place individual components in antistatic bags.
2. Use the original packing materials if they are available. If the original packing materials are not available, ensure that the component is adequately packed to prevent damage during transit. The packing material that you use must be able to support the weight of the component.
3. Ensure that the components are adequately protected by wrapping them well with packing materials. Pack the component in an oversized box (if the original box is not available) with extra packing material around the unit so that the component does not move inside the box.
4. Securely tape the box closed.
5. Write the RMA number on the exterior of the box to ensure proper tracking.

# 7

CHAPTER

## Safety and Compliance Information

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# 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 være 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

- [Fire Suppression | 142](#)
- [Fire Suppression Equipment | 142](#)

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 virtälähteeseen.

**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 Spezialwerkzeug, 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.

**Warning!** 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.

**Warning!** 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 stelling 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 vältetään 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 edifício.
- 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, oerriormente 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.

**Warning!** 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.

## 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 kytkettyä, 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 emitteres 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 a 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.

## Laser and LED Safety Guidelines and Warnings

### IN THIS SECTION

- [General Laser Safety Guidelines | 153](#)
- [Class 1 Laser Product Warning | 153](#)
- [Class 1 LED Product Warning | 154](#)
- [Laser Beam Warning | 154](#)

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.

**Advarel** 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.

**Advarel** 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.

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

## Maintenance and Operational Safety Guidelines and Warnings

### IN THIS SECTION

- [Battery Handling Warning | 155](#)
- [Jewelry Removal Warning | 156](#)
- [Lightning Activity Warning | 158](#)
- [Operating Temperature Warning | 159](#)
- [Product Disposal Warning | 160](#)

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 suosittama. 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 batería 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.

**Warning!** Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledning. 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.

**Warning!** 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 metallicly 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 metallicly 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 59 on page 164](#)) 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.

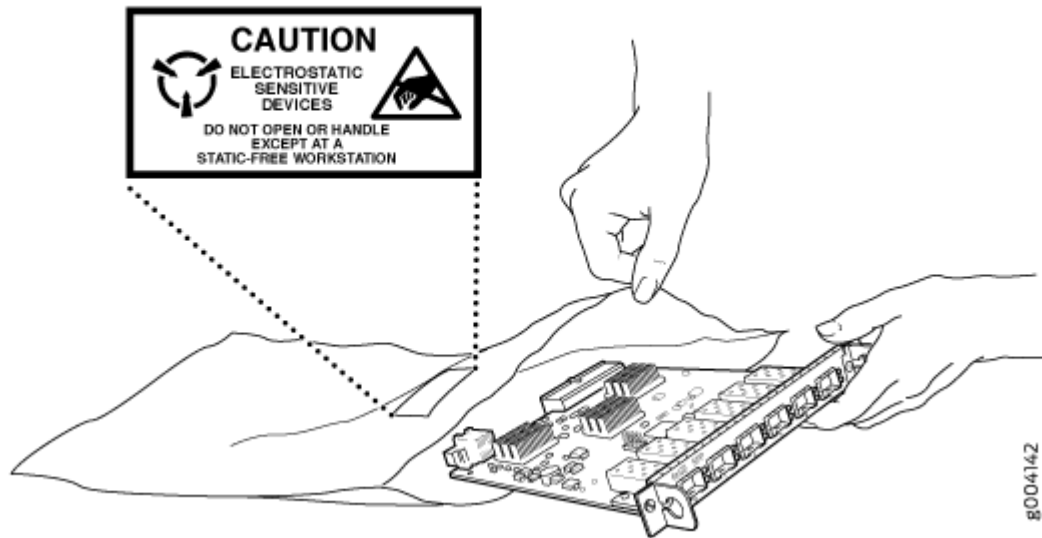
**Avertissement** Par mesure de sécurité, vérifiez régulièrement la résistance du bracelet antistatique. Cette valeur doit être comprise entre 1 et 10 mégohms (Mohms).

- 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 59 on page 164](#)). If you are returning a component, place it in an antistatic bag before packing it.

Figure 59: 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。

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## 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.

**Warning!** 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 yhdistettävä kytkentäjäjestys on maajohto maajohtoon, +RTN varten +RTN, -48 V varten - 48 V. Oikea irrotettava kytkentäjäjestys on -48 V varten - 48 V, +RTN varten +RTN, maajohto maajohtoon.

**Avertissement** Câblez l'alimentation 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.

**Warning!** 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 johdinliitintää, esimerkiksi suljettua silmukkaa tai kourumaista liitintää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitintöjen 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 occhio 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 ledaren.

**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.

**Warning!** 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 EX4650 Switches

### IN THIS SECTION

- [Compliance Statement for Argentina | 175](#)

EX4650 switches comply with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1, Safety of Information Technology Equipment
  - CAN/CSA-C22.2 No. 62368-1 Information Technology Equipment
  - UL 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements
  - UL 62368-1 Second Edition
  - EN 60950-1: 2006/ A2: 2013- Safety of Information Technology Equipment
  - EN 62368-1 Second Edition
  - IEC 60950-1: 2005/ A2: 2013- Information Technology Equipment - Safety - Part 1: General Requirements (with country deviations)
  - IEC 62368-1 Second Edition
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EMC

- EN 300 386 V1.6.1 (2012-09) Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electro Magnetic Compatibility (EMC) requirements
- EN 300 386 V2.1.1 (2016-07) Telecommunication network equipment; Electro Magnetic Compatibility (EMC) requirements; Harmonized Standard covering the essential requirements of the Directive 2014/30/EU
- EN 55032:2015 (CISPR 32:2015) Electromagnetic compatibility of multimedia equipment - Emission requirements
- EN 55024:2010 (CISPR 24:2010) Information technology equipment - Immunity characteristics - Limits and methods of measurement
- EN 55035:2017 (CISPR 35:2016) Electromagnetic compatibility of multimedia equipment - Immunity requirements
- IEC/EN 61000 Immunity Test
- AS/NZS CISPR 32:2015 Australia/New Zealand Radiated and Conducted Emissions
- FCC 47 CFR Part 15 USA Radiated and Conducted Emissions
- IC ICES-003 Canada Radiated and Conducted Emissions
- VCCI-CISPR 32:2016 Japanese Radiated and Conducted Emissions
- BSMI CNS 13438 Taiwan Radiated and Conducted Emissions (at 10 Meter)
- KN 32 and KN 35 Korea Radiated Emission and Immunity Characteristics (at 10 Meter)
- KN 61000 Korea Immunity Test
- IEC/EN 61000 Immunity Test
- TEC/SD/DD/EMC-221/05/OCT-16 (Supersedes No. TEC/EMI/TEL-001/01/FEB-09) India EMC standard
- Juniper Inductive GND (JIG)

## Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

# Compliance Statements for EMC Requirements for EX Series Switches

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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。

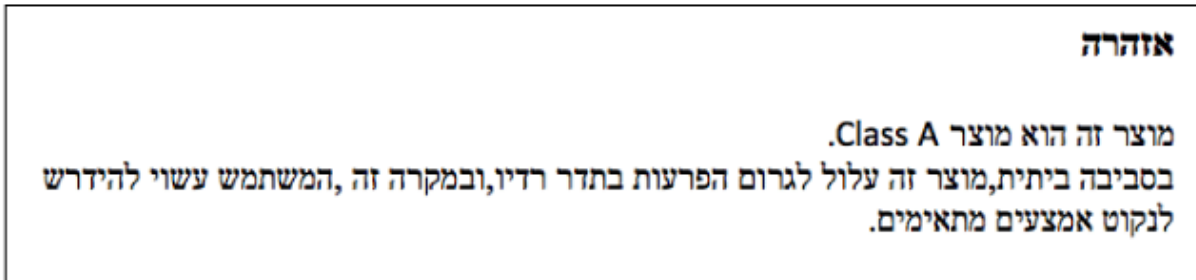
The preceding translates as follows:

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.

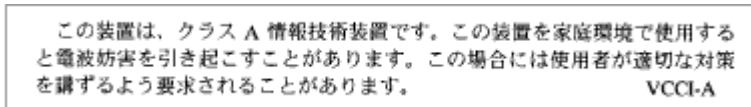
## Israel



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

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.