EX4600 Switch Hardware Guide

Release
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EX4600 Switch Hardware Guide
15.1
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Documentation and Release Notes

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Supported Platforms

For the features described in this document, the following platforms are supported:

- EX4600

Documentation Conventions

Table 1 on page xvi defines notice icons used in this guide.

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Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xvi defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*

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Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

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- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/
- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: http://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

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For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

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PART 1

Overview

- System Overview on page 3
- Chassis Components and Descriptions on page 7
- Cooling System and Airflow on page 21
- Power Supplies on page 27

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CHAPTER 1

System Overview

- EX4600 Switch Hardware Overview on page 3
- EX4600 Switch Models on page 5
- Understanding Redundancy of EX4600 Switch Components and Functionality on page 6

EX4600 Switch Hardware Overview

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

- Campus distribution
- Small campus core
- Top-of-rack in small, low -density data centers
- Data center distribution in small, low -density data centers

In addition to operating as a standalone switch, the EX4600 switch can act as a member switch in a non-mixed Virtual Chassis, a Virtual Chassis composed entirely of EX4600 switches, as well as participate as member switches in a mixed Virtual Chassis with EX4300 switches. The switch offers a flexible configuration of high-performance 10-gigabit and 40-gigabit ports to add higher port densities, additional scalability, and improved latency to the EX Series of switches.

This topic covers:

- EX4600 Hardware on page 3
- System Software on page 5

EX4600 Hardware

The EX4600 switch is a compact 1 U model that provides wire-speed packet performance, very low latency, and a rich set of Layer 2 and Layer 3 features. In addition to a high-throughput Packet Forwarding Engine, the performance of the control plane running on the EX4600 model is enhanced by the 1.5 -GHz dual-core Intel CPU with 8 GB of memory and 32 GB of solid-state drive (SSD) storage.

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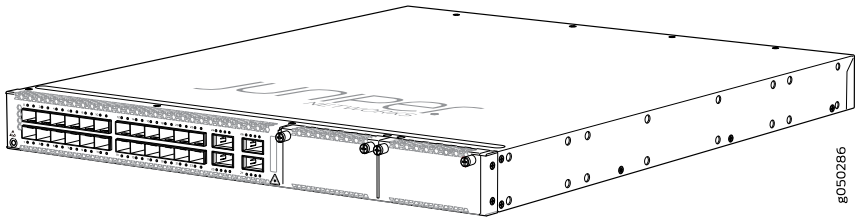
The port panel of the EX4600 features 24 fixed small form-factor pluggable (SFP) or SFP+ access ports and 4 fixed quad SFP+ (QSFP+) high-speed uplinks.

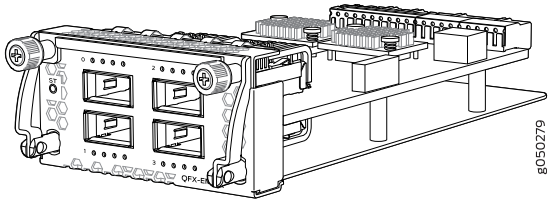
Figure 1: EX4600 Port Panel with Expansion Bays



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

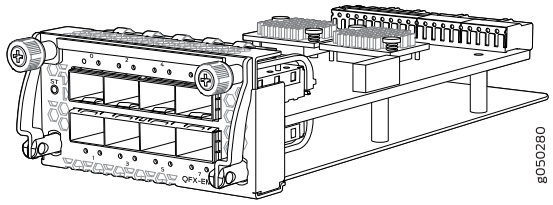
- QFX-EM-4Q–Adds four additional QSFP+ ports to the chassis. When fully populated with QFX-EM-4Q expansion modules, the EX4600 is equivalent to one with 72 interfaces (24 + 16 + 16 + 16). See Figure 2 on page 4.

Figure 2: QFX-EM-4Q Expansion Module



- EX4600-EM-8F–Adds a total of eight additional SFP+ ports to the chassis. When fully populated with EX4600-EM-8F expansion modules, the EX4600 is equivalent to one with 56 interfaces (24 + 16 + 8 + 8). See Figure 3 on page 4.

Figure 3: EX4600-EM-8F Expansion Module



The EX4600 switch can be used as:

- A standalone switch.
- A master, backup, or *linecard* member in a Virtual Chassis with EX4600 switches or EX4300 switches. When in a mixed Virtual Chassis consisting of EX4600 switches and EX4300 switches, the EX4600 switches can be the master, backup, or in the linecard role, while the EX4300 switches must be in the linecard role. An EX4600 Virtual Chassis enables you to interconnect up to 10 switches into one logical device

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and manage the device as a single chassis. An EX4600 Virtual Chassis is cabled in a ring topology.

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

System Software

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

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

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

Related Documentation

- EX4600 Switch Models on page 5
- Expansion Modules for the EX4600 on page 11

EX4600 Switch Models

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

Table 3 on page 5 lists the EX4600 switch configurations.

Table 3: EX4600 Switches

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

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Table 3: EX4600 Switches *(continued)*

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

CAUTION: Do not mix:

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

Related Documentation

- Management Panel of an EX4600 Switch on page 8
- Port Panel of an EX4600 Switch on page 7
- EX4600 Switch Hardware Overview on page 3

Understanding Redundancy of EX4600 Switch Components and Functionality

The following hardware components provide redundancy on an EX4600 switch:

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

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- DC Power Supply in an EX4600 Switch on page 30
- Cooling System and Airflow in an EX4600 Switch on page 21

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CHAPTER 2

Chassis Components and Descriptions

- Chassis Physical Specifications for an EX4600 Switch on page 7
- Port Panel of an EX4600 Switch on page 7
- Management Panel of an EX4600 Switch on page 8
- Field-Replaceable Units in an EX4600 Switch on page 10
- Expansion Modules for the EX4600 on page 11
- Chassis Status LEDs on an EX4600 Switch on page 14
- Access Port and Uplink Port LEDs on an EX4600 Switch on page 15
- Management Port LEDs on an EX4600 Switch on page 18

Chassis Physical Specifications for an EX4600 Switch

The EX4600 switch chassis is a rigid sheet-metal structure that houses the hardware components. Table 4 on page 7 summarizes the physical specifications of the EX4600 chassis.

Table 4: Physical Specifications for the EX4600 Switch Chassis

Product Number	Height	Width	Depth	Weight
EX4600	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (4.37 cm)	With power supplies and fan modules installed: 22 lbs (9.97 kg)

Related Documentation

- Rack Requirements for an EX4600 Switch on page 42
- Cabinet Requirements for an EX4600 Switch on page 43
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114
- Installing and Connecting an EX4600 Switch on page 113
- Installing and Removing EX4600 Switch Hardware Components on page 117

Port Panel of an EX4600 Switch

The fixed portion of the port panel of the EX4600-40F switch supports up to a maximum of 40 logical 10 GbE ports. Twenty-four physical ports (**0** through **23**) support 10 Gbps

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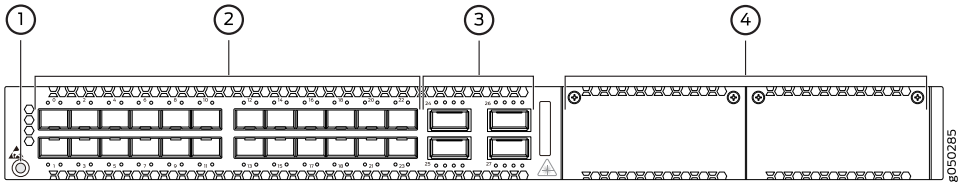
small form-factor pluggable plus (SFP+) transceivers. These ports can be configured as access ports. See "Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch" on page 58 and "Interface Specifications for SFP+ DAC Cables for the EX4600 Switch" on page 83. All 24 of these ports can be used for SFP+ transceivers or SFP+ direct attach copper (DAC) cables. You can use 1-Gigabit Ethernet SFP+ transceivers, 10-Gigabit Ethernet SFP+ transceivers, and SFP+ direct attach copper cables in any access port.

The remaining 16 logical ports are available for four 40 GbE ports (**24** through **27**) that support up to four quad small-form factor pluggable plus (QSFP+) transceivers. Each QSFP+ port can operate either as a single 40 Gbps port or as a set of 4 independent 10 Gbps ports using QSFP+ breakout cables. The 40 GbE ports can be configured as either access ports or as uplinks. See "Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch" on page 91.

CAUTION: **Do not install a copper transceiver in an access port directly above or below another copper transceiver. Internal damage to the access ports and switch can occur. We recommend that you either use the top port row exclusively, or the bottom port row exclusively, for installing copper transceivers.**

Figure 4 on page 8 shows the port panel of an EX4600 switch.

Figure 4: EX4600 Switch Port Panel



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

Related Documentation

- Field-Replaceable Units in an EX4600 Switch on page 10
- Access Port and Uplink Port LEDs on an EX4600 Switch on page 15
- Installing and Removing EX4600 Switch Hardware Components on page 117

Management Panel of an EX4600 Switch

The management panel of the EX4600 switch is located on the Field Replaceable Unit (FRU) side of the switch, as shown in Figure 5 on page 9. See Figure 6 on page 9 for management panel details.

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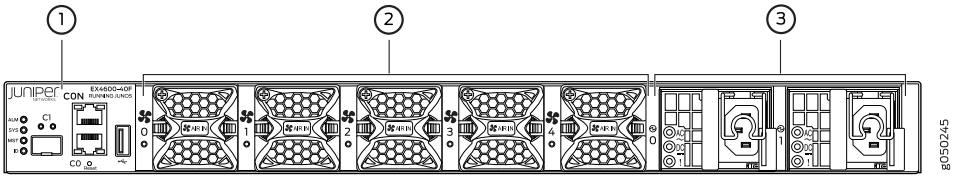
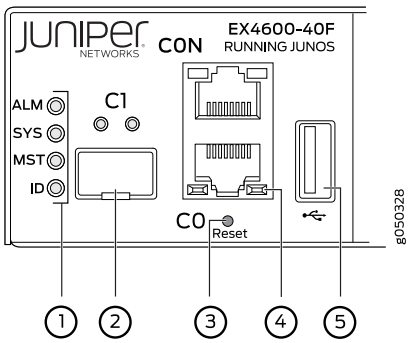
Figure 5: EX4600 Switch, FRU Side with Fans Modules and Power Supplies Installed



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

Figure 6: Management Panel Components



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

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

The management panel consists of the following components:

- Status LEDs
  - ALM–Alarm or beacon
    - Unlit indicates the switch is halted or that there is no alarm.
    - Red indicates a major alarm.
    - Amber indicates a minor alarm.
  - SYS–System
    - Unlit indicates the switch is powered off or halted.

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

Related Documentation

- Field-Replaceable Units in an EX4600 Switch on page 10
- Chassis Status LEDs on an EX4600 Switch on page 14
- USB Port Specifications for an EX Series Switch on page 106
- Cooling System and Airflow in an EX4600 Switch on page 21
- AC Power Supply in an EX4600 Switch on page 27
- Prevention of Electrostatic Discharge Damage on page 215

Field-Replaceable Units in an EX4600 Switch

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

- Power supplies
- Fan modules

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- Optical transceivers
- Expansion modules

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

Table 5 on page 11 lists the FRUs for the EX4600 switch and actions to take before removing them.

Table 5: FRUs in a EX4600 Switch

FRU	Required Action
Power supplies	None, if two power supplies are installed as recommended. If only one power is installed, you must power down the switch. See "Removing a Power Supply from an EX4600 Switch" on page 148.
Fan modules	None. See "Removing a Fan Module from an EX4600 Switch" on page 144 for details.
Optical transceivers	None. We recommend that you disable the interface using the **set interfaces *interface-name* disable** command before you remove the transceiver. See "Disconnecting a Fiber-Optic Cable from a Switch" on page 162.
Expansion modules	None. See "Removing an Expansion Module from an EX4600 Switch" on page 153.

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

Related Documentation

- Installing and Removing EX4600 Switch Hardware Components on page 117

Expansion Modules for the EX4600

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

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

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

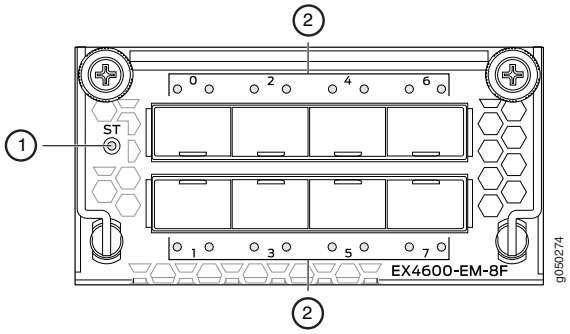
NOTE: **Expansion modules and transceivers are not shipped with the switch and must be ordered separately.**

- EX4600-EM-8F on page 12
- QFX-EM-4Q on page 13

EX4600-EM-8F

The EX4600-EM-8F, provides 8 additional 10-Gigabit Ethernet SFP+ ports to one of the bays in the EX4600 switch. Figure 7 on page 12 shows the ports and LEDs on the expansion module.

Figure 7: EX4600-EM-8F Faceplate and LEDs



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

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

Table 6 on page 13 describes the Status LED on the EX4600-EM-8F.

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Table 6: EX4600-EM-8F Status LED

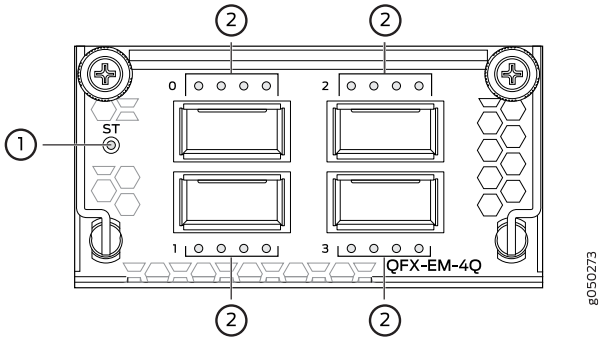
LED	State	Description
ST	Unlit	• The expansion module is offline. • The chassis is powered off.
	Green	• The expansion module is online and functioning normally.

QFX-EM-4Q

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

Figure 8 on page 13 shows the QFX-EM-4Q ports and LEDs.

Figure 8: QFX-EM-4Q Faceplate and LEDs



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

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

Table 7 on page 13 describes the Status LED on the QFX-EM-4Q expansion module.

Table 7: Expansion Module Status LED

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

Related Documentation

- Installing an Expansion Module in an EX4600 Switch on page 151
- Removing an Expansion Module from an EX4600 Switch on page 153
- Installing and Removing EX4600 Switch Hardware Components on page 117

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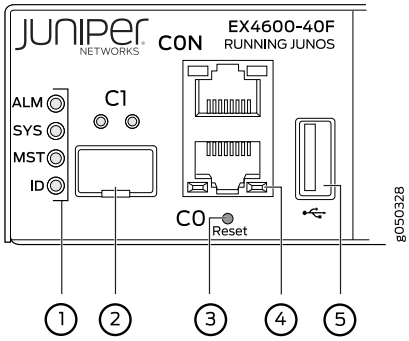
Chassis Status LEDs on an EX4600 Switch

The EX4600 switch has four status LEDs on the field-replaceable unit (FRU) end of the chassis, next to the management ports (see Figure 9 on page 14).

Figure 9: Chassis Status LEDs on an EX4600 Switch



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

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

Table 8 on page 15 describes the chassis status LEDs on an EX4600 switch, their colors and states, and the status they indicate. You can view the colors of the three LEDs remotely through the CLI by issuing the operational mode command **show chassis lcd**.

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Table 8: Chassis Status LEDs on an EX4600 Switch

Name	Color	State	Description
ALM–Alarm or beacon	Unlit	Off	The switch is halted or there is no alarm.
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the switch has halted. Power off the EX4600 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Correct any voltage or site temperature issues, and allow the switch to cool down. Power on the EX4600 switch and monitor the power supply and fan LEDs to help determine where the error is occurring.
	Amber	On steadily	A minor alarm has occurred, such as a software error. Power off the EX4600 switch by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Power on the EX4600 switch and monitor the status LEDs to ensure that Junos OS boots properly.
SYS–System	Unlit	Off	The switch is powered off or halted.
	Green	On steadily	Junos OS for EX Series is loaded on the switch.
MST–Master	Unlit	Off	The switch is standalone.
ID–Identification	Unlit	Off	The beacon feature is not enabled on the switch. This feature is enabled using the **request chassis beacon** command.
	Blue	Blinking	The beacon feature is enabled on the switch. This feature is enabled using the **request chassis beacon** command.

Related Documentation

- Management Panel of an EX4600 Switch on page 8
- *show chassis alarms*
- *request chassis beacon*

Access Port and Uplink Port LEDs on an EX4600 Switch

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

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- Figure 10 on page 16 shows the location of the LEDs on the SFP+ access ports on the EX4600 and Figure 11 on page 16 shows the location of the LEDs on the QSFP+ uplink ports on the EX4600.

Figure 10: LEDs on the SFP+ Ports

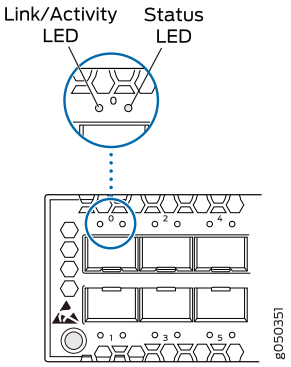
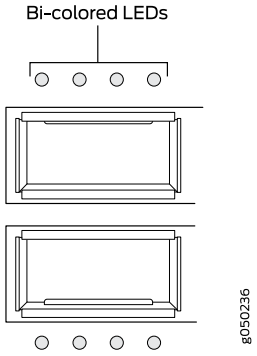


Figure 11: LEDs on the QSFP+ Ports



The LED in Figure 10 on page 16 labeled Link/Activity indicate link activity or a fault. The LED labeled Status in indicates transceiver presence.

Table 9 on page 16 describes how to interpret the SFP+ port LEDs.

Table 9: Network Port LEDs on SFP+ Ports on an EX4600 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	The port is administratively disabled, there is no power, the link is down, or there is a fault.
	Green	On steadily	A link is established, but there is no link activity.
		Blinking	A link is established, and there is link activity.
	Amber	Blinking	The beacon is enabled on the port.

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Table 9: Network Port LEDs on SFP+ Ports on an EX4600 Switch *(continued)*

LED	Color	State	Description
Status	Unlit	Off	The link is down.
	Amber	Blinking	The beacon function is enabled on the port.
	Green	Blinking	A 1-Gigabit Ethernet transceiver is installed in the port and the link is established.
	Green	On steadily	A 10-Gigabit Ethernet transceiver is installed in the port and link is established.

As shown in Figure 11 on page 16, there are four bi-color LEDs for each QSFP+ port. The first LED is used and the remaining LEDs are not used when the interface is configured for 40-Gigabit Ethernet and connected to a QSFP+ transceiver. All four LEDs are used when the interface is configured for 10-Gigabit Ethernet and the port is connected using an optical split cable or a copper DACBO cable. Table 10 on page 17 describes how to interpret the QSFP+ LEDs.

Table 10: Network Port LEDs on QSFP+ Ports on an EX4600 Switch

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

Related Documentation

- Management Panel of an EX4600 Switch on page 8
- Installing a Transceiver in a Switch on page 155
- Connecting a Fiber-Optic Cable to a Switch on page 161

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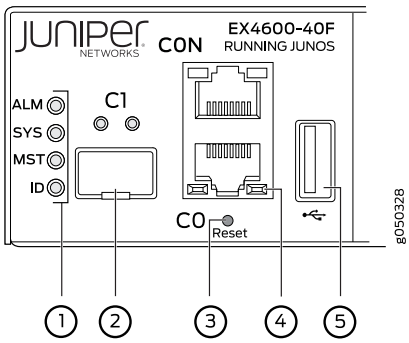
Management Port LEDs on an EX4600 Switch

The management ports (labeled **C0** for 10/100/1000 Base-T and **C1** for 10/100/1000 Base-T and SFP 1000 Base-X connections) on an EX4600 switch have two LEDs that indicate link status and link activity (see Figure 12 on page 18). The left LED indicates status; the right LED indicates link/activity.

Figure 12: Management Port LEDs on an EX4600 Switch



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

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

Table 11 on page 18 describes the management port LEDs.

Table 11: Management Port LEDs on an EX4600 Switch

LED	Color	State	Description
Link/Activity	Unlit	Off	No link is established, there is a fault, or the link is down.
	Green	On steadily	A link is established, but there is no link activity.
		Blinking or flickering	A link is established, and there is link activity.
Status	Unlit	Off	Either the port speed is 10 M or the link is down.
	Green	On steadily	The port speed is 1000 M.
	Amber	On steadily	The port speed is 100 M.

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Related Documentation

- Management Panel of an EX4600 Switch on page 8
- Connecting an EX4600 Switch to a Network for Out-of-Band Management on page 129

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CHAPTER 3

Cooling System and Airflow

- Cooling System and Airflow in an EX4600 Switch on page 21
- Fan Module LED on an EX4600 Switch on page 25

Cooling System and Airflow in an EX4600 Switch

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

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

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

CAUTION: **Do not mix:**

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

This topic describes:

- Fan Modules on page 21
- Do Not Install Components with Different Airflow or Wattage in the Switch on page 24
- Fan Module Status on page 25

Fan Modules

The fan modules in EX4600 switches are hot-insertable and hot-removable field-replaceable units (FRUs). These fan modules are designed for one of the two

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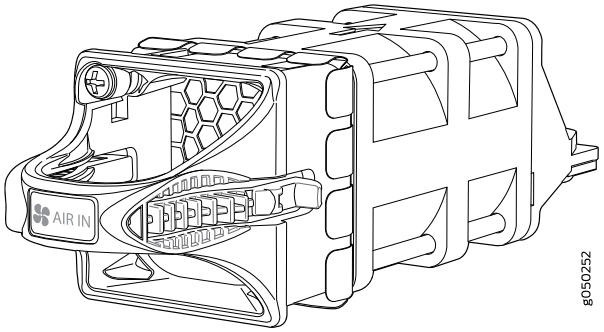
available airflow directions airflow in (**AIR IN**) or airflow out (**AIR IN**)) and are the same fan modules used in the QFX5100 switches. Some modules are also color-coded for the indication of the airflow direction. The fan modules are installed in the fan module slots on the FRU end of the switch,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

Figure 13 on page 22 shows the fan module for the EX4600 switch.

Figure 13: Fan Module for EX4600 Switches



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

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

The fan modules are available in two product SKUs that have different airflow directions—FRU-to-port airflow, indicated on some units by the azure blue color and the label **AIR IN** , or port-to-FRU, indicated by the gold color and the label **AIR OUT** . On legacy switches or switches with LCDs, this airflow is also called front-to-back and back-to-front. Table 12 on page 22 lists the available fan module product SKUs and the direction of airflow in them:

Table 12: Fan Modules for EX4600 Switches

Fan Module	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-FAN-AFI	Figure 14 on page 23	**AIR IN**	Juniper azure blue	FRU-to-port, that is, air enters from the FRUs; air exhausts from the vents in the port panel (also known as back-to-front airflow).	You must install only power supplies that have **AFI** labels or that are Juniper azure blue, in switches in which the fan modules have **AIR IN** labels or that are Juniper azure blue..

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Table 12: Fan Modules for EX4600 Switches *(continued)*

Fan Module	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-FAN-AFO	Figure 15 on page 24	**AIR OUT**	Juniper gold	Port-to-FRU, that is, air enters through vents on the port panel; air exhausts out the FRUs (also known as front-to-back airflow).	You must install only power supplies that have **AFO** labels or that are Juniper gold in switches in which the fan modules have **AIR OUT** labels or that are Juniper gold.

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

Figure 14: Air In Airflow Through EX4600 Switch Chassis

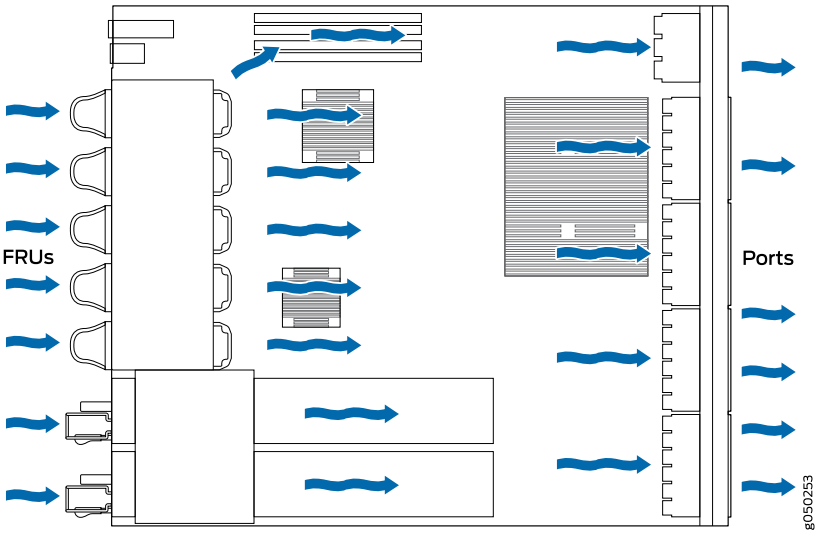

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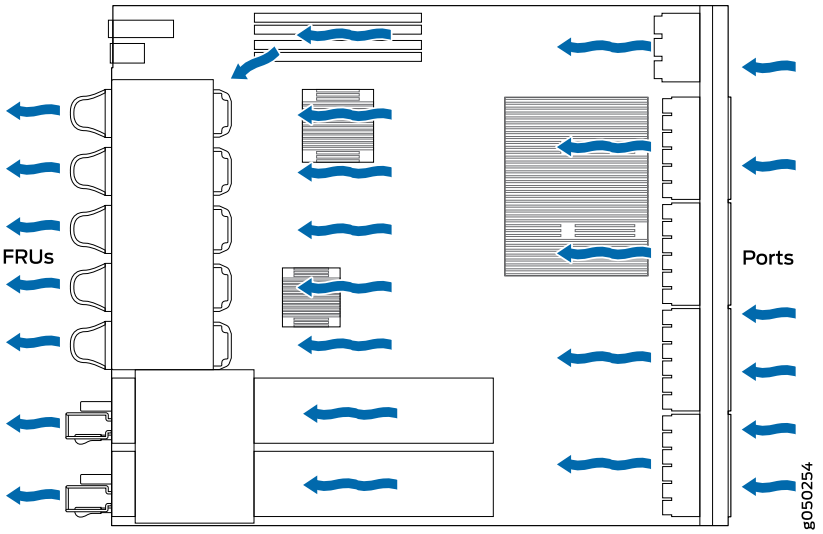
Figure 15: Air Out Airflow Through EX4600 Switch Chassis



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

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

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

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

Do not mix fans with different wattage. Only use the replacement fans that are designed for use with your EX4600. See Table 12 on page 22 for the correct part number for your switch product SKU.

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

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

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Fan Module Status

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

Each switch has a Status LED (labeled **ST**) for each fan module on the left side of the corresponding fan module slot. It indicates the status of all the fan modules. Table 13 on page 25 describes the Status LED on the fan module in an EX4600 switch.

Table 13: Fan Module LED

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

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

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

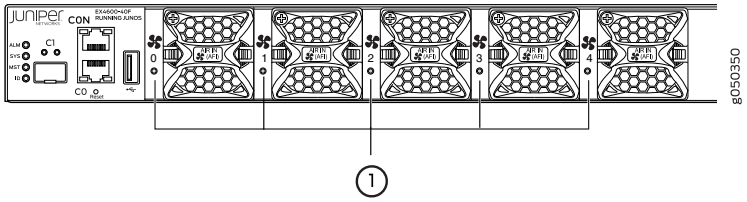
Related Documentation

- Field-Replaceable Units in an EX4600 Switch on page 10
- Prevention of Electrostatic Discharge Damage on page 215
- EX4600 Switch Hardware Overview on page 3
- Installing a Fan Module in an EX4600 Switch on page 143
- Removing a Fan Module from an EX4600 Switch on page 144

Fan Module LED on an EX4600 Switch

Figure 16 on page 25 shows the location of the LED next to the fan module.

Figure 16: Fan Module LED in an EX4600 Switch



1— Fan LED	

Table 14 on page 26 describes the function of the fan tray LED.

Table 14: Fan Tray LED in an EX4600 Switch

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

Related Documentation

- Cooling System and Airflow in an EX4600 Switch on page 21
- Installing a Fan Module in an EX4600 Switch on page 143
- Removing a Fan Module from an EX4600 Switch on page 144

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CHAPTER 4

Power Supplies

- AC Power Supply in an EX4600 Switch on page 27
- AC Power Supply LEDs on an EX4600 Switch on page 29
- DC Power Supply in an EX4600 Switch on page 30
- DC Power Supply LEDs on an EX4600 Switch on page 31

AC Power Supply in an EX4600 Switch

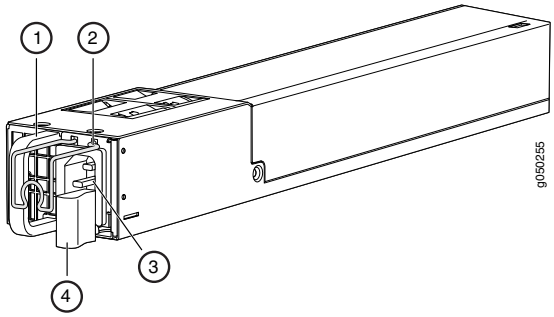
Except for the EX4600-40F-S switch, the EX4600 is shipped from the factory with two power supplies pre-installed. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power supply is installed and running. You can install replacement power supplies in the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

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

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

See Figure 17 on page 27 for an example of the power supply.

Figure 17: AC Power Supply in EX4600 Switches



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

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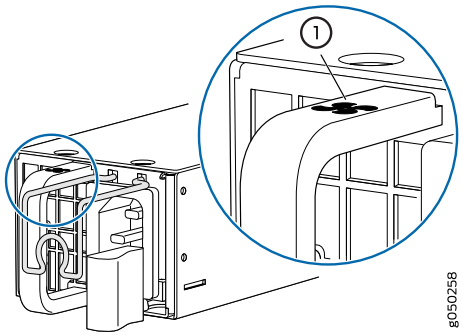
The power supply provides FRU-to-port or port-to-FRU airflow depending on the product SKU you purchase. On legacy switches, or switches with an LCD, this airflow is called back-to-front and front-to-back. The power supplies either have labels on the handles that indicate the direction of airflow or they have color-coded handles with a fan icon. See Figure 18 on page 28 for an example of the power supply. Either a power supply has the label **AFI** or a blue handle, which denotes FRU-to-port airflow. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Figure 18: Power Supply Handle Detail



1— Fan icon on handle	

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

Table 15 on page 28 shows the different power supplies and their direction of airflow.

Table 15: Airflow Direction in EX4600 and QFX5100 AC Power Supplies

Product Number	Direction of Airflow	Color of Power Supply Handle
JPSU-650W-AC-AFI QFXC01-PWRACI-650A	FRU-to-port	Juniper azure blue
JPSU-650W-AC-AFO	Port-to-FRU	Juniper gold

To avoid electrical injury, carefully follow instructions in "Connecting AC Power to an EX4600 Switch" on page 121.

Related Documentation

- AC Power Cord Specifications for an EX4600 Switch on page 48
- AC Power Supply LEDs on an EX4600 Switch on page 29

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- Management Panel of an EX4600 Switch on page 8
- Field-Replaceable Units in an EX4600 Switch on page 10
- AC Power Specifications for an EX4600 Switch on page 47
- Connecting AC Power to an EX4600 Switch on page 121

AC Power Supply LEDs on an EX4600 Switch

Figure 19 on page 29 shows the location of the LEDs on the power supply.

Figure 19: AC Power Supply LEDs on an EX4600 Switch

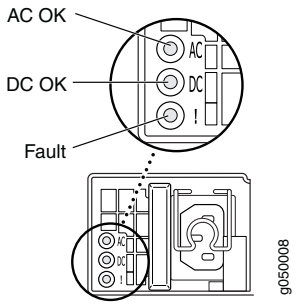

Table 16 on page 29 describes the LEDs on the AC power supplies.

Table 16: AC Power Supply LEDs on a EX4600 Switch

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

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

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Related Documentation

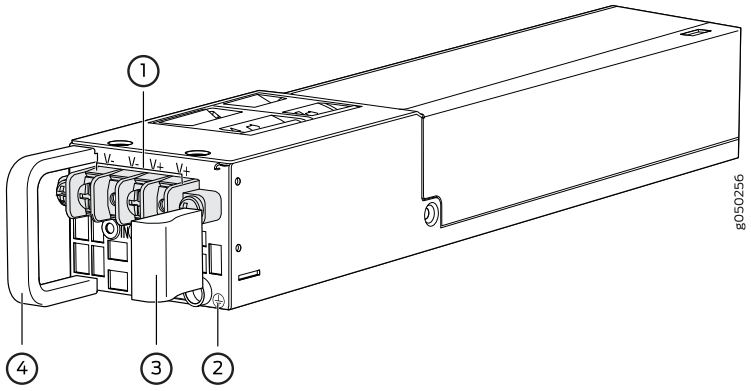
- AC Power Supply in an EX4600 Switch on page 27
- Connecting AC Power to an EX4600 Switch on page 121

DC Power Supply in an EX4600 Switch

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

The DC power supply is 650 W with dual feeds for power resiliency. It is same power supply that is used in the Juniper Networks QFX5100 line of switches (see Figure 20 on page 30).

Figure 20: DC Power Supply in EX4600 and QFX5100 Switches



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

NOTE: The DC power supply in the switch has four terminals labeled V-, V-, V+, and V+ (see Figure 21 on page 31) for connecting DC power source cables labeled positive (+) and negative (–).

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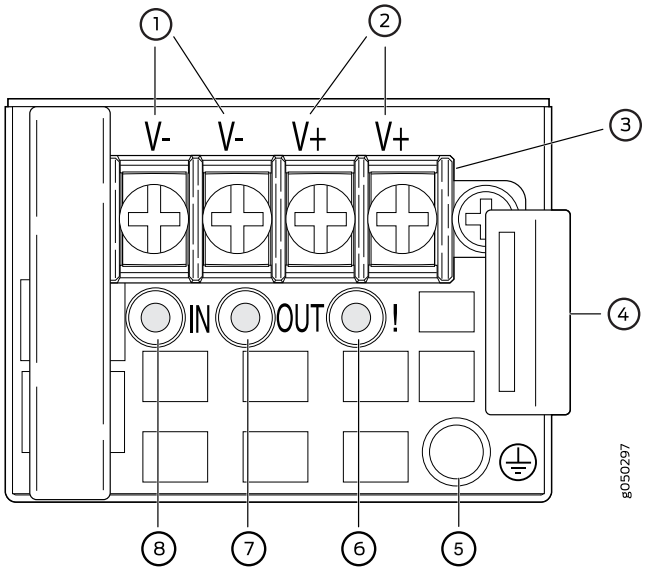
Figure 21: DC Power Supply Faceplate in EX4600 Switches



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

To avoid electrical injury, carefully follow instructions in "Installing a Power Supply in an EX4600 Switch" on page 147 and "Removing a Power Supply from an EX4600 Switch" on page 148.

Related Documentation

- DC Power Supply LEDs on an EX4600 Switch on page 31
- Management Panel of an EX4600 Switch on page 8
- Field-Replaceable Units in an EX4600 Switch on page 10
- DC Power Specifications for an EX4600 Switch on page 49
- Prevention of Electrostatic Discharge Damage on page 215
- Connecting DC Power to an EX4600 Switch on page 123

DC Power Supply LEDs on an EX4600 Switch

Figure 22 on page 32 shows the location of the LEDs on the DC power supply.

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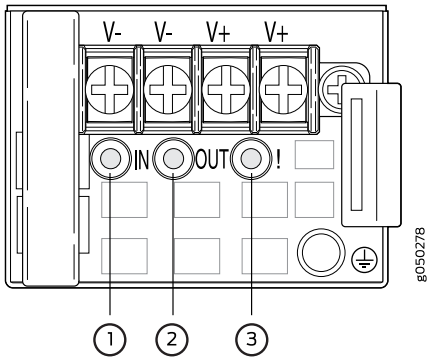
Figure 22: DC Power Supply Faceplate on an EX4600 Switch



1—Input LED	3—Fault LED
2—Output LED	

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

Table 17 on page 32 describes the LEDs on the DC power supplies.

Table 17: DC Power Supply LEDs on an EX4600 Switch

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

Related Documentation

- DC Power Supply in an EX4600 Switch on page 30
- DC Power Specifications for an EX4600 Switch on page 49
- Connecting DC Power to an EX4600 Switch on page 123

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PART 2

Site Planning, Preparation, and Specifications

- Preparation Overview on page 35
- Power Specifications and Requirements on page 47
- Transceiver and Cable Specifications on page 53
- Pinout Specifications on page 105

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CHAPTER 5

Preparation Overview

- Site Preparation Checklist for an EX4600 Switch on page 35
- Environmental Requirements and Specifications for EX Series Switches on page 36
- General Site Guidelines on page 40
- Site Electrical Wiring Guidelines on page 41
- Rack Requirements for an EX4600 Switch on page 42
- Cabinet Requirements for an EX4600 Switch on page 43
- Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch on page 44

Site Preparation Checklist for an EX4600 Switch

The checklist in Table 18 on page 35 summarizes the tasks you need to perform when preparing a site for EX4600 switch installation.

Table 18: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed switch tolerances.	"Environmental Requirements and Specifications for EX Series Switches" on page 36		
Power			
Measure the distance between external power sources and switch installation site.			
Calculate the power consumption and requirements.	"AC Power Specifications for an EX4600 Switch" on page 47		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the switch.	"Rack Requirements for an EX4600 Switch" on page 42 "Cabinet Requirements for an EX4600 Switch" on page 43		

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Table 18: Site Preparation Checklist *(continued)*

Item or Task	For More Information	Performed By	Date
Plan rack or cabinet location, including required space clearances.	"Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch" on page 44		
Secure the rack or cabinet to the floor and building structure.			
Cables			
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	*Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the QFX Series* *Interface Specifications for SFP+ DAC Cables for the QFX Series*		
Plan the cable routing and management.			

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Site Guidelines on page 40
- Installing and Connecting an EX4600 Switch on page 113
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114

Environmental Requirements and Specifications for EX Series Switches

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

Ensure that these environmental guidelines are followed:

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

Table 19 on page 37 provides the required environmental conditions for normal switch operation.

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Table 19: EX Series Switch Environmental Tolerances

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX2200-C	No performance degradation up to 5,000 feet (1524 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 104° F (40° C) at altitudes up to 5,000 ft (1,524 m). For information about extended temperature SFP transceivers supported on EX2200 switches, see *Pluggable Transceivers Supported on EX2200 Switches*.	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX2200 (except EX2200-C switches)	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX2300-C	No performance degradation up to 5,000 feet (1524 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX2300 (except EX2300-C switches)	No performance degradation up to 13,000 feet (3962.4 meters) at 104° F (40° C) as per GR-63	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX3200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX3300	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX3400	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

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Table 19: EX Series Switch Environmental Tolerances *(continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX4300	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4500	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4550	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	• EX4550-32F switches—Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C) • EX4550-32T switches—Normal operation is ensured in the temperature range 32° F through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX4600	No performance degradation to 6,562 feet (2000 meters)	Normal operation ensured in the relative humidity range 5% through 90%, noncondensing • Short-term operation ensured in the relative humidity range 5% through 93%, noncondensing NOTE: As defined in NEBS GR-63-CORE, Issue 4, short-term events can be up to 96 hours in duration but not more than 15 days per year.	• Normal operation ensured in the temperature range 32° F (0° C) through 113° F (45° C) • Nonoperating storage temperature in shipping container: –40° F (–40° C) through 158° F (70° C)	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 4.
EX6210	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX8208	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

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Table 19: EX Series Switch Environmental Tolerances *(continued)*

Switch or device	Environment Tolerance			
	Altitude	Relative Humidity	Temperature	Seismic
EX8216	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.
EX9204	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: –40° F (–40° C) to 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.
EX9208	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: –40° F (–40° C) to 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.
EX9214	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 5% through 90% (noncondensing)	Normal operation is ensured in the temperature range 32° F (0° C) through 104° F (40° C) Nonoperating storage temperature in shipping container: –40° F (–40° C) through 158° F (70° C)	Complies with Zone 4 earthquake requirements as per GR-63.
XRE200	No performance degradation up to 10,000 feet (3048 meters)	Normal operation ensured in the relative humidity range 10% through 85% (noncondensing)	Normal operation ensured in the temperature range 41° F (5° C) through 104° F (40° C)	Complies with Zone 4 earthquake requirements as per GR-63, Issue 4.

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

Related Documentation

- *Clearance Requirements for Airflow and Hardware Maintenance for EX2200 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX2300 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX3200 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX3300 Switches*

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- *Clearance Requirements for Airflow and Hardware Maintenance for EX3400 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX4200 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX4300 Switches*
- Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch on page 44
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX Series Redundant Power System*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX4500 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for EX4550 Switches*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX6210 Switch*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX8208 Switch*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX8216 Switch*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX9204 Switch*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX9208 Switch*
- *Clearance Requirements for Airflow and Hardware Maintenance for an EX9214 Switch*

General Site Guidelines

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

Efficient device operation requires proper site planning and maintenance and proper layout of the equipment, rack or cabinet (if used), 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 and 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.

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Related Documentation

- Prevention of Electrostatic Discharge Damage on page 215
- Environmental Requirements and Specifications for EX Series Switches on page 36
- *Environmental Requirements and Specifications for OCX1100 Switches*
- *Environmental Requirements and Specifications for a QFX3100 Director Device*
- *Environmental Requirements and Specifications for a QFX3008-I Interconnect Device*
- *Environmental Requirements and Specifications for a QFX3500 Device*
- *Environmental Requirements and Specifications for QFX3600 and QFX3600-I Devices*
- *Environmental Requirements and Specifications for a QFX5100 Device*
- *QFX5200 Environmental Requirements and Specifications*
- *QFX10002 Environmental Requirements and Specifications*
- *QFX10000 Environmental Requirements and Specifications*
- *Environmental Requirements and Specifications for an NFX250 Device*

Site Electrical Wiring Guidelines

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

Table 20 on page 41 describes the factors you must consider while planning the electrical wiring at your site.

WARNING: **It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.**

Table 20: Site Electrical Wiring Guidelines

Site Wiring Factor	Guidelines
Signaling limitations	If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding: • Improperly installed wires cause radio frequency interference (RFI). • Damage from lightning strikes occurs when wires exceed recommended distances or pass between buildings. • Electromagnetic pulses (EMPs) caused by lightning damage unshielded conductors and electronic devices.

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Table 20: Site Electrical Wiring Guidelines *(continued)*

Site Wiring Factor	Guidelines
Radio frequency interference	To reduce or eliminate RFI from your site wiring, do the following: • Use a twisted-pair cable with a good distribution of grounding conductors. • If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.
Electromagnetic compatibility	If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, seek expert advice. Some of the problems caused by strong sources of electromagnetic interference (EMI) are: • Destruction of the signal drivers and receivers in the switch • Electrical hazards as a result of power surges conducted over the lines into the equipment

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- Prevention of Electrostatic Discharge Damage on page 215

Rack Requirements for an EX4600 Switch

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

Rack requirements consist of:

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

Table 21 on page 42 provides the rack requirements and specifications for the EX4600 Switch.

Table 21: Rack Requirements for the EX4600 Switch

Rack Requirement	Guidelines
Rack type	Use a four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association.
Mounting bracket hole spacing	The holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm), so that the switch can be mounted in any rack that provides holes spaced at that distance.

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Table 21: Rack Requirements for the EX4600 Switch *(continued)*

Rack Requirement	Guidelines
Rack size and strength	• Ensure that the rack complies with the standards for a 19-in. or 23-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association. • A 600-mm rack as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (href="http://www.etsi.org">http://www.etsi.org). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the device's mounting brackets, which measure 19 in. (48.26 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required. • Ensure that the rack rails are spaced widely enough to accommodate the switch chassis' external dimensions. The outer edges of the front-mounting brackets extend the width to 19 in. (48.26 cm). • The front and rear rack rails must be spaced between 28 in. (71.1 cm) and 36 in. (91.4 cm) front-to-back. • The rack must be strong enough to support the weight of the switch. • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the switch and rack.
Rack connection to building structure	• Secure the rack to the building structure. • If earthquakes are a possibility in your geographical area, secure the rack to the floor. • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

Related Documentation

- Chassis Physical Specifications for an EX4600 Switch on page 7
- Rack-Mounting and Cabinet-Mounting Warnings on page 194
- Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch on page 44
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114

Cabinet Requirements for an EX4600 Switch

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

Cabinet requirements consist of:

- Cabinet size and clearance
- Cabinet airflow requirements

Table 22 on page 44 provides the cabinet requirements and specifications for the EX4600 switch.

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Table 22: Cabinet Requirements for the EX4600 Switch

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a EX4600 switch is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet airflow requirements	When you mount the switch in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating. • Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the switch (or switches). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the switch. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. • The EX4600 fans exhaust hot air either through the vents on the port panel or through the fans and power supplies. Install the switch in the cabinet in a way that maximizes the open space on the FRU side of the chassis. This maximizes the clearance for critical airflow. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the switch and cabinet.

Related Documentation

- Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch on page 44
- Rack Requirements for an EX4600 Switch on page 42
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114

Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch

When planning the site for installing an EX4600 switch, you must allow sufficient clearance around the installed chassis (see Figure 23 on page 45).

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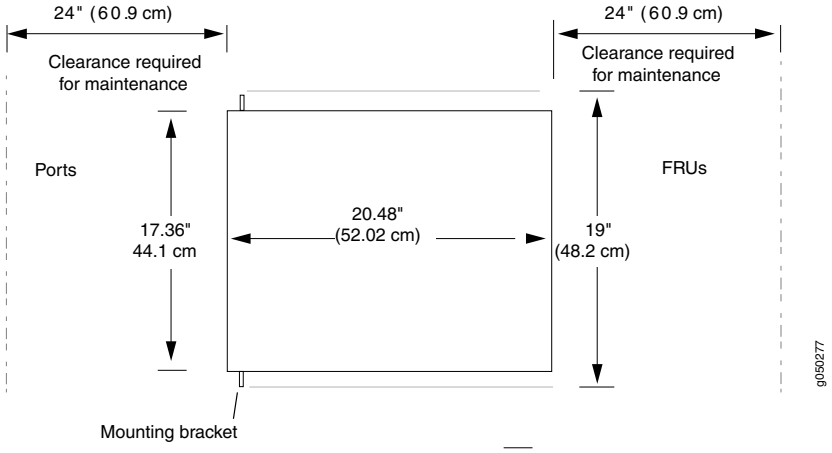
Figure 23: Clearance Requirements for Airflow and Hardware Maintenance for a EX4600 Switch



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "Cooling System and Airflow in an EX4600 Switch" on page 21 for more information about the airflow through the chassis.
- If you are mounting an EX4600 switch in a rack or cabinet with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- Leave at least 24 in. (61 cm) both in front of and behind the EX4600 switch. For service personnel to remove and install hardware components, you must leave adequate space at the front and back of the switch. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack or cabinet and 24 in. (61 cm) behind the rack or cabinet.

Related Documentation

- Rack Requirements for an EX4600 Switch on page 42
- Cabinet Requirements for an EX4600 Switch on page 43
- General Site Guidelines on page 40
- Rack-Mounting and Cabinet-Mounting Warnings on page 194

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CHAPTER 6

Power Specifications and Requirements

- AC Power Specifications for an EX4600 Switch on page 47
- AC Power Cord Specifications for an EX4600 Switch on page 48
- DC Power Specifications for an EX4600 Switch on page 49
- Calculating the EX Series Switch Fiber-Optic Cable Power Budget on page 49
- Calculating the EX Series Switch Fiber-Optic Cable Power Margin on page 50
- Grounding Cable and Lug Specifications for an EX4600 Switch on page 51

AC Power Specifications for an EX4600 Switch

Table 23 on page 47 describes the AC power specifications for an EX4600 switch.

Table 23: AC Power Specifications for an EX4600 Switch

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

Related Documentation

- AC Power Cord Specifications for an EX4600 Switch on page 48
- AC Power Supply in an EX4600 Switch on page 27
- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213

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AC Power Cord Specifications for an EX4600 Switch

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

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

Table 24 on page 48 lists AC power cord specifications provided for each country or region.

Table 24: AC Power Cord Specifications

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

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- General Safety Guidelines and Warnings on page 181

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- General Electrical Safety Guidelines and Warnings on page 213
- Prevention of Electrostatic Discharge Damage on page 215

DC Power Specifications for an EX4600 Switch

Table 25 on page 49 describes the DC power specifications for DC product SKUs of the EX4600 switch.

Table 25: DC Power Specifications for an EX4600 Switch

Item	Specifications
DC input voltage	• Rated operating voltage: –48 VDC to -60 VDC • Operating voltage range: -40 VDC through –72 VDC
DC input current rating	10 A maximum
Typical power consumption	300 W
Maximum power consumption	385 W

Related Documentation

- DC Power Supply in an EX4600 Switch on page 30
- DC Power Supply LEDs on an EX4600 Switch on page 31

Calculating the EX Series Switch Fiber-Optic Cable Power Budget

Calculate the link's power budget when planning fiber-optic cable layout and distances to 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, even though all the parts of an actual system do not operate at the worst-case levels.

To calculate the worst-case estimate for 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). For example, here, (P_T) and (P_R) are measured in decibels, and decibels are referred to one milliwatt (dBm).

   P_T = –15 dBm

   P_R = –28 dBm

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

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

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–15 dBm – (–28 dBm) = 13 dBm

Related Documentation

- Calculating the EX Series Switch Fiber-Optic Cable Power Margin on page 50
- Understanding EX Series Switches Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 102
- *Pluggable Transceivers Supported on EX Series Switches*

Calculating the EX Series Switch Fiber-Optic Cable Power Margin

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 losses 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 attenuation or link loss (LL) has been subtracted 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 all the parts of an actual system do not 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 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.

Before you begin to calculate the power margin:

- Calculate the power budget. See "Calculating the EX Series Switch Fiber-Optic Cable Power Budget" on page 49.

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 50 (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)	• Multimode—0.5 dBm • Single mode—None	• 0.5 dBm • 0 dBm
Modal and chromatic dispersion	• Multimode—None, if product of bandwidth and distance is less than 500 MHz/km • Single mode—None	• 0 dBm • 0 dBm
Connector	0.5 dBm	This example assumes 5 connectors. Loss for 5 connectors: (5) * (0.5 dBm) = 2.5 dBm

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Table 26: Estimated Values for Factors Causing Link Loss *(continued)*

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

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

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

   $P_B - LL = P_M$

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

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

   P_M = 6 dBm

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

Related Documentation

- Calculating the EX Series Switch Fiber-Optic Cable Power Budget on page 49
- Understanding EX Series Switches Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 102
- *Pluggable Transceivers Supported on EX Series Switches*

Grounding Cable and Lug Specifications for an EX4600 Switch

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

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

CAUTION: Before switch installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. See "Connecting Earth Ground to an EX4600 Switch" on page 120. A cable with an incorrectly attached lug can damage the switch.

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

- A protective earthing terminal bracket is provided in the accessory kit for connecting the switch to earth ground. This L-shaped bracket attaches to a post on the EX4600 switch left front mounting bracket, providing a protective earthing terminal for the switch. The grounding points are studs sized for M4 hex nuts. The grounding points are spaced at 0.625 in. (15.86 mm). M4 hex nuts with integrated washers are provided in the accessory kit.
- The grounding lug required is a Panduit LCD10-10A-L or equivalent. This grounding lug is provided in the accessory kit. The grounding lug provided accommodates 14–10 AWG (2–5.3 mm^2) stranded wire.
- The grounding cable that you provide for an EX4600 switch must be 14 AWG (2 mm^2), minimum 60° C wire, or as permitted by the local code.

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- DC Power Supply in an EX4600 Switch on page 30
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123

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CHAPTER 7

Transceiver and Cable Specifications

- Interface Support for an EX4600 Switch on page 53
- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for SFP+ DAC Cables for the EX4600 Switch on page 83
- Interface Specifications for SFP+ Active Optical Cables for the EX4600 on page 88
- Interface Specifications for QSFP+ to SFP+ Active Optical Breakout Cables for the EX4600 on page 90
- Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch on page 91
- Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch on page 94
- Cable Specifications for QSFP+ Transceivers on EX Series Switches on page 98
- Network Cable Specifications for EX4600 Switches on page 100
- Cable Specifications for Console and Management Connections for the EX4600 on page 101
- Understanding EX Series Switches Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 102

Interface Support for an EX4600 Switch

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

The 24 downlink or access ports of the EX4600 switch are 10-Gigabit Ethernet.

Figure 24 on page 54 shows the different ports available on the EX4600 switch.

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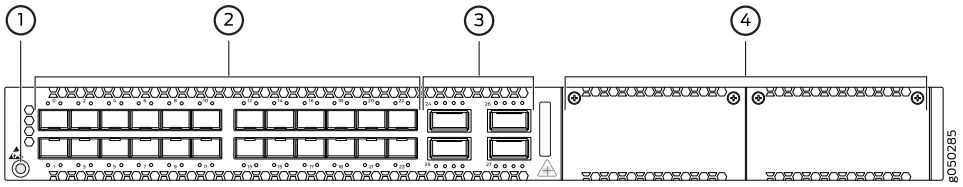
Figure 24: Port Panel of EX4600



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

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

Table 27 on page 54 lists the optical transceivers supported on EX4600 switches. For the full specification for each of these optical transceivers, see the Hardware Compatibility Tool or "Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch" on page 58.

Table 27: Supported Optical Transceivers for the EX4600 Switch

Part Number	Description	Maximum Distance Supported
QFX-SFP-1GE-T	SFP module 1000BASE-T Gigabit Ethernet. Also available in packs of eight transceivers, (JNP-1G-T–8PACK)	100 m transmission on Category 5 cable
QFX-SFP-1GE-SX	SFP module 1000BASE-SX Gigabit Ethernet Also available in packs of eight transceivers, (JNP-1G-SX-8PACK)	220 m transmission on FDDI, multimode fiber (MMF) cable 275 m transmission on OM1, MMF cable 550 m transmission on OM2, MMF cable
QFX-SFP-1GE-LX	SFP module 1000BASE-LX Gigabit Ethernet	10 km transmission on single-mode fiber (SMF) cable 550 m transmission on OM1, MMF cable 550 m transmission on OM2, MMF cable
JNP-SFP-10G-BX10D	SFP module 10-Gigabit Ethernet bi-directional; works in conjunction with JNP-SFP-10G-BX10U	10 km transmission on single strand fiber cable
JNP-SFP-10G-BX10U	SFP module 10-Gigabit Ethernet bi-directional; works in conjunction with JNP-SFP-10G-BX10D	10 km transmission on single strand fiber cable

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Table 27: Supported Optical Transceivers for the EX4600 Switch *(continued)*

Part Number	Description	Maximum Distance Supported
QFX-SFP-10GE-ER	SFP+ module 10GBASE-ER, 10-Gigabit Ethernet	40 km transmission on SMF cable
QFX-SFP-10GE-LR	SFP+ module 10GBASE-LR, 10-Gigabit Ethernet	10 km transmission on MMF cable
QFX-SFP-10GE-SR	SFP+ module 10GBASE-SR, 10-Gigabit Ethernet Also available in packs of eight transceivers, (JNP-10G-SR-8PACK)	26 m transmission on FDDI, MMF cable 33 m transmission on OM1, MMF cable 82 m transmission on OM2, MMF cable 300 m transmission on OM3, MMF cable 400 m transmission on OM4, MMF cable
JNP-QSFP-40GE-ER4	QSFP+ module 40GBASE-ER4, 40-Gigabit Ethernet	40 km transmission on SMF cable
QFX-QSFP-40G-ESR4	Juniper Networks proprietary QSFP+ module 4X10G-SR, 40-Gigabit Ethernet	300 m transmission on OM3, MMF cable 400 m transmission on OM4, MMF cable
JNP-QSFP-40GE-IR4	Juniper Networks proprietary 40GBASE-IR4 QSFP+ module , 40-Gigabit Ethernet pluggable	2 km transmission on SMF cable
JNP-QSFP-4X10GE-LR	QSFP+ module 10GBASE-LW and 10GBASE-LR, 40-Gigabit Ethernet pluggable	10 km transmission on SMF cable
JNP-QSFP-40G-LR4	QSFP+ module 40GBASE-LR4, 40-Gigabit Ethernet pluggable	10 km transmission on SMF cable
JNP-QSFP-40G-LX4 Also available in packs of 4 transceivers, JNP-40-LX4-4PACK	Juniper Networks proprietary 40G-LX4, QSFP+ module 40-Gigabit Ethernet pluggable	2 km transmission on SMF cable 100 m transmission on OM3, MMF cable 150 m transmission on OM4, MMF cable
QFX-QSFP-40G-SR4	QSFP+ module 40GBASE-SR4, 40-Gigabit Ethernet	100 m transmission on OM3, MMF cable 150 m transmission on OM4, MMF cable
QFX-SFP-10GE-USR	Juniper Networks proprietary SFP+ module 10-Gigabit Ethernet Ultra Short Reach (USR)	10 m transmission on OM1 MMF cable 30 m transmission on OM2, MMF cable 100 m transmission on OM3 (OM4 compatible) cable
QFX-SFP-10GE-ZR	Juniper Networks proprietary SFP+ module 10GBASE-ZR, 10-Gigabit Ethernet	80 km transmission on SMF cable

Table 28 on page 56 describes the supported DAC and DAC breakout cables. For an online version of the specifications, see the Hardware Compatibility Tool.

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CAUTION: You can use DAC and DAC breakout cables purchased from a third party at your own risk. If you choose to use a third-party cable, it should meet the specifications described in "Interface Specifications for SFP+ DAC Cables for the EX4600 Switch" on page 83, "Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch" on page 91, and "Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch" on page 94.

Table 28: Supported DAC and DAC Breakout Cables for the EX4600 Switch

Part Number	Description	Active/Passive	Length
QFX-SFP-10GE-DAC-1M	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Passive	1 m (3.3 ft.)
QFX-SFP-10GE-DAC-3M	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Passive	3 m (9.84 ft.)
QFX-SFP-10GE-DAC-5M	SFP+ 10-Gigabit Ethernet DAC cable assembly, 24 AWG	Passive	5 m (16.4 ft.)
QFX-SFP-10GE-DAC-1MA	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Active	1 m (3.3 ft.)
QFX-SFP-10GE-DAC-3MA	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Active	3 m (9.84 ft.)
QFX-SFP-10GE-DAC-5MA	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Active	5 m (16.4 ft.)
QFX-SFP-10GE-DAC-7MA	SFP+ 10-Gigabit Ethernet DAC cable assembly, 30 AWG	Active	7 m (22.9 ft.)
QFX-SFP-10GE-DAC-10MA	SFP+ 10-Gigabit Ethernet DAC cable assembly, 28 AWG	Active	10 m (32.8 ft.)
QFX-QSFP-DAC-1M	QSFP+ 40-Gigabit Ethernet, programmable ID, cable assembly, 30 AWG	Passive	1 m (3.3 ft.)
QFX-QSFP-DAC-3M	QSFP+ 40-Gigabit Ethernet, programmable ID, cable assembly, 30 AWG	Passive	3 m (9.84 ft.)
JNP-QSFP-DAC-5M	QSFP+ 40-Gigabit Ethernet DAC assembly, programmable ID, cable assembly, 26 AWG	Passive	5 m (16.4 ft.)
QFX-QSP-DACBO-1M	QSFP+ to SFP+ 10-Gigabit Ethernet DACBO cable assembly, 30 AWG	Passive	1 m (3.3 ft.)
QFX-QSFP-DACBO-3M	QSFP+ to SFP+ 10-Gigabit Ethernet DACBO assembly, 30 AWG	Passive	3 m (9.84 ft.)

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Table 28: Supported DAC and DAC Breakout Cables for the EX4600 Switch *(continued)*

Part Number	Description	Active/Passive	Length
JNP-QSFP-DACBO-5MA	QSFP+ to SFP+ 10-Gigabit Ethernet DACBO assembly, 30 AWG	Active	5 m (16.4 ft.)
JNP-QSFP-DAC-7MA	QSFP+ 40-Gigabit Ethernet DAC assembly, programmable ID, cable assembly, 30 AWG	Active	7 m (22.9 ft.)
JNP-QSFP-DAC-10MA	QSFP+ 40-Gigabit Ethernet DAC assembly, programmable ID, cable assembly, 28 AWG	Active	10 m (32.8 ft.)

Table 29 on page 57 describes the active optical cables (AOCs) on EX4600 switches. Details for these cables are found in the Hardware Compatibility Tool and in "Interface Specifications for SFP+ Active Optical Cables for the EX4600" on page 88.

Table 29: Supported AOC and AOC Break Out on EX4600

Part Number	Description	Maximum Distance Supported
JNP-10G-AOC-1M	SFP+ 10-Gigabit Ethernet active optical cable assembly	1 m (3.3 ft.)
JNP-10G-AOC-3M	SFP+ 10-Gigabit Ethernet active optical cable assembly	3 m (9.84 ft.)
JNP-10G-AOC-5M	SFP+ 10-Gigabit Ethernet active optical cable assembly	5 m (16.4 ft.)
JNP-10G-AOC-7M	SFP+ 10-Gigabit Ethernet active optical cable assembly	7 m (22.9 ft.)
JNP-10G-AOC-10M	SFP+ 10-Gigabit Ethernet active optical cable assembly	10 m (32.8 ft.)
JNP-10G-AOC-15M	SFP+ 10-Gigabit Ethernet active optical cable assembly	15 m (49.2 ft.)
JNP-10G-AOC-20M	SFP+ 10-Gigabit Ethernet active optical cable assembly	20 m (65.6 ft.)
JNP-10G-AOC-30M	SFP+ 10-Gigabit Ethernet active optical cable assembly	30 m (98.4 ft.)

Related Documentation

- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for SFP+ DAC Cables for the EX4600 Switch on page 83
- Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch on page 91
- Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch on page 94

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Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch

This topic describes the specifications for the SFP, SFP+, and QSFP+ transceivers used in the EX4600 switch.

The optical transceivers installed in an EX4600 switch 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**. The command does not give any output for copper transceivers or transceivers not purchased from Juniper Networks.

In the newer standards, optical modulation amplitude (OMA) is used to measure the absolute receiver sensitivity.

The Hardware Compatibility Tool and the three tables in this topic describe the optical interface support over single-mode fiber-optic (SMF) and multimode fiber-optic (MMF) cables and copper interface support over four-pair, Category 5 shielded twisted-pair cables:

- Table 30 on page 59—Copper interface support and optical interface support for Gigabit Ethernet SFP transceivers.
- Table 31 on page 62—Optical interface support for 10-Gigabit Ethernet SFP+ transceivers.
- Table 32 on page 75—Optical interface support for 40-Gigabit Ethernet QSFP+ transceivers.

NOTE: If you are using the QFX-QSFP-40G-ESR4 transceiver in a QSFP+ port and have configured the port to operate as multiple 10-Gigabit Ethernet interfaces, you can use a fiber breakout cable to distribute the interfaces to up to four 10GBASE-SR SFP+ transceivers. Juniper Networks does not sell fiber breakout cables.

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Table 30: Copper Interface Support and Optical Interface Support for Gigabit Ethernet SFP Transceivers for the EX4600 Switch

Standards Compliance	Specifications	
1000BASE-T	Product SKU number	QFX-SFP-1GE-T
	Signaling rate (range)	1.25 GBd +/- 100 ppm
	Connector type	RJ-45
	Fiber pairs	–
	Transmit and receive wavelength	–
	Average transmit launch power (minimum)	–
	Average transmit launch power (maximum)	–
	Average receive power (maximum)	–
	Receive sensitivity	–
	DOM support	Not available
	Fiber type	–
	Core/cladding size	–
	Modal bandwidth	–
	Operating range	100 m (328 ft)

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Table 30: Copper Interface Support and Optical Interface Support for Gigabit Ethernet SFP Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications				
1000BASE-SX	Product SKU number	QFX-SFP-1GE-SX			
	Signaling rate	1.25 GBd +/- 100 ppm			
	Connector type	Lucent connector (LC)/physical contact (PC) connector			
	Fiber pairs	1			
	Transmit and receive wavelength (range)	770 nm to 860 nm			
	Average transmit launch power (minimum)	-9.5 dBm			
	Average transmit launch power (maximum)	-3 dBm			
	Receive sensitivity	-17 dBm			
	Average receive power (maximum)	0 dBm			
	DOM support	Available			
	Fiber type	Multimode fiber (MMF)			
	Core/cladding size	62.5/125 µm	62.5/125 µm	50/125 µm	50/125 µm
	Fiber grade	FDDI	OM1	–	OM2
	Modal bandwidth at 850 nm (minimum overfilled launch)	160 MHz x km	200 MHz x km	400 MHz x km	500 MHz x km
	Operating range	2 m (6.6 ft) to 220 m (721 ft)	2 m (6.6 ft) to 275 m (902 ft)	2 m (6.6 ft) to 500 m (1640 ft)	2 m (6.6 ft) to 550 m (1804 ft)

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Table 30: Copper Interface Support and Optical Interface Support for Gigabit Ethernet SFP Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications				
1000BASE-LX	Product SKU number	QFX-SFP-1GE-LX			
	Signaling rate	1.25 GBd +/- 100 ppm			
	Connector type	LC/PC			
	Fiber pairs	1			
	Wavelength range	1270 nm to 1355 nm			
	Average transmit launch power (minimum)	-9.5 dBm			
	Average transmit launch power (maximum)	-3 dBm			
	Receive sensitivity	-19 dBm			
	Average receiver power (maximum)	-3 dBm			
	DOM support	Available			
	Fiber type	NOTE: Mode-conditioning patch (MCP) cable is required for 1000BASE-LX applications over OM1 and OM2 fiber types.			
	Core/cladding size	9/125 µm	62.5/125 µm	50/125 µm	50/125 µm
	Fiber grade	Single-mode fiber (SMF)	OM1	–	OM2
	Modal bandwidth at 850 nm (minimum overfilled launch)	–	500 MHz x km	400 MHz x km	500 MHz x km
	Operating range	2 m (6.6 ft) to 10 km (6.2 miles)	2 m (6.6 ft) to 550 m (0.34 miles)	2 m (6.6 ft) to 500 m (1640 ft)	2 m (6.6 ft) to 550 m (1804 ft)

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch

Standards Compliance	Specifications	
Juniper Networks proprietary10 km 10G-BiDi Complies with SSF-8431; SSF-8472; and SSF-8432	Product SKU number	JNP-SFP-10G-BX10D Used in conjunction with JNP-SFP-10G-BX10U
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber count	1
	Transmit center wavelength (range)	1320 nm to 1340 nm
	Receive center wavelength (range)	1260 nm to 1280 nm
	Average transmit launch power, each lane (minimum)	–8.2 dBM
	Average transmit launch power, each lane (maximum)	0.5 dBm
	Average receive power each lane (minimum)	–14.4 dBm
	Average receive power each lane (maximum)	0.5 dBm
	Receiver sensitivity (OMA) each lane (maximum)	–12.6 dBm
	Stressed receiver sensitivity (OMA) each lane (maximum)	–10.3 dBm
	Fiber type	Type B1.1, B1.3 SMF
	Core/cladding	9/125 µm
	Operating range	2 m (6.56 ft.) to 10 km (6.21 miles)
	Diagnostic support	Supported
		14.1X53-D35

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications
	Minimum Junos OS release

Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
Juniper Networks proprietary10 km 10G-BiDi Complies with SSF-8431; SSF-8472; and SSF-8432	Product SKU number	JNP-SFP-10G-BX10U Used in conjunction with JNP-SFP-10G-BX10D
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber count	1
	Transmit center wavelength (range)	1260 nm to 1280 nm
	Receive center wavelength (range	1320 nm to 1340 nm
	Average transmit launch power, each lane (minimum)	–8.2 dBm
	Average transmit launch power, each lane (maximum)	0.5 dBm
	Average receive power each lane (minimum)	–14.4 dBm
	Average receive power each lane (maximum)	0.5 dBm
	Receiver sensitivity (OMA) each lane (maximum)	–12.6 dBm
	Stressed receiver sensitivity (OMA) each lane (maximum)	–10.3 dBm
	Fiber type	Type B1.1, B1.3 SMF
	Core/cladding	9/125 µm
	Operating range	2 m (6.56 ft.) to 10 km (6.21 miles)
	Diagnostic support	Supported
		14.1X53-D35

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications
	Minimum Junos OS release

Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
Juniper Networks proprietary 40 km 10G-BiDi Complies with SSF-8431; SSF-8472; and SSF-8432	Product SKU number	JNP-SFP-10G-BX40D Used in conjunction with JNP-SFP-10G-BX40U
	Supported models	QFX5100-24Q QFX5100-48S QFX5100-48T QFX5100-96S
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber count	1
	Transmit center wavelength (range)	1320 nm to 1340 nm
	Receive center wavelength (range)	1260 nm to 1280 nm
	Average transmit launch power each lane (minimum)	–2.7 dBm
	Average transmit launch power each lane (maximum)	4.5 dBm
	Average receive power each lane (minimum)	–21.2 dBm
	Average receive power each lane (maximum)	–9 dBm
	Receiver sensitivity (OMA) each lane (maximum)	–19.8 dBm
	Fiber type	Type B1.1, B1.3 SMF
	Core/cladding	9/125 µm
	Operating range	40 km (24.85 miles)

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
	Diagnostic support	Supported
	Minimum Junos OS release	14.1X53-D35

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
Juniper Networks proprietary 40 km 10G-BiDi Complies with SSF-8431; SSF-8472; and SSF-8432	Product SKU number	JNP-SFP-10G-BX40D Used in conjunction with JNP-SFP-10G-BX40U
	Supported models	QFX5100-24Q QFX5100-48S QFX5100-48T QFX5100-96S
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber count	1
	Transmit center wavelength (range)	1320 nm to 1340 nm
	Receive center wavelength (range)	1260 nm to 1280 nm
	Average transmit launch power each lane (minimum)	–2.7 dBm
	Average transmit launch power each lane (maximum)	4.5 dBm
	Average receive power each lane (minimum)	–21.2 dBm
	Average receive power each lane (maximum)	–9 dBm
	Receiver sensitivity (OMA) each lane (maximum)	–19.8 dBm
	Fiber type	Type B1.1, B1.3 SMF
	Core/cladding	9/125 µm
	Operating range	40 km (24.85 miles)

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
	Diagnostic support	Supported
	Minimum Junos OS release	14.1X53-D35

Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications			
Juniper Networks proprietary 10G-USR	Product SKU number	QFX-SFP-10GE-USR		
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm		
	Connector type	LC/PC		
	Fiber pairs	1		
	Center wavelength (range)	840 nm to 860 nm		
	RMS spectral width (maximum)	0.65 nm		
	Average transmit launch power (minimum)	-7.3 dBm		
	Average transmit launch power (maximum)	-1.3 dBm		
	Average receive power (minimum)	-9.9 dBm		
	Average receive power (maximum)	-1.0 dBm		
	Receiver sensitivity (OMA) (maximum)	-11.1 dBm		
	DOM support	Available		
	Fiber type	MMF		
	Core/cladding size	62.5/125 µm	50/125 µm	50/125 µm
	Fiber grade	OM1	OM2	OM3 (OM4 compatible)
	Minimum modal bandwidth at 850 nm	200 MHz x km	500 MHz x km	2000 MHz x km
	Operating range	2 m (6.6 ft) to 10 m (32 ft)	2 m (6.6 ft) to 30 m (98 ft)	2 m (6.6 ft) to 100 m (328 ft)

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications					
10GBASE-SR	Product SKU number	QFX-SFP-10GE-SR				
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm				
	Connector type	LC/ultra physical contact (UPC)				
	Fiber pairs	1				
	Center wavelength (range)	840 nm to 860 nm				
	RMS spectral width (maximum)	0.45 nm				
	Average transmit launch power (minimum)	-7.3 dBm				
	Average transmit launch power (maximum)	-1.3 dBm				
	Average receive power (minimum)	-9.9 dBm				
	Average receive power (maximum)	-1.0 dBm				
	Receiver sensitivity (OMA) (maximum)	-11.1 dBm				
	Stressed receiver sensitivity in OMA (maximum)	-7.5 dBm				
	DOM support	Available				
	Fiber type	MMF				
	Core/cladding size	62.5/125 µm	62.5/125 µm	50/125 µm	50/125 µm	50/125 µm	50/125 µm
	Fiber grade	FDDI	OM1	–	OM2	OM3	OM4
	Minimum modal bandwidth at 850 nm	160 MHz x km	200 MHz x km	400 MHz x km	500 MHz x km	2000 MHz x km	4700 MHz x km

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications						
	Operating range	26 m (85 ft)	33 m (108 ft)	66 m (216 ft)	82 m (269 ft)	300 m (984 ft)	400 m (1312 ft)
10GBASE-LR	Product SKU number	QFX-SFP-10GE-LR					
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm					
	Connector type	LC/UPC					
	Fiber pairs	1					
	Center wavelength (range)	1260 nm to 1355 nm					
	Average transmit launch power (minimum)	-8.2 dBm					
	Average transmit launch power (maximum)	0.5 dBm					
	Average receive power (minimum)	-14.4 dBm					
	Average receive power (maximum)	0.5 dBm					
	Receiver sensitivity (OMA) maximum)	-12.6 dBm					
	Stressed receiver sensitivity (OMA) (maximum)	-10.3 dBm					
	DOM support	Available					
	Fiber type	SMF					
	Core/cladding size	9/125 µm					
	Operating range	2 m (6.6 ft) to 10 km (6.2 miles)					

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
10GBASE-ER	Product SKU Number	QFX-SFP-10GE-ER
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	LC/UPC
	Fiber pairs	1
	Center wavelength (range)	1530 nm to 1565 nm
	Average transmit launch power (minimum)	-4.7 dBm
	Average transmit launch power (maximum)	4.0 dBm
	Average receive power (minimum)	-15.8 dBm
	Average receive power (maximum)	-1.0 dBm
	Receiver sensitivity (OMA) (maximum)	-14.1 dBm
	Stressed receiver sensitivity (maximum) in (OMA	-11.3 dBm
	DOM support	Available
	Fiber type	SMF
	Core/cladding size	9/125 µm
	Operating range	2 m (6.6 ft) to 40 km (24.85 miles)

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Table 31: Optical Interface Support for 10-Gigabit Ethernet SFP+ Transceivers for the EX4600 Switch *(continued)*

Standards Compliance	Specifications	
Juniper Networks proprietary 10GBASE-ZR	Product SKU Number	EX-SFP-10GE-ZR
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connection Type	LC/PC
	Fiber pairs	1
	Transmitter wavelength (range)	1530 nm to 1565 nm
	Mean transmit output power (minimum)	0
	Mean transmit output power (maximum)	4 dBM
	Average receive power (maximum)	--7 dBM
	Equivalent sensitivity (minimum)	–24 dBM
	DOM support	Available
	Fiber type	SMF
	Operating range	80 km (49.7 miles)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series

Standards Compliance	Specifications	
40GBASE-ER4 and SFF-8436	Product SKU number	JNP-QSFP-40GE-ER4
	Signaling rate	10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber pairs	1
	Transmit and receive lane wavelengths (range)	Lane 0–1264.5 to 1277.5 nm Lane 1–12845 to 1297.5 nm Lane 2–1304.5 to 1317.5 nm Lane 3–1324.5 to 1337.5 nm
	Average transmit launch power, each lane (minimum)	–2.7 dBm
	Average transmit launch power, each lane (maximum)	4.5 dBm
	Average receive power, each lane (minimum)	–21.2 dBm
	Average receive power, each lane (maximum)	–4.5 dBm
	Receiver sensitivity (OMA), each lane (maximum)	–19 dBm
	Stressed receiver sensitivity (OMA) each lane (maximum)	–16.8 dBm
	Fiber type	Type B1.1, B1.3, or B6 SMF
	Core/cladding	9/125 µm
	Operating range	2 m (6.6 ft) to 40 km (24.8 miles)
	Diagnostic support	Supported
	Minimum Junos OS release	14.1X53-D35

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Standards Compliance	Specifications		
40GBASE-SR4	Product SKU number	QFX-QSFP-40G-SR4	
	Signaling rate	10.3125 GBd +/- 100 ppm	
	Connector type	12-ribbon multimode fiber crossover cable with female multi-fiber push-on (MPO)/UPC connectors. To channelize a 40-Gigabit port to four 10-Gigabit ports, use a 12-fiber parallel to 2-fiber duplex breakout cable. NOTE: See "Cable Specifications for QSFP+ Transceivers on EX Series Switches" on page 98 for more information.	
	Fiber pairs	4	
	Center wavelength (range)	840 nm to 860 nm	
	RMS spectral width (maximum)	0.65 nm	
	Average transmit launch power, each lane (minimum)	-7.6 dBm	
	Average transmit launch power, each lane (maximum)	2.4 dBm	
	Average receive power, each lane (maximum)	-9.5 dBm	
	Average receive power, each lane (minimum)	2.4 dBm	
	Stressed receiver sensitivity (OMA), each lane (maximum)	-5.4 dBm	
	DOM support	Available	
	Fiber type	MMF	
	Core/cladding size	50/125 µm	50/125 µm
	Fiber grade	OM3	OM4
	Effective modal bandwidth at 850 nm	2000 MHz x km	4700 MHz x km
	Operating range	0.5 m (1.64 ft) to 100 m (325 ft)	0.5 m (1.64 ft) to 150 m (425 ft)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Standards Compliance	Specifications	
Juniper Networks proprietary 4X10G-SR	Product SKU number	QFX-QSFP-40G-ESR4
	Signaling rate	9.95328 GBd +/- 20 ppm 10.3125 GBd +/- 100 ppm
	Connector type	12-ribbon multimode fiber crossover cable with female MPO/PC connectors. To channelize a 40-Gigabit port to four 10-Gigabit ports, use a 12-fiber parallel to 2-fiber duplex breakout cable. NOTE: See "Cable Specifications for QSFP+ Transceivers on EX Series Switches" on page 98or more information.
	Fiber pairs	4
	Center wavelength (range)	840 nm to 860 nm
	RMS spectral width (maximum)	0.45 nm
	Average transmit launch power, each lane (minimum)	-7.3 dBm
	Average transmit launch power, each lane (maximum)	-1.3 dBm
	Average receive power, each lane (minimum)	-9.9 dBm
	Average receive power, each lane (maximum)	-1.0 dBm
	Receiver sensitivity (OMA), each lane (maximum)	-11.1 dBm
	Stressed receiver sensitivity (OMA), each lane (maximum)	-7.5 dBm
	DOM support	Available
	Fiber type	MMF
	Core/cladding size	50/125 µm

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Standards Compliance	Specifications		
	Fiber grade	OM3	OM4
	Effective modal bandwidth at 850 nm	2000 MHz x km	4700 MHz x km
	Operating range	2 m (6.6 ft) to 300 m (984 ft)	2 m (6.6 ft) to 400 m (1312 ft)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Standards Compliance	Specifications	
40GBASE-LR4	Product SKU number	JNP-QSFP-40G-LR4
	Signaling rate	10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber pairs	1
	Lane wavelength	Lane 0–1264.5 nm through 1277.5 nm Lane 1–1284.5 nm through 1297.5 nm Lane 2–1304.5 nm through 1317.5 nm Lane 3–1324.5 nm through 1337.5 nm
	Average transmit launch power, each lane (minimum)	-7.0 dBm
	Average transmit launch power, each lane (maximum)	2.3 dBm
	Average receive power, each lane (minimum)	-13.7 dBm
	Average receive power, each lane (maximum)	2.3 dBm
	Receiver sensitivity (OMA), each lane (maximum)	-11.5 dBm
	Stressed receiver sensitivity (OMA) each lane (maximum)	-9.6 dBm
	DOM support	Available
	Fiber type	SMF
	Core/cladding size	9/125 µm
	Operating range	2 m (6.6 ft) to 10 km (6.2 miles)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Juniper Networks proprietary 4X10G-LR	Product SKU number	JNP-QSFP-4X10GE-LR
	Signaling rate, each lane (range)	9.95328 +/- 20 ppm 10.3125 GBd +/-100 ppm
	Connector type	12-ribbon single mode fiber-cable with female MPO/APC connector NOTE: See "Cable Specifications for QSFP+ Transceivers on EX Series Switches" on page 98.
	Fiber pairs	4
	Transmit and receive lane wavelength	1260 nm to 1355 nm
	Average transmit launch power, each lane (minimum)	-6.5 dBm
	Average transmit launch power, each lane (maximum)	0.5 dBm
	Average receive power, each lane (minimum)	-14.4 dBm
	Average receive power, each lane (maximum)	-1.5 dBm
	Receiver sensitivity (OMA), each lane (maximum)	-12.6 dBm
	Stressed receiver sensitivity (OMA), each lane (maximum)	-10.3 dBm
	DOM support	Available
	Core/cladding size	9/125 µm
	Operating distance	2 m (6.56 ft) to 10 km (6.21 miles)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Juniper Networks proprietary 40G-IR4	Product SKU Number	JNP-QSFP-40GE-IR4
	Signaling rate	10.3125 GBd +/- 100 ppm
	Connector type	LC/PC
	Fiber pairs	1
	Transmit and receive lane wavelengths	Lane 0–1264.5 nm through 1277.5 nm Lane 1–1284.5 nm through 1297.5 nm Lane 2–1304.5 nm through 1317.5 nm Lane 3–1324.5 nm through 1337.5 nm
	Average transmit launch power, each lane (minimum)	-7.0 dBm
	Average transmit launch power, each lane (maximum)	2.3 dBm
	Average receive power, each lane (minimum)	-11.5 dBm
	Average receive power, each lane (maximum)	2.3 dBm
	Receiver sensitivity (OMA), each lane (maximum)	–10.6 dBm
	DOM support	Available
	Fiber type	SMF
	Core/cladding size	9/125 µm
	Operating range	2 m (6.6 ft) to 2 km (1.24 miles)

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Table 32: Interface Support for 40-Gigabit Ethernet QSFP+ Transceivers for the QFX Series *(continued)*

Juniper Networks proprietary 40G-LX4	Product SKU Number	JNP-QSFP-40G-LX4		
	Signaling rate	10.3125 GBd +/- 100 ppm		
	Connector	Dual LC/PC		
	Fiber pairs	1		
	Lane wavelength (typical)	Lane 0–1264.5 nm through 1277.5 nm Lane 1–1284.5 nm through 1297.5 nm Lane 2–1304.5 nm through 1317.5 nm Lane 3–1324.5 nm through 1337.5 nm		
	Average transmit launch power, each lane (minimum)	SMF MMF	-9.0 dBm -7.0 dBm	
	Average transmit launch power, each lane (maximum)	SMF MMF	2.3 dBm 4.3 dBm	
	Average receive power, each lane (minimum)	SMF MMF	-12 dBm -10.0 dBm	
	Average receive power, each lane (maximum)	SMF MMF	2.3 dBm 4.3 dBm	
	Receiver sensitivity (OMA), each lane (maximum)	SMF MMF	-0.5 dBm -11.5 dBm	
	DOM support	Available		
	Fiber type	SMF	MMF	MMF
	Core/cladding size	9/125 µm	50/125 µm	50/125 µm
	Fiber grade	OS1	OM3	OM4
	Effective modal bandwidth at 850 nm	–	2000 MHz x km	4700 MHz x km
	Operating range	2 km	100 m (328 ft)	150 m (492 ft)

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Related Documentation

- Interface Support for an EX4600 Switch on page 53
- Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch on page 91
- Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch on page 94
- Installing a Transceiver in a Switch on page 155
- Removing a Transceiver from a Switch on page 157

Interface Specifications for SFP+ DAC Cables for the EX4600 Switch

Small form-factor pluggable plus (SFP+) direct attach copper (DAC) cables, also known as Twinax cables, are suitable for in-rack connections between servers and EX4600 switches.

EX4600 switches support third-party DAC cables starting with the Junos OS 13.2X51-D25 release. We highly recommend using Juniper Network DAC cables. If you choose to use a third-party cable, it should meet the specifications described in Table 33 on page 84 and Table 34 on page 86.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

The cables are hot-removable and hot-insertable. A cable consists of a cable assembly that connects directly into two SFP+ 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 10 Gbps. There are two types of DAC cables:

- Passive DAC cables have no signal amplification built into the cable assembly. The Hardware Compatibility Tool and Table 33 on page 84 describe the passive DAC cable specifications.
- Active DAC cables have signal amplification and equalization built into the cable assembly. The Hardware Compatibility Tool and Table 34 on page 86 describe the active DAC cable specifications.

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Table 33: SFP+ Passive Direct Attach Copper Cable Specifications

Product Number	Specifications	
QFX-SFP-DAC-1M	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	1% maximum
	Time delay	4.3 nsec/m
	Length	1 m (3.3 ft)
QFX-SFP-DAC-3M	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	1% maximum
	Time delay	4.3 nsec/m
	Length	3 m (9.9 ft)

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Table 33: SFP+ Passive Direct Attach Copper Cable Specifications *(continued)*

Product Number	Specifications	
QFX-SFP-DAC-5M	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	24 AWG
	Minimum cable bend radius	1.25 in. (3.2 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Time delay	4.3 nsec/m
	Length	5 m (16.4 ft)

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Table 34: SFP+ Active Direct Attach Copper Cable Specifications

Product Number	Specifications	
QFX-SFP-DAC-1MA	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.627 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Length	1 m (3.3 ft)
QFX-SFP-DAC-3MA	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.627 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Length	3 m (9.9 ft)

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Table 34: SFP+ Active Direct Attach Copper Cable Specifications *(continued)*

Product Number	Specifications	
QFX-SFP-DAC-5MA	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.627 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Length	5 m (16.4 ft)
QFX-SFP-DAC-7MA	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.627 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Length	7 m (23 ft)

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Table 34: SFP+ Active Direct Attach Copper Cable Specifications *(continued)*

Product Number	Specifications	
QFX-SFP-DAC-10MA	Rate	10-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.627 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	28 AWG
	Minimum cable bend radius	2 in. (5 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2% maximum
	Length	10 m (32.8 ft)

Related Documentation

- Interface Support for an EX4600 Switch on page 53
- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch on page 94
- Installing a Transceiver in a Switch on page 155
- Removing a Transceiver from a Switch on page 157

Interface Specifications for SFP+ Active Optical Cables for the EX4600

An active optical cable (AOC) is a fiber assembly that has the transceivers permanently attached. Juniper Networks provides AOC solutions for both 10-GbE and 40-GbE.

Use the Hardware Compatibility Tool and Table 35 on page 89 to locate the specifications for 10-GbE AOC and Table 36 on page 89 for 40-GbE AOC.

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Table 35: SFP+ Active Optical Cables

Characteristic	Value	
Standards compliance	SFF-8431 SFF-8432 SFF-8472	
Product SKU number	JNP-10G-AOC-xx	
Signaling rate, each lane (range)	10.3125 GBd +/-100 ppm	
Operating range	JNP-10G-AOC-1M	1 m (3.3 ft.)
	JNP-10G-AOC-3M	3 m (9.8 ft.)
	JNP-10G-AOC-5M	5 m (16.4 ft.)
	JNP-10G-AOC-7M	7 m (22.9 ft.)
	JNP-10G-AOC-10M	10 m (32.8 ft.)
	JNP-10G-AOC-15M	15 m (49.2 ft.)
	JNP-10G-AOC-20M	20 m (65.6 ft.)
	JNP-10G-AOC-30M	30 m (98.4 ft.)
Diagnostic support	Not supported	
Minimum Junos OS release	14.1X53-D35	

Table 36: QSFP+ Active Optical Cables

Characteristic	Value
Standards compliance	SFF-8431 SFF-8435 SFF-8436
Product SKU number	JNP-40G-AOC-xx
Signaling rate, each lane (range)	10.3125 GBd +/-100 ppm

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Table 36: QSFP+ Active Optical Cables *(continued)*

Characteristic	Value	
Operating range	JNP-40G-AOC-1M	1 m (3.3 ft.)
	JNP-40G-AOC-3M	3 m (9.84 ft.)
	JNP-40G-AOC-5M	5 m (16.4 ft.)
	JNP-40G-AOC-7M	7 m (22.9 ft.)
	JNP-40G-AOC-10M	10 m (32.8 ft.)
	JNP-40G-AOC-15M	15 m (49.2 ft.)
	JNP-40G-AOC-20M	20 m (65.6 ft.)
	JNP-40G-AOC-30M	30 m (98.4 ft.)
Diagnostic support	Laser bias current—supported RX input power—supported Case temperature—supported Power supply voltage—supported Laser output power—not supported	
Minimum Junos OS release	14.1X53-D35	

Related Documentation

- Interface Support for an EX4600 Switch on page 53

Interface Specifications for QSFP+ to SFP+ Active Optical Breakout Cables for the EX4600

A 40-GbE active optical breakout cable (AOCBO) is a four-fiber assembly that has an QSFP+ transceiver permanently attached to one end and has four SFP+ transceivers attached to the individual fibers at the other end.

Use Table 37 on page 91 to locate the specifications for 40-GbE AOCBO.

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Table 37: QSFP+ to SFP+ Active Optical Breakout Cables

Characteristic	Value	
Standards compliance	SFF-8431 SFF-8432 SFF-8436 SFF-8472	
Product SKU number	JNP-QSFP-AOCBO-xx	
Operating range	JNP-QSFP-AOCBO-1M	1 m (3.3 ft.)
	JNP-QSFP-AOCBO-3M	3 m (9.84 ft.)
	JNP-QSFP-AOCBO-5M	5 m (16.4 ft.)
	JNP-QSFP-AOCBO-7M	7 m (22.9 ft.)
	JNP-QSFP-AOCBO-10M	10 m (32.8 ft.)
Diagnostic support	SFP+ end module: Not supported QSFP+ end module: Only case temperature and power supply voltage supported	
Minimum Junos OS release	14.1X53-D40	

Related Documentation

- Interface Support for an EX4600 Switch on page 53

Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch

Quad small form-factor pluggable plus (QSFP+) transceiver to four small form-factor pluggable plus (SFP+) direct-attach copper (DAC) breakout cables are suitable for in-rack connections between servers and EX4600 switches.

You can use breakout cables purchased from a third party. These cables should meet the specifications described in Table 38 on page 92. The minimum Junos OS release for breakout cable support for EX4600 switches is Junos OS 13.2X51-D25.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

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The cables are hot-removable and hot-insertable. A breakout cable consists of a QSFP+ transceiver on one end and four SFP+ transceivers on the other end. The QSFP+ transceiver connects directly into the QSFP+ access port on the QFX Series device. The cables use high-performance integrated duplex serial data links for bidirectional communication on four links simultaneously. The SFP+ links are designed for data rates up to 10 Gbps each. Passive breakout cables have no signal amplification built into the cable assembly. There are two types of DAC cables:

- Passive DAC cables have no signal amplification built into the cable assembly. The Hardware Compatibility Tool and Table 38 on page 92 describe the passive QSFP+ DAC breakout cable specifications.
- Active DAC cables have signal amplification and equalization built into the cable assembly. The Hardware Compatibility Tool and Table 39 on page 93 describes the passive QSFP+ DAC breakout cable specifications.

Table 38: QSFP+ DAC Passive Breakout Cable Specifications

Product SKU	Specifications	
QFX-QSFP-DACBO-1M	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Time delay	4.3 nsec/m
	Length	1 m (3.3 ft)

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Table 38: QSFP+ DAC Passive Breakout Cable Specifications *(continued)*

Product SKU	Specifications	
QFX-QSFP-DACBO-3M	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Time delay	4.3 nsec/m
	Length	3 m (9.9 ft)

Table 39: QSFP+ Active DAC Breakout Cable Specifications

Product SKU	Specifications	
JNP-QSFP-DACBO-5MA	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	0.3 in. (0.762 cm)
	Cable characteristic impedance	100 ohms
	Time delay	4.5 nsec/m
	Length	5 m (16.4 ft)

Related Documentation

- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58

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- Interface Specifications for SFP+ DAC Cables for the EX4600 Switch on page 83
- Interface Support for an EX4600 Switch on page 53
- Installing a Transceiver in a Switch on page 155
- Removing a Transceiver from a Switch on page 157

Interface Specifications for QSFP+ DAC Cables for the EX4600 Switch

Quad small form-factor pluggable plus (QSFP+) direct-attach copper (DAC) cables are suitable for connections between EX4600 switches operating as a standalone switch. The QSFP+ DAC cables consist of a cable assembly terminated with QSFP+ transceivers on either end

You may use third-party DAC cables on the EX4600 switch. The minimum Junos OS software release for third-party DAC cable support is Junos OS 13.2X51-D25. We highly recommend using Juniper Networks DAC cables. If you choose to use a third-party able, it should meet the specifications described in Table 40 on page 95 and Table 41 on page 97.

CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

The cables are hot-removable and hot-insertable. A cable consists of a cable assembly that connects directly into two QSFP+ 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 40 Gbps.

Passive DAC cables have no signal amplification built into the cable assembly. The Hardware Compatibility Tool and Table 40 on page 95 describe the passive DAC cable specifications for QSFP+.

Active DAC cables have signal amplification and equalization built into the cable assembly. The Hardware Compatibility Tool and Table 41 on page 97 describes the active DAC cable specifications.

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Table 40: Interface Specifications for Passive Copper QSFP+ DAC Cables

Product Number	Specifications	
QFX-QSFP-DAC-1M	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	1% maximum
	Time delay	4.3 nsec/m
	Length	1 m (3.3 ft)
QFX-QSFP-DAC-3M	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	1% maximum
	Time delay	4.3 nsec/m
	Length	3 m (9.9 ft)

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Table 40: Interface Specifications for Passive Copper QSFP+ DAC Cables *(continued)*

Product Number	Specifications	
JNP-QSFP-DAC-5M	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption (per end)	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	26 AWG
	Minimum cable bend radius	1 in. (2.54 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	1% maximum
	Time delay	4.3 nsec/m
	Length	5 m (16.4 ft)

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Table 41: Interface Specifications for Active Copper QSFP+ DAC Cables

Product Number	Specifications	
JNP-QSFP-DAC-5MA	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	0.3 in. (0.762 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2 % maximum
	Time delay	4.3 nsec/m
	Length	5 m (16.4 ft)
JNP-QSFP-DAC-7MA	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption	0.015 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	30 AWG
	Minimum cable bend radius	0.3 in. (0.762 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2 % maximum
	Time delay	4.3 nsec/m
	Length	7 m (22.9 ft)

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Table 41: Interface Specifications for Active Copper QSFP+ DAC Cables *(continued)*

Product Number	Specifications	
JNP-QSFP-DAC-10MA	Rate	40-Gbps full-duplex serial transmission
	Connector type	None. SFPs are permanently attached.
	Supply voltage	3.3 V
	Power consumption	0.058 W
	Storage temperature	–40° C to 85° C
	Cable type	Twinax
	Wire AWG	28 AWG
	Minimum cable bend radius	0.3 in. (0.762 cm)
	Cable characteristic impedance	100 ohms
	Crosstalk between pairs	2 % maximum
	Time delay	4.3 nsec/m
	Length	10 m (32.8 ft)

Related Documentation

- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for QSFP+ DAC Breakout Cables for the EX4600 Switch on page 91
- Installing a Transceiver in a Switch on page 155
- Removing a Transceiver from a Switch on page 157

Cable Specifications for QSFP+ Transceivers on EX Series Switches

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

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

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

Table 42 on page 99 describes the signals on each fiber. Table 43 on page 99 shows the pin-to-pin connections for proper polarity.

Table 42: QSFP+ MPO Cable Signals

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

Table 43: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

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

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Table 43: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts *(continued)*

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

Related Documentation

- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Network Cable Specifications for EX4600 Switches on page 100

Network Cable Specifications for EX4600 Switches

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

Table 44 on page 100 lists the specifications for the cables that connect the console (**CON**) and management (**MGMT**) ports to management devices.

NOTE: The EX4600 can be configured with SFP management ports that support 1000BASE-SX transceivers. See "Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch" on page 58 for more information about the fiber-optic cables required for use with these transceivers.

Table 44: Cable Specifications for Switch-to-Management-Device Connections

Ports on EX4600 Switches	Cable Specification	Cable/Wire Supplied	Maximum Length	Switch Receptacle	Additional Information
RJ-45 Console (**CON**) port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter) length RJ-45 patch cable and RJ-45 to DB-9 adapter	7 ft (2.13 m)	RJ-45	"Connecting a Switch to a Management Console by Using an RJ-45 Connector" on page 130

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Table 44: Cable Specifications for Switch-to-Management-Device Connections *(continued)*

Ports on EX4600 Switches	Cable Specification	Cable/Wire Supplied	Maximum Length	Switch Receptacle	Additional Information
Management (**MGMT**) Ethernet port (10/100/1000)	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter) length RJ-45 patch cable	328 feet (100 meters)	RJ-45	*Connecting a Switch to a Network for Out-of-Band Management*

Related Documentation

- *Management Port Connector Pinouts for an EX4600 Switch*
- Console Port Connector Pinout Information for an EX Series Switch on page 105
- EX4600 Switch Hardware Overview on page 3

Cable Specifications for Console and Management Connections for the EX4600

Table 45 on page 101 lists the specifications for the cables that connect the QFX Series to a management device.

NOTE: The QFX Series can be configured with SFP management ports that support 1000BASE-SX transceivers. See "Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch" on page 58 for more information about the fiber-optic cables required for use with these transceivers.

Table 45: Cable Specifications for Console and Management Connections for the QFX Series

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

Related Documentation

- Console Port Connector Pinout Information for an EX Series Switch on page 105
- Connecting an EX4600 Switch to a Network for Out-of-Band Management on page 129

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Understanding EX Series Switches Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

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

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 102
- Attenuation and Dispersion in Fiber-Optic Cable on page 102

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

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

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

Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission. For information about the maximum transmission distance and supported wavelength range for the types of single-mode and multimode fiber-optic cables that are used on different EX Series switches see *Pluggable Transceivers Supported on EX Series Switches*.

Attenuation and Dispersion in Fiber-Optic Cable

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

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

- Chromatic dispersion, which is the spreading of the signal over time caused by the different speeds of light rays.

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- Modal dispersion, which is the spreading of the signal over time caused by the different propagation modes in the fiber.

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

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

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

Related Documentation

- Calculating the EX Series Switch Fiber-Optic Cable Power Budget on page 49
- Calculating the EX Series Switch Fiber-Optic Cable Power Margin on page 50

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CHAPTER 8

Pinout Specifications

- Console Port Connector Pinout Information for an EX Series Switch on page 105
- USB Port Specifications for an EX Series Switch on page 106

Console Port Connector Pinout Information for an EX Series Switch

The console port on an EX Series switch 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 46 on page 105 provides the pinout information for the RJ-45 console connector. An Ethernet cable that has an RJ-45 connector at either end and an RJ-45 to DB-9 serial port adapter are supplied with the switch.

NOTE: If your laptop or PC does not have a DB-9 male connector pin and you want to connect your laptop or PC directly to an EX Series switch, use a combination of the RJ-45 to DB-9 female adapter supplied with the switch and a USB to DB-9 male adapter. You must provide the USB to DB-9 male adapter.

Table 46: EX Series Switches Console Port Connector Pinout Information

Pin	Signal	Description
1	RTS Output	Request to send
2	DTR Output	Data terminal ready
3	TxD Output	Transmit data
4	Signal Ground	Signal ground
5	Signal Ground	Signal ground
6	RxD Input	Receive data
7	CD Input	Data carrier detect

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Table 46: EX Series Switches Console Port Connector Pinout Information *(continued)*

Pin	Signal	Description
8	CTS Input	Clear to send

Related Documentation

- *EX2200 Switches Hardware Overview*
- *EX2300 Switches Hardware Overview*
- *Rear Panel of an EX3200 Switch*
- *Rear Panel of an EX3300 Switch*
- *Rear Panel of an EX3400 Switch*
- *Rear Panel of an EX4200 Switch*
- *EX4300 Switches Hardware Overview*
- *Front Panel of an EX4500 Switch*
- *EX4550 Switches Hardware Overview*
- Management Panel of an EX4600 Switch on page 8
- *Switch Fabric and Routing Engine (SRE) Module in an EX6200 Switch*
- *Switch Fabric and Routing Engine (SRE) Module in an EX8208 Switch*
- *Routing Engine (RE) Module in an EX8216 Switch*
- Connecting a Switch to a Management Console by Using an RJ-45 Connector on page 130
- *Configuring the Console Port Type (CLI Procedure)*

USB Port Specifications for an EX Series Switch

The following Juniper Networks USB flash drives have been tested and are officially supported for the USB port on all EX Series switches:

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

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

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

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

Related Documentation

- *EX2200 Switches Hardware Overview*
- *EX2300 Switches Hardware Overview*
- *Rear Panel of an EX3200 Switch*
- *Rear Panel of an EX3300 Switch*
- *Rear Panel of an EX3400 Switch*
- *Rear Panel of an EX4200 Switch*
- *EX4300 Switches Hardware Overview*
- *Front Panel of an EX4500 Switch*
- Management Panel of an EX4600 Switch on page 8
- *EX4550 Switches Hardware Overview*
- *Switch Fabric and Routing Engine (SRE) Module in an EX6200 Switch*
- *Switch Fabric and Routing Engine (SRE) Module in an EX8208 Switch*
- *Routing Engine (RE) Module in an EX8216 Switch*
- *Routing Engine Module in an EX9200 Switch*
- *Booting an EX Series Switch Using a Software Package Stored on a USB Flash Drive*

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PART 3

Initial Installation and Configuration

- Unpacking the Switch on page 111
- Installing the Switch on page 113
- Connecting the Switch to Power on page 119
- Connecting the Switch to the Network on page 129
- Performing Initial Configuration on page 135

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CHAPTER 9

Unpacking the Switch

- Unpacking an EX4600 Switch on page 111

Unpacking an EX4600 Switch

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

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

To unpack a EX4600 switch:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.
2. Position the carton so that the arrows are pointing up.
3. Open the top flaps on the shipping carton.
4. Remove the accessory box and verify the contents against the inventory included in the box. Table 47 on page 111 lists the inventory of components supplied with a EX4600 switch.
5. Pull out the packing material holding the switch in place.
6. Verify the chassis components received:
   - Two power supplies
   - Five fan modules
7. Save the shipping carton and packing materials in case you need to move or ship the switch later.

Table 47: Inventory of Components Supplied with an EX4600 Switch

Component	Quantity
Chassis with five fan modules and two power supplies.	1

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Table 47: Inventory of Components Supplied with an EX4600 Switch *(continued)*

Component	Quantity
Rear mounting blades	2
Front mounting brackets	2
Extension brackets	2
RJ-45 cable and RJ-45 to DB-9 adapter	1
Power cords	2

Related Documentation

- Mounting an EX4600 Switch in a Rack or Cabinet on page 114
- Installing and Connecting an EX4600 Switch on page 113

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CHAPTER 10

Installing the Switch

- Installing and Connecting an EX4600 Switch on page 113
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114
- Installing and Removing EX4600 Switch Hardware Components on page 117

Installing and Connecting an EX4600 Switch

You can mount an EX4600 switch:

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

To install and connect an EX4600 switch:

1. Follow the instructions in "Unpacking an EX4600 Switch" on page 111.
2. Determine how the switch is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see "Mounting an EX4600 Switch in a Rack or Cabinet" on page 114.
3. Follow the instructions in:
   a. Connecting Earth Ground to an EX4600 Switch on page 120
   b. "Connecting DC Power to an EX4600 Switch" on page 123 or Connecting AC Power to an EX4600 Switch on page 121
   c. *Registering Products—Mandatory for Validating SLAs*
   d. Configuring an EX4600 Switch on page 135

Related Documentation

- Rack Requirements for an EX4600 Switch on page 42
- Cabinet Requirements for an EX4600 Switch on page 43
- Clearance Requirements for Airflow and Hardware Maintenance for an EX4600 Switch on page 44

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Mounting an EX4600 Switch in a Rack or Cabinet

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

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

(The remainder of this topic uses “rack” to mean “rack or cabinet.”) The front and rear rack rails must be spaced between 28 in. (71.1 cm) and 36 in. (91.4 cm) front to back.

This topic describes:

- Before You Begin Rack Installation on page 114
- Four Post Procedure on page 115

Before You Begin Rack Installation

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

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See “Prevention of Electrostatic Discharge Damage” on page 215.
2. Verify that the site meets the requirements described in “Site Preparation Checklist for an EX4600 Switch” on page 35.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read “General Site Guidelines” on page 40, with particular attention to “Chassis Lifting Guidelines for an EX4600 Switch” on page 191.
5. Remove the switch from the shipping carton (see “Unpacking an EX4600 Switch” on page 111).
6. Ensure that you have the following parts and tools available to mount the switch in a rack:
   - ESD grounding strap (not provided).
   - Blades, rails, or brackets (provided).
     - For four-post installations:
       - One pair of rear mounting blades. These mounting blades support the rear of the chassis and must be installed (provided).
       - One pair of front mounting rails. The mounting blades slide into the mounting rails to support the switch (provided).

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    - Twelve screws to secure the mounting rails to the chassis (provided).
    - Eight screws to secure the chassis and rear installation blades to the rack (not provided).
- Appropriate screwdriver for the mounting screws (not provided).
- Two power cords with plugs appropriate to your geographical location (provided).
- RJ-45 cable and RJ-45 to DB-9 serial port adapter (provided).
- Management host, such as a PC laptop, with a serial port (not provided).

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

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

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

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

Four Post Procedure

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

1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.
2. Decide whether the Field Replaceable Unit (FRU) end of the switch or the port end is to be placed at the front of the rack. Position the switch in such a manner that the **AIR IN** labels on components are next to the cold aisle and **AIR OUT** labels on components are next to the hot aisle.
3. Align the holes in the mounting rail with the holes on the side of the chassis. See Figure 25 on page 116 to see the proper alignment for the EX4600 switch.

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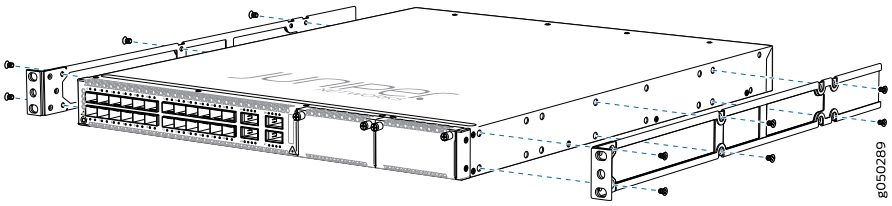
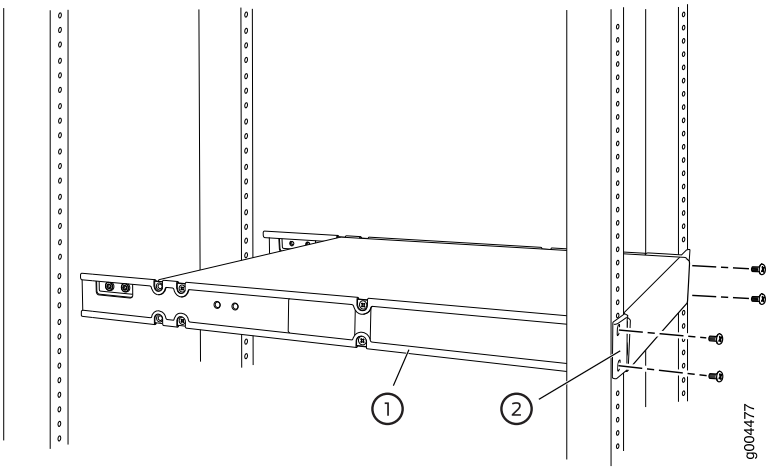
Figure 25: Attaching Mounting Rails to the EX4600



4. Attach the mounting rail to the switch using the mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.
5. Repeats steps 4 and 5 on the opposite side of the switch.
6. Have one person grasp both sides of the switch, lift it, and position it in the rack so that the front bracket is aligned with the rack holes.
7. Have a second person secure the front of the switch to the rack using four mounting screws (and cage nuts and washers if your rack requires them.) Tighten the screws. See Figure 26 on page 116 for examples of connecting the mounting rails and blades.

Figure 26: Attach EX4600 Switch to Rack



1—Mounting rail	2—Front bracket

8. Continue to support the switch while sliding the rear mounting-blades into the channel of the side mounting-rails and securing the blades to the rack. Use the four mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. Tighten the screws. See Figure 27 on page 117.

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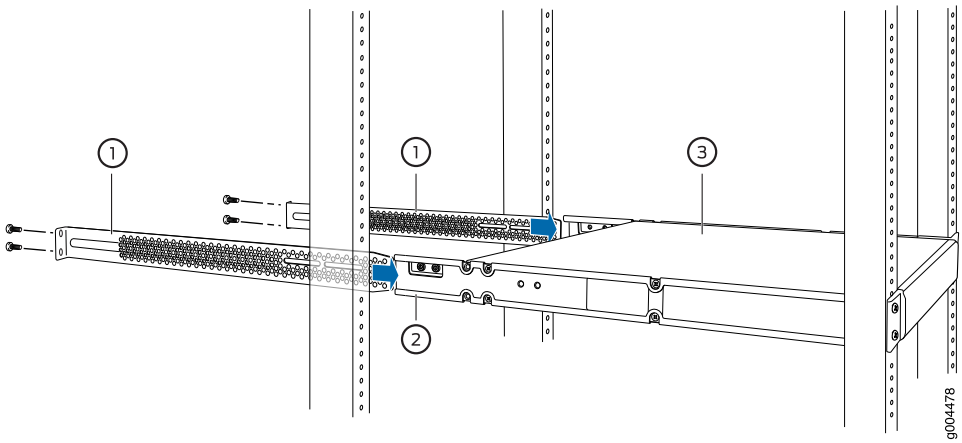
Figure 27: Slide Mounting Blade into EX4600 Mounting Rail



1—Mounting blade	3—EX4600 switch
2—Mounting rail	

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

Related Documentation

- Rack-Mounting and Cabinet-Mounting Warnings on page 194
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting Earth Ground to an EX4600 Switch on page 120

Installing and Removing EX4600 Switch Hardware Components

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

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

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

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

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To install a power supply in a EX4600 switch, follow the instructions in "Installing a Power Supply in an EX4600 Switch" on page 147. To remove a power supply from a EX4600 switch, follow the instructions in "Removing a Power Supply from an EX4600 Switch" on page 148.

To install a fan module in a EX4600 switch, follow the instructions in "Installing a Fan Module in an EX4600 Switch" on page 143. To remove a fan module from a EX4600 switch, follow the instructions in "Removing a Fan Module from an EX4600 Switch" on page 144.

To install an SFP+ or QSFP+ transceiver in an EX4600 switch, follow the instructions in "Installing a Transceiver in a Switch" on page 155. To remove an SFP+ or QSFP+ transceiver from an EX4600 switch, follow the instructions in "Removing a Transceiver from a Switch" on page 157.

To connect a fiber-optic cable to an SFP+ or QSFP+ transceiver in an EX4600 switch, follow the instructions in "Connecting a Fiber-Optic Cable to a Switch" on page 161. To disconnect a fiber-optic cable from an SFP+ or QSFP+ transceiver from an EX4600 switch, follow the instructions in "Disconnecting a Fiber-Optic Cable from a Switch" on page 162.

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- Cooling System and Airflow in an EX4600 Switch on page 21
- Management Panel of an EX4600 Switch on page 8
- Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch on page 58
- Interface Specifications for SFP+ DAC Cables for the EX4600 Switch on page 83

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CHAPTER 11

Connecting the Switch to Power

- Connecting Earth Ground to an EX4600 Switch on page 120
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123

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Connecting Earth Ground to an EX4600 Switch

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the EX4600 switch to earth ground before you connect it to power.

For installations that require a separate grounding conductor to the chassis, you must attach a protective earthing terminal bracket on the EX4600 switch left front mounting bracket to connect to the earth ground (see Figure 28 on page 121).

Before you connect earth ground to the protective earthing terminal of a EX4600 switch, ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable.

CAUTION: **Using a grounding cable with an incorrectly attached lug can damage the switch.**

NOTE: **Mount your switch in the rack or cabinet before attaching the grounding lug to the switch. See** "Mounting an EX4600 Switch in a Rack or Cabinet" on page 114.

Ensure that you have the following parts and tools available:

- Protective earthing terminal bracket—This bracket attaches to the EX4600 switch chassis through the left front mounting bracket, providing a protective earthing terminal for the switch.
- Grounding cable for your EX4600 switch—The grounding cable must be 14 AWG (2 mm^2), 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 SAE 10-32 washers and screws—To attach the grounding lug to the protective earthing terminal.
- Screwdriver to attach the screws.

An AC-powered EX4600 switch chassis gains additional grounding when you plug the power supply in the switch into a grounded AC power outlet by using an AC power cord appropriate for your geographical location. See "AC Power Cord Specifications for an EX4600 Switch" on page 48.

To connect earth ground to a EX4600 switch:

1. Attach one end of the grounding cable to an appropriate earth ground site, such as the mounting rack.
2. Position the grounding lug over the protective earthing terminal on the side of the

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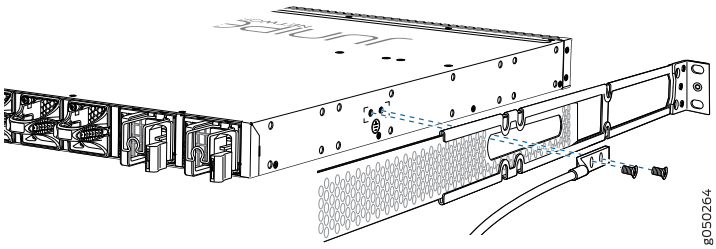
chassis, which is visible through the mounting bracket.

3. Secure the grounding lug to the protective earthing terminal with the washers and screws. See Figure 28 on page 121.

Figure 28: Connecting a Grounding Cable to an EX4600 Switch



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

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Grounded Equipment Warning on page 199
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123

Connecting AC Power to an EX4600 Switch

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

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 215).
- 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

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before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the switch chassis to connect to the earth ground. For instructions on connecting earth ground, see "Connecting Earth Ground to an EX4600 Switch" on page 120. 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 (see "AC Power Supply in an EX4600 Switch" on page 27).

- Install the power supply in the chassis. For instructions on installing a power supply in an EX4600 switch, see "Installing a Power Supply in an EX4600 Switch" on page 147.

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

To connect AC power to an EX4600 switch:

1. Attach the grounding strap to your bare wrist and to a site ESD point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure. If only one power supply is installed, ensure a that blank cover panel is installed over the second power supply slot.
3. Locate the power cord or cords shipped with the switch; the cords have plugs appropriate for your geographical location. See "AC Power Cord Specifications for an EX4600 Switch" on page 48.

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 29 on page 123).

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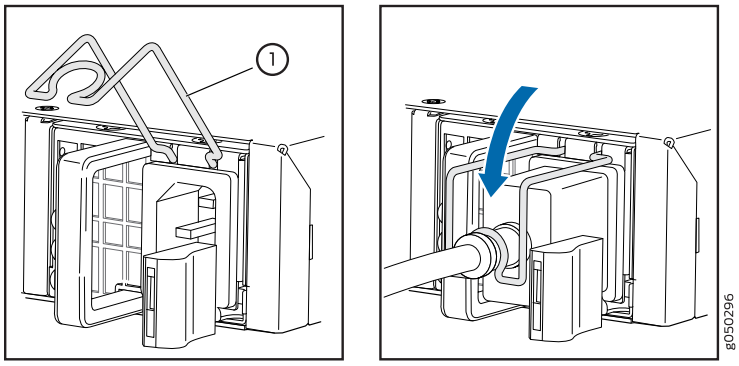
Figure 29: Connecting an AC Power Cord to an AC Power Supply in an EX4600 Switch



1— Power cord retainer	

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

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

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

   If the amber fault LED is lit, remove power from the power supply, and replace the power supply (see"Removing a Power Supply from an EX4600 Switch" on page 148). Do not remove the power supply until you have a replacement power supply ready: the power supplies or a blank cover panel must be installed in the switch to ensure proper airflow.

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

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- AC Power Supply LEDs on an EX4600 Switch on page 29

Connecting DC Power to an EX4600 Switch

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

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

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

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 215).
- 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 EX4600 Switch" on page 120.

- Install the power supply in the chassis. For instructions on installing a power supply in an EX4600 switch, see "Installing a Power Supply in an EX4600 Switch" on page 147.

Ensure that you have the following parts and tools available:

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

To connect DC power to an EX4600 switch:

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

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- 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. 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 225 and "DC Power Electrical Safety Guidelines" on page 220.

4. Ensure that the power supplies are fully inserted in the chassis.
5. 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 30 on page 126).
6. 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.

7. 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 30 on page 126 and Figure 31 on page 127).

   The EX4600 is designed to operate with a DC power supply that has a single, non-redundant, feed input. For source redundancy, two DC power supplies must be installed in EX4600; connect source (A) to one power supply and connect source (B) to the second power supply. This configuration provides the commonly deployed A/B feed redundancy for the system.

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

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

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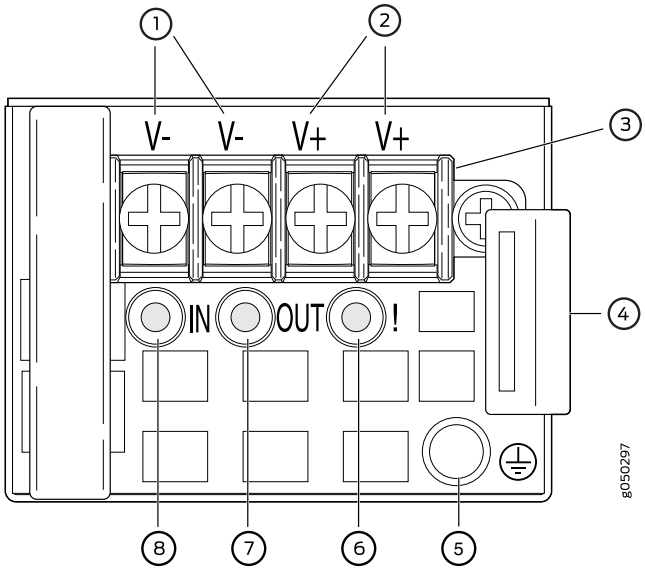
Do not connect two sources to a single power supply because doing so can potentially cause circulating current in feed wires whenever there is any difference in the voltage of the two sources.

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 30: DC Power Supply Faceplate for an EX4600 Switch



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.

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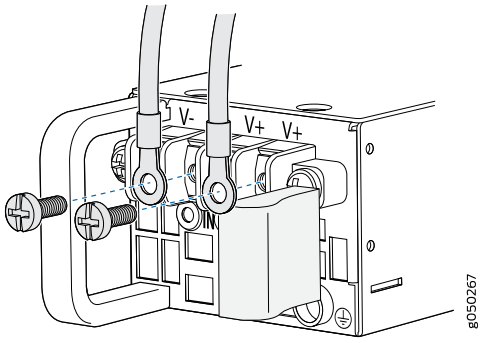
Figure 31: Securing Ring Lugs to the Terminals on the EX4600 DC Power Supply



8. Replace the terminal block cover.
9. 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.

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

Related Documentation

- DC Power Supply in an EX4600 Switch on page 30
- DC Power Supply LEDs on an EX4600 Switch on page 31

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CHAPTER 12

Connecting the Switch to the Network

- Connecting an EX4600 Switch to a Network for Out-of-Band Management on page 129
- Connecting a Switch to a Management Console by Using an RJ-45 Connector on page 130
- Connecting EX4600 Switches in a Virtual Chassis on page 132

Connecting an EX4600 Switch to a Network for Out-of-Band Management

You can monitor and manage the EX4600 device using a dedicated management channel. EX4600 devices have two management ports: a 10/100/1000BASE-T RJ-45 port and a 1-Gbps SFP ports. Use the management ports to connect the EX4600 switch to a network for out-of-band management.

CAUTION: Configuring the two management interfaces within the same subnet is not supported.

NOTE: You cannot use the management ports to perform the initial configuration of the EX4600 switch. You must configure the management ports before you can successfully connect to the EX4600 switch using these ports. See "Configuring an EX4600 Switch" on page 135.

Ensure that you have an appropriate cable available. See "Cable Specifications for Console and Management Connections for the EX4600" on page 101 and "Interface Specifications for SFP, SFP+, and QSFP+ Transceivers for the EX4600 Switch" on page 58

To connect a EX4600 switch to a network for out-of-band management (see Figure 32 on page 130):

1. Connect one end of the cable to one of the management ports (labeled **C0** and **C1**) on the EX4600 switch.
2. Connect the other end of the cable to the management switch (see Figure 32 on page 130).

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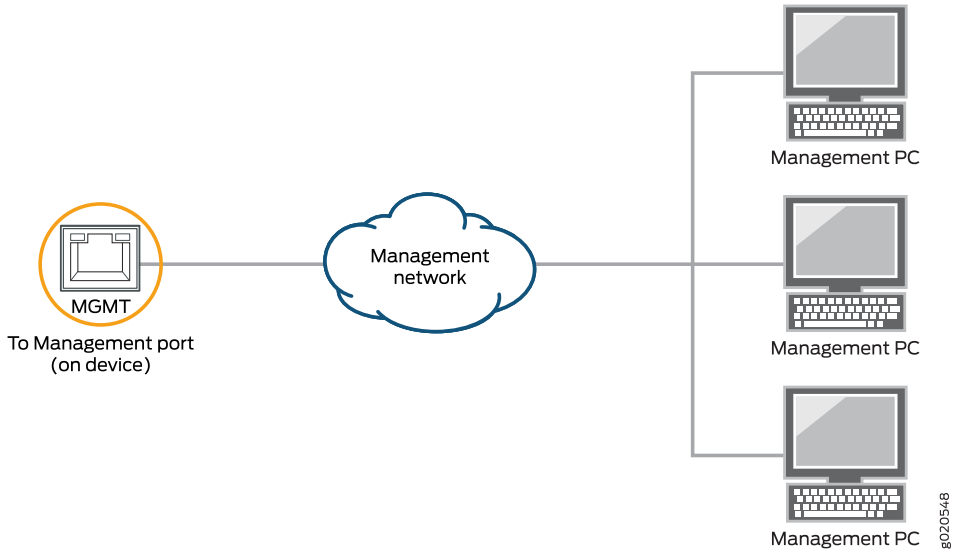
Figure 32: Connecting an EX4600 Switch to a Network for Out-of-Band Management



Related Documentation

- Management Panel of an EX4600 Switch on page 8
- Network Cable Specifications for EX4600 Switches on page 100
- Connecting a Switch to a Management Console by Using an RJ-45 Connector on page 130

Connecting a Switch to a Management Console by Using an RJ-45 Connector

This topic applies to multiple hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

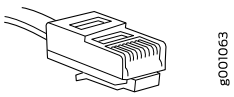
This topic also applies to hardware devices in the QFX series, OCX1100 switches, and to NFX250 devices.

You can configure and manage these devices by using a dedicated management channel. Every device has a console port to which you can connect 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.

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end. One such cable and an RJ-45 to DB-9 serial port adapter are supplied with the device.

Figure 33 on page 130 shows the RJ-45 connector of the Ethernet cable supplied with the device.

Figure 33: RJ-45 Connector on an Ethernet Cable



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

To connect the device to a management console (see Figure 34 on page 132 and Figure 35 on page 132):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**, **CONSOLE**, or **CON1**) on the device.

   For the location of the console port on different devices:

   - See *EX2200 Switches Hardware Overview*.
   - See *Rear Panel of an EX3200 Switch*.
   - See *Rear Panel of an EX3300 Switch*.
   - See *Rear Panel of an EX4200 Switch*.
   - See *EX4300 Switches Hardware Overview*
   - See *Front Panel of an EX4500 Switch*.
   - See *EX4550 Switches Hardware Overview*
   - See *Switch Fabric and Routing Engine (SRE) Module in an EX6200 Switch*.
   - See *Switch Fabric and Routing Engine (SRE) Module in an EX8208 Switch*.
   - See *Routing Engine (RE) Module in an EX8216 Switch*.
   - See *Front Panel of an XRE200 External Routing Engine*.
   - See "Management Panel of an EX4600 Switch" on page 8
   - *OCX1100 Switches Hardware Overview*
2. Connect the other end of the Ethernet cable to the console server (see Figure 34 on page 132) or management console (see Figure 35 on page 132).

To configure the device from the management console, see *Connecting and Configuring an EX Series Switch (CLI Procedure)* or *Connecting and Configuring an EX Series Switch (J-Web Procedure)* or *Connecting and Configuring an OCX1100 Switch (CLI Procedure)*.

NOTE: EX2200-24T-4G-DC switches do not support switch connection and configuration through the J-Web interface.

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Figure 34: Connecting a Switch to a Management Console Through a Console Server

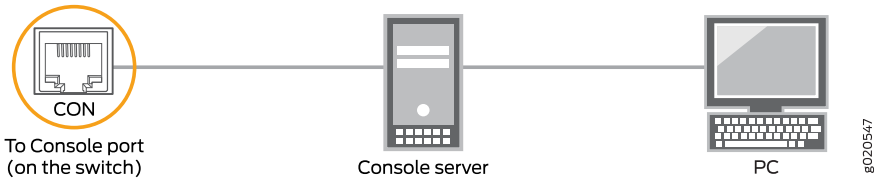

Figure 35: Connecting a Switch Directly to a Management Console

Related Documentation

- *Configuring the Console Port Type (CLI Procedure)*
- *Connecting a Switch to a Network for Out-of-Band Management*
- Console Port Connector Pinout Information for an EX Series Switch on page 105
- *Cables Connecting the EX6200 Switch to Management Devices*
- *Cables Connecting the EX8200 Switch to Management Devices*
- *Console Port Connector Pinout Information for an OCX1100 Switch*

Connecting EX4600 Switches in a Virtual Chassis

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

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

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

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

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

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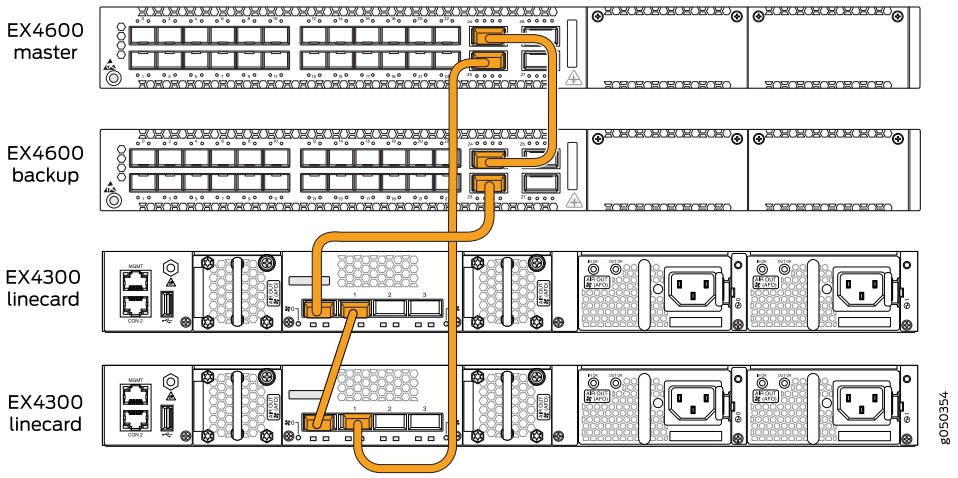
the Virtual Chassis. For Junos OS Release 14.1X53-D25 and later, the EX4600 is fully supported as the master in a mixed Virtual Chassis of EX4600 and EX4300. Ensure all members of the Virtual Chassis are running the same Junos OS Release by issuing the **show chassis version** CLI command.

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

Figure 36: Four Member Virtual Chassis with EX4600 Master and Backup



Related Documentation

- Port Panel of an EX4600 Switch on page 7

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CHAPTER 13

Performing Initial Configuration

- Configuring an EX4600 Switch on page 135

Configuring an EX4600 Switch

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

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

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

To connect and configure the switch from the console:

1. Connect the console port to a laptop or PC using the supplied RJ-45 cable and RJ-45 to DB-9 adapter. The console (**CON**) port is located on the management panel of the switch.
2. Log in as **root**. There is no password. If the software booted before you connected to the console port, you might need to press the Enter key for the prompt to appear.

   ```
   login: root
   ```
3. Start the CLI.

   ```
   root@% cli
   ```
4. Enter configuration mode.

   ```
   root> configure
   ```
5. Add a password to the root administration user account.

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

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

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

7. Configure the default gateway.

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

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

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

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

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

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

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

10. Enable telnet service.

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

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

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

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

Related Documentation

- Installing and Connecting an EX4600 Switch on page 113

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PART 4

Installing, Maintaining, and Replacing Components

- Removing the Switch on page 139
- Replacing Cooling System Component on page 143
- Replacing Power Supply on page 147
- Replacing Expansion Module on page 151
- Replacing Transceivers and Fiber-Optic Cables on page 155
- Maintaining and Replacing Fiber-Optic Cable on page 161
- Contacting Customer Support and Returning the Chassis or Components on page 165

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CHAPTER 14

Removing the Switch

- Powering Off an EX4600 Switch on page 139
- Removing an EX4600 Switch from a Rack or Cabinet on page 141

Powering Off an EX4600 Switch

Before you power off an EX4600 switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 215.
- Ensure that you do not need to forward traffic through the switch.

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

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

To power off an EX4600 switch:

1. Connect to the switch using one of the following methods:
   - Connect a management device to the console (**CON**) port on a EX4600 switch. For instructions about connecting a management device to the console (**CON**) port, see "Connecting a Switch to a Management Console by Using an RJ-45 Connector" on page 130.
   - You can shut down the EX4600 switch from a management device on your out-of-band management network. For instructions about connecting a management device to the management (**CO** or **C1**) port, see "Connecting an EX4600 Switch to a Network for Out-of-Band Management" on page 129.
2. Shut down Junos OS from the external management device by issuing the **request system halt** operational mode CLI command. This command shuts down the switch gracefully and preserves system state information. A message appears on the console, confirming that the operating system has halted.

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

```
Shutdown NOW!
System going down IMMEDIATELY


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

syncing disks... All buffers synced.
Uptime: 11h0m30s
Normal shutdown (no dump device defined)
unloading fpga driver
unloading fx-scpld
Powering system off using ACPI
kvm: 28646: cpu0 disabled perfctr wrmsr: 0xc1 data 0xabcd
pci-stub 0000:01:00.2: transaction is not cleared; proceeding with reset anyway
pci-stub 0000:01:00.1: transaction is not cleared; proceeding with reset anyway
hub 1-1:1.0: over-current change on port 1
Stopping crond: [  OK  ]
Stopping libvirtd daemon: [  OK  ]
Shutting down ntpd: [  OK  ]
Shutting down system logger: [  OK  ]
Shutting down sntpc: [  OK  ]
Stopping sshd: [  OK  ]
Stopping vehostd: [  OK  ]
Stopping watchdog: [  OK  ]
Stopping xinetd: [  OK  ]
Sending all processes the TERM signal... [  OK  ]
Sending all processes the KILL signal... [  OK  ]
Saving random seed:  [  OK  ]
Syncing hardware clock to system time [  OK  ]
Turning off swap:  [  OK  ]
Unmounting file systems:  [  OK  ]
init: Re-executing /sbin/init
Halting system...
System halted.
```

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

3. Attach the grounding strap to your bare wrist and to a site ESD point.

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

Related Documentation

- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123

Removing an EX4600 Switch from a Rack or Cabinet

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

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

Before removing an EX4600 switch from a rack:

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed EX4600 switch in its new location and along the path to the new location.
- Read “General Safety Guidelines and Warnings” on page 181.
- Ensure that the EX4600 switch has been safely powered off (see “Powering Off an EX4600 Switch” on page 139) and that you have unplugged (disconnected) the power cords.
- Ensure that you have disconnected any cables or wires attached to the EX4600 switch ports.

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Ensure that you have the following parts and tools available:

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

To remove a EX4600 switch from a rack or cabinet:

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

Related Documentation

- Mounting an EX4600 Switch in a Rack or Cabinet on page 114

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CHAPTER 15

Replacing Cooling System Component

- Installing a Fan Module in an EX4600 Switch on page 143
- Removing a Fan Module from an EX4600 Switch on page 144

Installing a Fan Module in an EX4600 Switch

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

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

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

Before you install a fan module in an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).

To install a fan module in an EX4600 switch (see Figure 37 on page 144):

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

CAUTION: Damage can occur if you attempt to install a fan module into a chassis with a different airflow direction. Compare the switch product SKU with the airflow marking on the handle to ensure that you are installing

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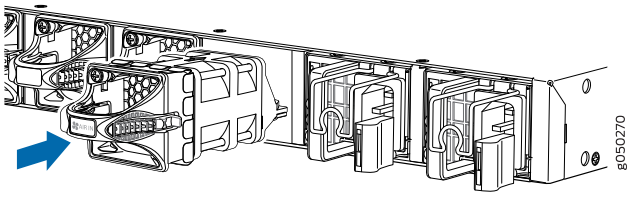
a fan module with the same airflow direction as the chassis. The fan modules are designed so that they can only be inserted into the EX4600 switch product SKU that supports the same airflow type. See "Cooling System and Airflow in an EX4600 Switch" on page 21 for more information.

4. Using a Phillips screwdriver, turn the locking screw until it is tight.

Figure 37: Installing a Fan Module in an EX4600 Switch



Related Documentation

- Removing a Fan Module from an EX4600 Switch on page 144
- Cooling System and Airflow in an EX4600 Switch on page 21
- Field-Replaceable Units in an EX4600 Switch on page 10
- Management Panel of an EX4600 Switch on page 8

Removing a Fan Module from an EX4600 Switch

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

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

Before you remove a fan module from an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).

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

- ESD grounding strap
- Antistatic bag or an antistatic mat

To remove a fan module from an EX4600 switch (see Figure 38 on page 145):

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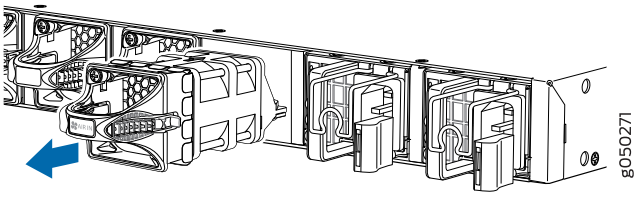
1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
3. Using a Phillips screwdriver, loosen the locking screw (3 or 4 turns).
4. Grasp the handle on the fan module and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

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

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

Figure 38: Removing a Fan Module from an EX4600 Switch



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

Related Documentation

- Cooling System and Airflow in an EX4600 Switch on page 21
- Field-Replaceable Units in an EX4600 Switch on page 10
- Management Panel of an EX4600 Switch on page 8
- Installing a Fan Module in an EX4600 Switch on page 143

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CHAPTER 16

Replacing Power Supply

- Installing a Power Supply in an EX4600 Switch on page 147
- Removing a Power Supply from an EX4600 Switch on page 148

Installing a Power Supply in an EX4600 Switch

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

- Before you install a power supply in an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).
- Ensure that the airflow direction of the power supply is the same as the chassis. Labels on the power supply handle indicate the direction of airflow. See "Cooling System and Airflow in an EX4600 Switch" on page 21 for more information.

To install a power supply in an EX4600 switch (see Figure 39 on page 148):

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

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

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

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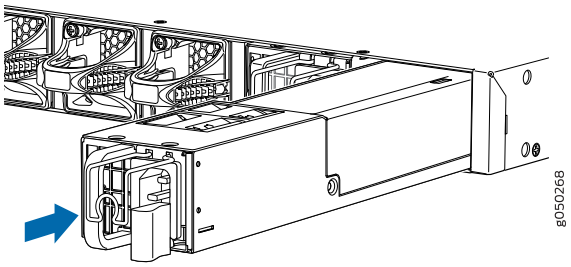
Figure 39: Installing a Power Supply in an EX4600 Switch



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

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

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

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

Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- Field-Replaceable Units in an EX4600 Switch on page 10
- Port Panel of an EX4600 Switch on page 7
- Management Panel of an EX4600 Switch on page 8
- AC Power Cord Specifications for an EX4600 Switch on page 48
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123
- Removing a Power Supply from an EX4600 Switch on page 148

Removing a Power Supply from an EX4600 Switch

The EX4600 is shipped from the factory with two power supplies. Each power supply is a hot-removable and hot-insertable field-replaceable unit (FRU) when the second power

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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.

Before you remove a power supply from an EX4600 switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).

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

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

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

To remove a power supply from an EX4600 switch (see Figure 40 on page 150):

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

NOTE: If only one power supply is installed in your EX4600 switch, you need to power off the switch before removing the power supply. See "Powering Off an EX4600 Switch" on page 139.

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 male 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 female end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.
5. Slide the locking lever toward the handle until it stops.

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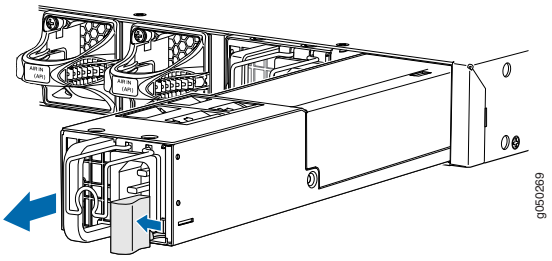
6. Grasp the power supply handle and pull firmly to slide the power supply halfway out of the chassis.
7. Place one hand under the power supply to support it and slide it completely out of the chassis. Take care not to touch power supply components, pins, leads, or solder connections.
8. Place the power supply in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

Figure 40: Removing a Power Supply from an EX4600 Switch



Related Documentation

- AC Power Supply in an EX4600 Switch on page 27
- Connecting AC Power to an EX4600 Switch on page 121
- Connecting DC Power to an EX4600 Switch on page 123
- Installing a Power Supply in an EX4600 Switch on page 147

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CHAPTER 17

Replacing Expansion Module

- Installing an Expansion Module in an EX4600 Switch on page 151
- Removing an Expansion Module from an EX4600 Switch on page 153

Installing an Expansion Module in an EX4600 Switch

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

- QFX-EM-4Q–Each module adds four Quad Enhanced Small Form-Factor Pluggable (QSFP+) ports
- EX4600-EM-8F–Each module adds eight 10 Gigabit RJ-45 ports

Both the QFX-EM-4Q and the EX4600-EM-8F are hot-removable and hot-insertable field-replaceable units (FRUs). You can remove and replace these modules without powering off the switch or disrupting switch functions.

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

Before you begin installing an expansion module in the switch, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).

Ensure that you have the following parts and tools available:

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

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To install an expansion module in an EX4600 switch (see Figure 41 on page 152):

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

   If a grounding strap is not available, hold the expansion module in its antistatic bag in one hand and touch the exposed metallic part of the switch with the other hand to ground yourself and the component.

2. If the module slot has a cover panel on it, remove the cover panel by using the screwdriver and save it for later use.

3. Taking care not to touch module components, pins, leads, or solder connections, remove the expansion module from its bag.

4. Loosen the captive screws on the front faceplate of the expansion module by using your fingers. If you are unable to loosen the captive screws by using your fingers, use the screwdriver.

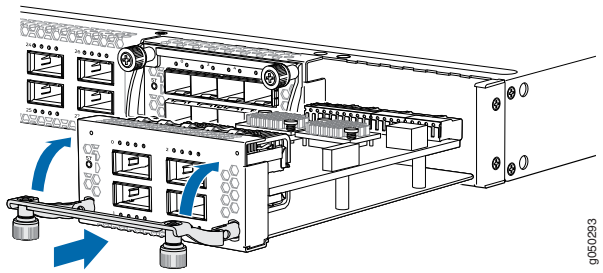
5. Using both hands, place the expansion module in the empty slot and slide it in gently until it is fully seated.

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

6. Raise the handle and tighten the captive screws by using your fingers or the screwdriver. When the **ST** LED turns green, the expansion module is ready for use.

Figure 41 on page 152 shows how to install a QSFP+ expansion module on the port panel of a EX4600 switch.

Figure 41: Installing a QFX4Q Expansion Module in an EX4600 Switch



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

Related Documentation

- EX4600 Switch Hardware Overview on page 3
- Installing and Removing EX4600 Switch Hardware Components on page 117

Removing an Expansion Module from an EX4600 Switch

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

Before you begin removing an expansion module from the switch:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 215).
- If there are any transceivers installed in the expansion module, remove them before you remove the expansion module. For instructions on removing transceivers, see "Removing a Transceiver from a Switch" on page 157.

Ensure that you have the following parts and tools available:

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

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

To remove an expansion module from the switch (see Figure 42 on page 154):

1. Attach the ESD grounding strap to your bare wrist, and connect the strap to the ESD point on the chassis.
2. Unscrew both captive screws on the faceplate of the expansion module by using your fingers. If you are unable to unscrew the captive screws by using your fingers, use the screwdriver.

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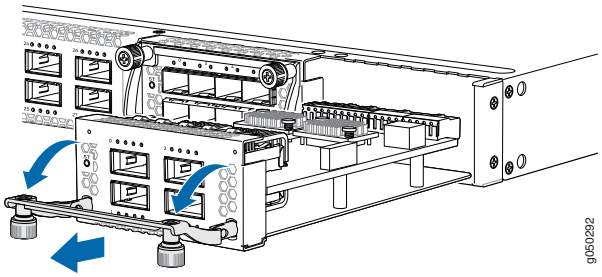
3. Hold the handle and gently pull the expansion module toward you and out of the module slot.
4. Place the expansion module in an antistatic bag or on an antistatic mat placed on a flat, stable surface.
5. If you are not replacing the expansion module with an optional module, install the cover panel over the slot.

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

Figure 42 on page 154 shows removing a QFX-EM-4Q expansion module from the port panel of a EX4600 switch.

Figure 42: Removing a QFX-EM-4Q Expansion Module from an EX4600 Switch



Related Documentation

- Installing an Expansion Module in an EX4600 Switch on page 151
- Installing and Removing EX4600 Switch Hardware Components on page 117
- Field-Replaceable Units in an EX4600 Switch on page 10
- EX4600 Switch Hardware Overview on page 3

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CHAPTER 18

Replacing Transceivers and Fiber-Optic Cables

- Installing a Transceiver in a Switch on page 155
- Removing a Transceiver from a Switch on page 157

Installing a Transceiver in a Switch

The transceivers for EX Series switches and OCX1100 switches are hot-removable and hot-insertable field-replaceable units (FRUs): You can remove and replace them without powering off the switch or disrupting switch functions.

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: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

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NOTE: On an EX3200 switch, if you install a transceiver in a 1-Gigabit Ethernet uplink module port, a corresponding network port from the last four built-in ports is disabled. For example, if you install a transceiver in the uplink module port 3 (ge-0/1/2), then the built-in port 23 (ge-0/0/22) is disabled. The disabled port is not listed in the output of show interface commands.

Before you begin installing a transceiver in an EX Series switch, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for Switches" on page 201).

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

Figure 43 on page 157 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the CFP transceivers.

To install a transceiver in an EX Series switch:

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

1. Remove the transceiver from its bag.
2. 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.

   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 prevents accidental exposure to laser light.

3. 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.
4. Using both hands, carefully place the transceiver in the empty port. The connectors must face the switch 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.

5. Slide the transceiver in gently until it is fully seated. If you are installing a CFP transceiver, tighten the captive screws on the transceiver by using your fingers.
6. Remove the rubber safety cap when you are ready to connect the cable to the transceiver.

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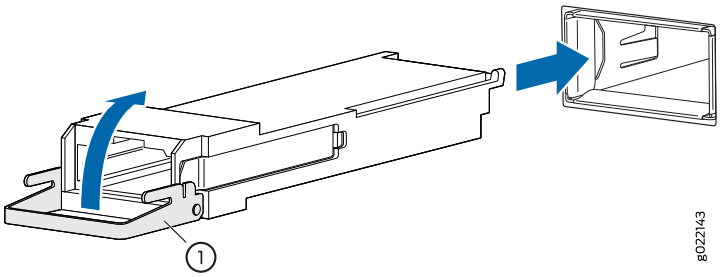
WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cables connected to transceivers emit laser light that can damage your eyes.

Figure 43: Installing a Transceiver in a Switch



1— Ejector lever	

Related Documentation

- Removing a Transceiver from a Switch on page 157
- Connecting a Fiber-Optic Cable to a Switch on page 161
- *Pluggable Transceivers Supported on EX Series Switches*
- *Pluggable Transceivers Supported on OCX1100 Switches*

Removing a Transceiver from a Switch

The transceivers for EX Series switches and OCX1100 switches are hot-removable and hot-insertable field-replaceable units (FRUs): You can remove and replace them without powering off the switch or disrupting switch functions.

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.

Before you begin removing a transceiver from a switch, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for Switches" on page 201).

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

Figure 44 on page 159 shows how to remove a QSFP+ transceiver. The procedure is the same for all types of transceivers except the CFP transceivers.

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To remove a transceiver from a switch:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Label the cable connected to the transceiver so that you can reconnect it correctly.

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.

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 prevents 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.

3. Remove the cable connected to the transceiver (see "Disconnecting a Fiber-Optic Cable from a Switch" on page 162). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.

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4. To remove an SFP, SFP+, XFP, or a QSFP+ transceiver:

   a. By 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 electrostatic discharge (ESD) damage to the transceiver, do not touch the connector pins at the end of the transceiver.

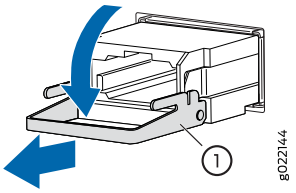
   To remove a CFP transceiver:

   a. Loosen the screws on the transceiver by using your fingers.

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

Figure 44: Removing an SFP, SFP+, XFP, or a QSFP+ Transceiver from a Switch



1— Ejector lever	

5. By using your fingers, grasp the body of the transceiver and pull it straight out of the port.
6. Place the transceiver in the antistatic bag or on the antistatic mat placed on a flat, stable surface.
7. Place the dust cover over the empty port.

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Related Documentation

- Installing a Transceiver in a Switch on page 155
- *Pluggable Transceivers Supported on EX Series Switches*
- *Installing a Transceiver in an OCX1100 Switch*
- *Pluggable Transceivers Supported on OCX1100 Switches*

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CHAPTER 19

Maintaining and Replacing Fiber-Optic Cable

- Connecting a Fiber-Optic Cable to a Switch on page 161
- Disconnecting a Fiber-Optic Cable from a Switch on page 162
- Maintaining Fiber-Optic Cables in Switches on page 163

Connecting a Fiber-Optic Cable to a Switch

EX Series, OCX1100, and QFX Series switches support optical transceivers, which are field-replaceable units (FRUs). You can connect fiber-optic cables to these transceivers.

Before you begin connecting a fiber-optic cable to an optical transceiver installed in a switch, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for Switches" on page 201).

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

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 45 on page 162).

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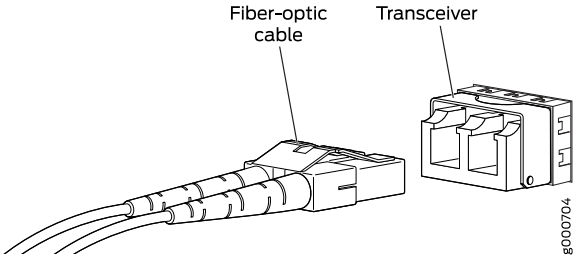
Figure 45: Connecting a Fiber-Optic Cable to an Optical Transceiver Installed in a Switch



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.

Related Documentation

- Disconnecting a Fiber-Optic Cable from a Switch on page 162
- Installing a Transceiver in a Switch on page 155
- Maintaining Fiber-Optic Cables in Switches on page 163
- *Pluggable Transceivers Supported on EX Series Switches*
- *Installing a Transceiver in an OCX1100 Switch*
- *Pluggable Transceivers Supported on OCX1100 Switches*

Disconnecting a Fiber-Optic Cable from a Switch

EX Series, OCX1100, and QFX Series switches have field-replaceable unit (FRU) optical transceivers to which you can connect fiber-optic cables.

Before you begin disconnecting a fiber-optic cable from an optical transceiver installed in a switch, ensure that you have taken the necessary precautions for safe handling of lasers. See "Laser and LED Safety Guidelines and Warnings for Switches" on page 201.

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

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

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

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

   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.

   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 prevents accidental exposure to laser light.

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

Related Documentation

- Connecting a Fiber-Optic Cable to a Switch on page 161
- Removing a Transceiver from a Switch on page 157
- Maintaining Fiber-Optic Cables in Switches on page 163
- *Pluggable Transceivers Supported on EX Series Switches*
- *Pluggable Transceivers Supported on OCX1100 Switches*

Maintaining Fiber-Optic Cables in Switches

Fiber-optic cables connect to optical transceivers that are installed in EX Series switches and OCX1100 switches.

To maintain 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. Attach a short fiber

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extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, 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 directions 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 directions in the cleaning kit you use.

Related Documentation

- Connecting a Fiber-Optic Cable to a Switch on page 161
- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- *Pluggable Transceivers Supported on EX Series Switches*
- *Pluggable Transceivers Supported on OCX1100 Switches*

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CHAPTER 20

Contacting Customer Support and Returning the Chassis or Components

- Returning an EX4600 Switch or Component for Repair or Replacement on page 165
- Locating the Serial Number on an EX4600 Switch or Component on page 165
- Packing an EX4600 Switch or Component for Shipping on page 168

Returning an EX4600 Switch or Component for Repair or Replacement

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

1. Determine the serial number of the component. For instructions, see "Locating the Serial Number on an EX4600 Switch or Component" on page 165.
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) as described in *Contacting Customer Support to Obtain Return Material Authorization for Switches*.

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

3. Pack the switch or component for shipping as described in "Packing an EX4600 Switch or Component for Shipping" on page 168.

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

Related Documentation

- EX4600 Switch Hardware Overview on page 3

Locating the Serial Number on an EX4600 Switch or Component

If you are returning a switch or component to Juniper Networks for repair or replacement, you must locate the serial number of the switch or component. You must provide the

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serial number to the Juniper Networks Technical Assistance Center (JTAC) when you contact them to obtain a Return Materials Authorization (RMA). See *Contacting Customer Support to Obtain Return Material Authorization for Switches*.

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

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

- Listing the Chassis and Component Details Using the CLI on page 166
- Locating the Chassis Serial Number ID Label on an EX4600 Switch on page 167
- Locating the Serial Number ID Labels on FRU Components on page 167

Listing the Chassis and Component Details Using the CLI

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

```
user@device> show chassis hardware

{master:0}
root@RIDGE_IEEE> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                TC3113520021      EX4600-40F
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           EX4600-40F
FPC 0            REV 11   650-049940   TC3113520021      EX4600-40F
  CPU                     BUILTIN      BUILTIN           FPC CPU
  PIC 0                   BUILTIN      BUILTIN           24x10G-4x40G
    Xcvr 2       REV 01   740-011614   C09K04908         SFP-LX10
    Xcvr 12      REV 01   740-038152   MOC12301520030    SFP+-10G-CU1M
    Xcvr 13      REV 01   740-038152   MOC12301520030    SFP+-10G-CU1M
    Xcvr 14      REV 01   740-038152   MOC12301520030    SFP+-10G-CU1M
    Xcvr 15      REV 01   740-038152   MOC12301520030    SFP+-10G-CU1M
    Xcvr 20      REV 01   740-038153   MOC13461530030    SFP+-10G-CU3M
    Xcvr 21      REV 01   740-038153   MOC13461530030    SFP+-10G-CU3M
    Xcvr 22      REV 01   740-038153   MOC13461530030    SFP+-10G-CU3M
    Xcvr 23      REV 01   740-038153   MOC13461530030    SFP+-10G-CU3M
    Xcvr 24      REV 01   740-038153   MOC13461530030    QSFP+-40G-CU3M
  PIC 1          REV 02   611-049556   RS3113520027      EX4600-EM-8F
  PIC 2          REV 02   611-049555   RR3113310086      QFX-EM-4Q
    Xcvr 0       REV 01   740-038152   MOC12301520030    QSFP+-40G-CU1M
Power Supply 1   REV 03   740-041741   1GA23381854       JPSU-650W-AC-AFO
Fan Tray 0                                              QFX5100 Fan Tray 0, Front
 to Back Airflow - AFO
Fan Tray 1                                              QFX5100 Fan Tray 1, Front
 to Back Airflow - AFO
Fan Tray 2                                              QFX5100 Fan Tray 2, Front
 to Back Airflow - AFO
```


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```
Fan Tray 3                                                    QFX5100 Fan Tray 3, Front
 to Back Airflow - AFO
Fan Tray 4                                                    QFX5100 Fan Tray 4, Front
 to Back Airflow - AFO

{master:0}
root@RIDGE_IEEE>

root@RIDGE_IEEE> show version
fpc0:
```

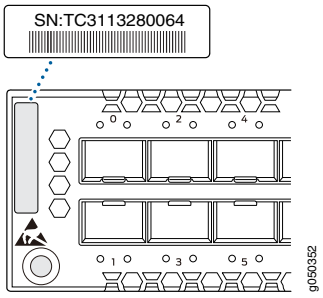
NOTE: The EX4600 and QFX5100 use the same fan modules. These modules are represented in CLI output as QFX5100 fan trays.

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

Locating the Chassis Serial Number ID Label on an EX4600 Switch

The location for the chassis serial number ID label is found to the right of the 40 Gigabit Ethernet ports. See Figure 46 on page 167 for an example of where to find the serial number ID on the EX4600 switch.

Figure 46: Location of the Serial Number ID Label on an EX4600 Switch



Locating the Serial Number ID Labels on FRU Components

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

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

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Related Documentation
- Returning an EX4600 Switch or Component for Repair or Replacement on page 165

Packing an EX4600 Switch or Component for Shipping

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

Before you pack an EX4600 switch or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 215.
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials. See *Contacting Customer Support to Obtain Return Material Authorization for Switches*.

Ensure that you have the following parts and tools available:

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

This topic describes:

- Packing an EX4600 Switch for Shipping on page 168
- Packing EX4600 Switch Components for Shipping on page 169

Packing an EX4600 Switch for Shipping

To pack an EX4600 switch for shipping:

1. Power down the switch and remove the power cables. See "Powering Off an EX4600 Switch" on page 139.
2. Remove the cables that connect the EX4600 switch to all external devices.
3. Remove all field-replaceable units (FRUs) from the switch.
4. Have one person support the weight of the switch while another person unscrews and removes the mounting screws.
5. Remove the switch from the rack or cabinet (see "Chassis Lifting Guidelines for an EX4600 Switch" on page 191) and place the switch in an antistatic bag.
6. Place the switch in the shipping carton.
7. Place the packing foam on top of and around the switch.
8. If you are returning accessories or FRUs with the switch, pack them as instructed in "Packing EX4600 Switch Components for Shipping" on page 169.

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9. Replace the accessory box on top of the packing foam.
10. Close the top of the cardboard shipping box and seal it with packing tape.
11. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing EX4600 Switch Components for Shipping

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

To pack and ship EX4600 switch components:

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

Related Documentation

- Returning an EX4600 Switch or Component for Repair or Replacement on page 165

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PART 5

Troubleshooting

- Restoring Junos OS on page 173
- Alarm Messages on page 177

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CHAPTER 21

Restoring Junos OS

- Creating an Emergency Boot Device on page 173
- Performing a Recovery Installation on page 175

Creating an Emergency Boot Device

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.

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

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

To create an emergency boot device:

1. Use FTP to copy the installation media image into the **/var/tmp** directory on the device.
2. Insert a USB device into the USB port.
3. From the Junos OS command-line interface (CLI), start the shell:

   ```
   user@device> start shell
   %
   ```
4. Switch to the root account using the **su** command:

   ```
   % su
   Password: password
   ```

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

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5. Enter the following command on the device:

   ```
   root@device% dd if=/var/tmp/filename of=/dev/da1 bs=16k
   ```

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

   ```
   root@device% dd if=/var/tmp/install-media-qfx3500.junos_11.1 of=/dev/da1 bs=16k
   11006+1 records in
   11006+1 records out
   180332544 bytes transferred in 71.764266 secs (2512846 bytes/sec)
   ```

6. 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/jinstall-vjunos-usb-13.2.img of=/dev/da0 bs=1048576
   11006+1 records in
   11006+1 records out
   180332544 bytes transferred in 71.764266 secs (2512846 bytes/sec)
   ```

7. Log out of the shell:

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

Related Documentation

- Performing a Recovery Installation on page 175

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Performing a Recovery Installation

If Junos OS on your device is damaged in some way that prevents the software from loading correctly, you may need to perform a recovery installation using an emergency boot device (for example, a USB flash drive) to restore the default factory installation. Once you have recovered the software, you need to restore the device configuration. You can either create a new configuration as you did when the device was shipped from the factory, or if you saved the previous configuration, you can simply restore that file to the device.

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

1. Ensure that you have an emergency boot device to use during the installation. See "Creating an Emergency Boot Device" on page 173 for information on how to create an emergency boot device.
2. Copy the existing configuration in the file **/config/juniper.conf.gz** from the device to a remote system, such as a server, or to an emergency boot device. For extra safety, you can also copy the backup configurations (the files named **/config/juniper.conf.*n***, where *n* is a number from 0 through 9) to a remote system or to an emergency boot device.

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

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

To reinstall Junos OS:

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

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

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

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

   When the software is finished being copied from the emergency device to the device, the device then reboots from the internal flash storage on which the software was

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just installed. When the reboot is complete, the device displays the Junos OS login prompt:

```
root@device#
```

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

Related Documentation

- Creating an Emergency Boot Device on page 173

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CHAPTER 22

Alarm Messages

- Understanding Alarms on page 177
- Interface Alarm Messages on page 178

Understanding Alarms

The QFX Series and OCX Series support different alarm types and severity levels. Table 48 on page 177 provides a list of alarm terms and definitions that may help you in monitoring the device.

Table 48: Alarm Terms and Definitions

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

Alarm severity levels	Seriousness of the alarm. The level of severity can be either major (red) or minor (yellow).
	• 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.
	  • One or more hardware components have failed.
	  • One or more hardware components have exceeded temperature thresholds.
	  • An alarm condition configured on an interface has triggered a critical warning.
	• Minor (yellow or amber)—Indicates a noncritical condition on the device that, if left unchecked, might cause an interruption in service or degradation in performance. A yellow alarm condition requires monitoring or maintenance. For example, a missing rescue configuration generates a yellow system alarm.

Alarm types	Alarms include the following types: • Chassis alarm—Predefined alarm triggered by a physical condition on the device such as a power supply failure or excessive component temperature. • Interface alarm—Alarm 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. • 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.

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Related Documentation

- *Chassis Alarm Messages on a QFX3008-I Interconnect Device*
- *Chassis Alarm Messages on a QFX3500 Device*
- Interface Alarm Messages on page 178
- *show chassis alarms*
- *show system alarms*

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 only valid on QFX3500 devices.

NOTE: When red alarms or major alarms are issued on QFX5100 and 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 will be handled as a red alarm.

Related Documentation

- Understanding Alarms on page 177

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PART 6

Safety and Compliance Information

- General Safety Guidelines and Warnings on page 181
- Fire Safety Requirements on page 187
- Installation Safety Guidelines and Warnings on page 189
- Radiation and Laser Safety Guidelines and Warnings on page 201
- Maintenance and Operational Safety Warnings on page 207
- Electrical Safety Guidelines and Warnings on page 213
- Agency Approvals and Compliance Statements on page 231

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CHAPTER 23

General Safety Guidelines and Warnings

- General Safety Guidelines and Warnings on page 181
- Definitions of Safety Warning Levels on page 182
- Qualified Personnel Warning on page 184
- Warning Statement for Norway and Sweden on page 185

General Safety Guidelines and Warnings

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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.

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- 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.
- Ensure that the separate protective earthing terminal provided on this device is permanently connected 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.
- Always ensure that all modules, power supplies, and cover panels are fully inserted and that the installation screws are fully tightened.

Related Documentation

- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220
- General Electrical Safety Guidelines and Warnings on page 213
- Maintenance and Operational Safety Guidelines and Warnings on page 207
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199

Definitions of Safety Warning Levels

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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.

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

WARNING: This symbol alerts you to the risk of personal injury from a 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 be familiar 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.

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

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

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

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

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Installation Instructions Warning on page 189
- Maintenance and Operational Safety Guidelines and Warnings on page 207
- Grounded Equipment Warning on page 199
- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- *Laser and LED Safety Guidelines and Warnings for the QFX Series*
- Warning Statement for Norway and Sweden on page 185

Qualified Personnel Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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.

Attention 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.

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220

Warning Statement for Norway and Sweden

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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.

Related Documentation

- General Safety Guidelines and Warnings on page 181

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CHAPTER 24

Fire Safety Requirements

- Fire Safety Requirements on page 187

Fire Safety Requirements

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

In the event of a fire emergency involving switches and other network equipment, 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

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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 switch or other network device provided by Juniper. 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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- Action to Take After an Electrical Accident on page 214

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CHAPTER 25

Installation Safety Guidelines and Warnings

- Installation Instructions Warning on page 189
- Chassis Lifting Guidelines for an EX4600 Switch on page 191
- Restricted Access Warning on page 192
- Ramp Warning on page 193
- Rack-Mounting and Cabinet-Mounting Warnings on page 194
- Grounded Equipment Warning on page 199

Installation Instructions Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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

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

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Attention 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.

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- *Laser and LED Safety Guidelines and Warnings for the QFX Series*
- Grounded Equipment Warning on page 199
- *Connecting AC Power to an EX2200 Switch*
- *Connecting AC Power to an EX2300 Switch*
- *Connecting AC Power to an EX3200 Switch*
- *Connecting AC Power to an EX3300 Switch*
- *Connecting AC Power to an EX3400 Switch*
- *Connecting AC Power to an EX4200 Switch*
- *Connecting AC Power to an EX4300 Switch*
- *Connecting AC Power to an EX4500 Switch*
- *Connecting AC Power to an EX4550 Switch*
- Connecting AC Power to an EX4600 Switch on page 121
- *Connecting AC Power to an EX6200 Switch*
- *Connecting AC Power to an EX8200 Switch*
- *Connecting AC Power to an EX9204 Switch*
- *Connecting AC Power to an EX9208 Switch*
- *Connecting AC Power to an EX9214 Switch*
- *Connecting DC Power to an EX3200 Switch*
- *Connecting DC Power to an EX4200 Switch*
- *Connecting DC Power to an EX4300 Switch*
- *Connecting DC Power to an EX4500 Switch*
- Connecting DC Power to an EX4600 Switch on page 123
- *Connecting DC Power to an EX4550 Switch*
- *Connecting DC Power to an EX6200 Switch*

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- *Connecting DC Power to an EX8200 Switch*
- *Connecting DC Power to an EX9204 Switch*
- *Connecting DC Power to an EX9208 Switch*
- *Connecting DC Power to an EX9214 Switch*
- *Connecting AC Power to an XRE200 External Routing Engine*
- *Connecting DC Power to an XRE200 External Routing Engine*
- *Connecting AC Power to an OCX1100 Switch*
- *Connecting DC Power to an OCX1100 Switch*
- *Connecting AC Power to a QFX3100 Director Device*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Single-Phase Wiring Trays*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Three-Phase Delta Wiring Trays*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Three-Phase Wye Wiring Trays*
- *Connecting AC Power to a QFX3500, QFX3600, or QFX3600-I Device*
- *Connecting DC Power to a QFX3500, QFX3600, or QFX3600-I Device*
- *Connecting AC Power to a QFX5100 Device*
- *Connecting DC Power to a QFX5100 Device*
- *Connecting AC Power to a QFX5200*
- *Connecting DC Power to a QFX5200*
- *Connecting AC Power to a QFX10002*
- *Connecting DC Power to a QFX10002*
- *Connecting AC Power to a QFX10000*
- *Connecting DC Power to a QFX10000*
- *Connecting AC Power to an NFX250 Device*

Chassis Lifting Guidelines for an EX4600 Switch

The weight of a fully loaded EX4600 switch chassis is approximately 30.8 lb (14 kg). Observe the following guidelines for lifting and moving an EX4600 switch:

CAUTION: If you are installing the EX4600 switch above 60 in. (152.4 cm) from the floor, either remove the power supplies, fan modules, and any expansion modules before attempting to install the switch, or ask someone to assist you during the installation.

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- Before installing a EX4600 switch, read the guidelines in "Site Preparation Checklist for an EX4600 Switch" on page 35 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Before lifting or moving the EX4600 switch, disconnect all external cables.
- As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Installation Instructions Warning on page 189
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114

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.

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

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

Avvertenza Questa unità deve essere installata in un'area ad accesso limitato. Un'area ad accesso limitato è un'area accessibile solo a personale di

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assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di sicurezza, ed è controllata dall'autorità responsabile della zona.

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

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

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

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

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199

Ramp Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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

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

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

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

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

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

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

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

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

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

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199

Rack-Mounting and Cabinet-Mounting Warnings

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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:

- The device must be installed in a rack that is secured to the building structure.
- The device should be mounted at the bottom of the rack if it is the only unit in the rack.

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- When mounting the device on a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

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

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

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

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

Attention 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.

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- 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.

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- Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.
- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

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

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

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

- El Juniper Networks switch debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.
- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

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

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- 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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199
- *Mounting an EX2200 Switch*
- *Mounting an EX2300 Switch*
- *Mounting an EX3200 Switch*
- *Mounting an EX3300 Switch*
- *Mounting an EX3400 Switch*
- *Mounting an EX4200 Switch*
- *Mounting an EX4300 Switch*
- *Mounting an EX4500 Switch*
- *Mounting an EX4550 Switch*
- Mounting an EX4600 Switch in a Rack or Cabinet on page 114
- *Mounting an EX6210 Switch on a Rack or Cabinet*
- *Mounting an EX8208 Switch on a Rack or Cabinet*
- *Mounting an EX8216 Switch on a Rack or Cabinet*
- *Mounting an EX9200 Switch on a Rack or Cabinet Using a Mechanical Lift*
- *Mounting an EX9204 Switch on a Rack or Cabinet Without Using a Mechanical Lift*
- *Mounting an EX9208 Switch on a Rack or Cabinet Without Using a Mechanical Lift*
- *Mounting an OCX1100 Switch*
- *Mounting a QFX3100 Director Device on Four Posts in a Rack or Cabinet*
- *Mounting a QFX3100 Director Device on Two Posts in a Rack or Cabinet*
- *Mounting a QFX3008-I Interconnect Device on a Rack or Cabinet Using a Mechanical Lift*
- *Mounting a QFX3600 or QFX3600-I Device on Four Posts in a Rack or Cabinet*

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- *Mounting a QFX3600 or QFX3600-I Device on Two Posts in a Rack or Cabinet*
- *Mounting a QFX3500 Device in a Rack or Cabinet*
- *Mounting a QFX5100 Device in a Rack or Cabinet*
- *Mounting a QFX5200 in a Rack or Cabinet*
- *Mounting a QFX10002 in a Rack*
- *Mounting a QFX10008 in a 4-Post Rack Using a Mechanical Lift*
- *Manually Mounting a QFX10008 in a 4-Post Rack*
- *Mounting an NFX250 Device*

Grounded Equipment Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

WARNING: The device is intended to be grounded. During normal use, ensure that you have connected earth ground to the chassis.

Waarschuwing Deze apparatuur hoort geaard te worden Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.

Varoitus Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaite on yhdistetty maahan normaalikäytön aikana.

Attention Cet équipement doit être relié à la terre. S'assurer que l'appareil hôte est relié à la terre lors de l'utilisation normale.

Warnung Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.

Avvertenza Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.

Advarsel Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

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Varning! Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.

Related Documentation

- General Safety Guidelines and Warnings on page 181

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CHAPTER 26

Radiation and Laser Safety Guidelines and Warnings

- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- Radiation from Open Port Apertures Warning on page 204

Laser and LED Safety Guidelines and Warnings for Switches

EX Series switches, OCX1100 switches, NFX250 devices, and the XRE200 External Routing Engine 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 EN 60825-1 requirements.

Observe the following guidelines and warnings:

- General Laser Safety Guidelines on page 201
- Class 1 Laser Product Warning on page 202
- Class 1 LED Product Warning on page 202
- Laser Beam Warning on page 203

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.

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.**

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Class 1 Laser Product Warning

WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

WARNING: **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

WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

WARNING: **Avvertenza** Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

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Laser Beam Warning

WARNING: Do not stare into the laser beam or view it directly with optical instruments.

WARNING: **Waarschuwing** Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

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

WARNING: **Attention** Ne pas fixer le faisceau des yeux, ni l'observer directement à l'aide d'instruments optiques.

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

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

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

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

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

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

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Related Documentation

- General Safety Guidelines and Warnings on page 181
- Radiation from Open Port Apertures Warning on page 204
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199
- *Pluggable Transceivers Supported on EX Series Switches*
- *Pluggable Transceivers Supported on OCX1100 Switches*

Radiation from Open Port Apertures Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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

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

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

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

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

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

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

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

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199
- *Laser and LED Safety Guidelines and Warnings for the QFX Series*

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CHAPTER 27

Maintenance and Operational Safety Warnings

- Maintenance and Operational Safety Guidelines and Warnings on page 207

Maintenance and Operational Safety Guidelines and Warnings

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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

- Battery Handling Warning on page 207
- Jewelry Removal Warning on page 208
- Lightning Activity Warning on page 210
- Operating Temperature Warning on page 210
- Product Disposal Warning on page 211

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.

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

Attention 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.

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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.

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

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

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

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

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

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

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

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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.

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

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

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

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

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

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning

WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104° F (40° C) for EX6200 switches, EX8208 switches, EX8216 switches, QFX Series devices, OCX1100 switches, and XRE200 External Routing Engines and 113° F (45° C) for EX2200, EX3300, EX3200, EX4200, EX4300, EX4500, and EX4550 switches. 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.

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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.

Attention 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.

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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.

Attention 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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220
- Laser and LED Safety Guidelines and Warnings for Switches on page 201
- *Laser and LED Safety Guidelines and Warnings for the QFX Series*
- Installation Instructions Warning on page 189
- Grounded Equipment Warning on page 199

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CHAPTER 28

Electrical Safety Guidelines and Warnings

- General Electrical Safety Guidelines and Warnings on page 213
- Action to Take After an Electrical Accident on page 214
- Prevention of Electrostatic Discharge Damage on page 215
- AC Power Electrical Safety Guidelines on page 217
- AC Power Disconnection Warning on page 219
- DC Power Electrical Safety Guidelines on page 220
- DC Power Disconnection Warning on page 223
- DC Power Grounding Requirements and Warning on page 224
- DC Power Wiring Sequence Warning on page 225
- DC Power Wiring Terminations Warning on page 227
- Multiple Power Supplies Disconnection Warning on page 229
- TN Power Warning on page 229

General Electrical Safety Guidelines and Warnings

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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 requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be metallically connected to interfaces that connect to the OSP or its wiring. The intrabuilding ports on the device are suitable for connection to intrabuilding or unexposed wiring or cabling only. The addition of primary protectors is not sufficient protection for connecting these interfaces metallically to OSP wiring.

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CAUTION: Before removing or installing components of a device, attach an electrostatic discharge (ESD) grounding strap to an ESD point and place the other end of the strap around your bare wrist. Failure to use an ESD grounding strap could result in damage to the switch.

- 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.
- 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 grounding surfaces are cleaned and brought to a bright finish before grounding connections are made.
- 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 an equipment that it appears to be damaged.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220

Action to Take After an Electrical Accident

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.

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This topic also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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, then call for help.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220

Prevention of Electrostatic Discharge Damage

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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 grounding 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 47 on page 216) 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.**

- 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 grounding strap is attached to the ESD point on the chassis.

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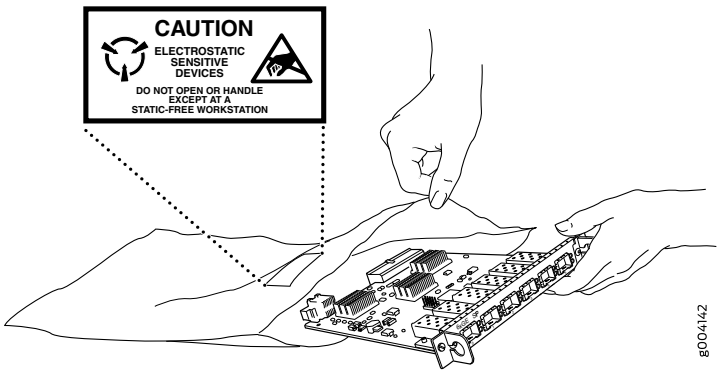
If no grounding strap is available, touch the exposed, bare metal of the device to ground yourself before handling the component.

- 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 47 on page 216). If you are returning a component, place it in an antistatic bag before packing it.

Figure 47: 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.

Related Documentation

- See General Safety Guidelines and Warnings on page 181.
- See *EX2200 Switches Hardware Overview* for the ESD point location.
- See *Rear Panel of an EX3200 Switch* for the ESD point location.
- See *Rear Panel of an EX3300 Switch* for the ESD point location.
- See *Rear Panel of an EX4200 Switch* for the ESD point location.
- See *EX4300 Switches Hardware Overview* for the ESD point location.
- See *Front Panel of an EX4500 Switch* for the ESD point location.
- See *EX4550 Switches Hardware Overview* for the ESD point location.
- See *Chassis Physical Specifications of an EX6210 Switch* for the ESD point location.
- See *Chassis Physical Specifications of an EX8208 Switch* for the ESD point location.
- See *Chassis Physical Specifications of an EX8216 Switch* for the ESD point location.
- See *EX9204 Switch Hardware Overview* for the ESD point location.

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- See *EX9208 Switch Hardware Overview* for the ESD point location.
- See *EX9214 Switch Hardware Overview* for the ESD point location.
- See *OCX1100 Switches Hardware Overview* for the ESD point location.
- See *QFX3008-I Interconnect Device Overview* for the ESD point location.
- See *Front Panel of a QFX3500 Device* for the ESD point location.
- See *Front Panel of a QFX3600 Device* for the ESD point location.
- See *Physical Description of a Redundant Power System*
- See Port Panel of an EX4600 Switch on page 7 for the ESD point location.
- See *Port Panel of a QFX5100-48S Device* for the ESD point location.
- See *Port Panel of a QFX5100-48T Device* for the ESD point location
- See *Port Panel of a QFX5100-24Q Device* for the ESD point location.
- See *Port Panel of a QFX5100-96S Device* for the ESD point location.
- See *QFX10002 FRU Panel* for the ESD location.
- See *QFX5200-32C Port Panel* for the ESD location.
- See *NFX250 Device Hardware Overview*

AC Power Electrical Safety Guidelines

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

CAUTION: **For devices with AC power supplies, an external surge protective device (SPD) must be used at the AC power source.**

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.

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- You must provide an external certified circuit breaker 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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Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- Multiple Power Supplies Disconnection Warning on page 229
- *Connecting AC Power to an EX2200 Switch*
- *Connecting AC Power to an EX3200 Switch*
- *Connecting AC Power to an EX3300 Switch*
- *Connecting AC Power to an EX4200 Switch*
- *Connecting AC Power to an EX4300 Switch*
- *Connecting AC Power to an EX4500 Switch*
- *Connecting AC Power to an EX4550 Switch*
- Connecting AC Power to an EX4600 Switch on page 121
- *Connecting AC Power to an EX6200 Switch*
- *Connecting AC Power to an EX8200 Switch*
- *Connecting AC Power to an EX9204 Switch*
- *Connecting AC Power to an EX9208 Switch*
- *Connecting AC Power to an EX9214 Switch*
- *Connecting AC Power to an XRE200 External Routing Engine*
- *Connecting AC Power to an OCX1100 Switch*

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- *Connecting AC Power to a QFX3100 Director Device*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Single-Phase Wiring Trays*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Three-Phase Delta Wiring Trays*
- *Connecting AC Power to a QFX3008-I Interconnect Device with Three-Phase Wye Wiring Trays*
- *Connecting AC Power to a QFX3500, QFX3600, or QFX3600-I Device*
- *Connecting AC Power to a QFX5100 Device*
- *Connecting AC Power to a QFX5200*
- *Connecting AC Power to a QFX10002*
- *Connecting AC Power to a QFX10000*
- *Connecting AC Power to an NFX250 Device*

AC Power Disconnection Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

WARNING: Before working on the switch or near power supplies, unplug all the power cords from an AC switch.

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.

Attention 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.

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- AC Power Electrical Safety Guidelines on page 217

DC Power Electrical Safety Guidelines

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

This topic also applies to hardware devices in the QFX Series and to OCX1100 switches.

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- A DC-powered device is equipped with a DC terminal block that is rated for the power requirements of a maximally configured device.

  NOTE: To supply sufficient power, terminate the DC input wiring on a facility DC source that is capable of supplying:

  - Minimum of 7.5 A at –48 VDC for EX2200 and EX3300 switches
  - Minimum of 8 A at –48 VDC for EX3200 and EX4200 switches
  - Minimum of 20 A at –48 VDC for EX4300, EX4500, EX4550, and QFX10002 switches
  - Minimum of 50 A at –48 VDC for EX6210 switches
  - Minimum of 60 A at –48 VDC for EX8208 and QFX10008 switches
  - Minimum of 100 A at –48 VDC for EX8216 switches
  - Minimum of 7 A at –48 VDC for QFX3500, EX4600, QFX5100, and QFX5200 devices
  - Minimum of 8 A at –48 VDC for QFX3600 devices
  - Minimum of 7 A at –48 VDC for OCX1100 switches

  Incorporate an easily accessible disconnect device into the facility wiring. Be sure to connect the ground wire or conduit to a solid 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.
- For personal safety, connect the green and yellow wire to safety (earth) ground at both the device and the supply side of the DC wiring.

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- 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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- DC Power Disconnection Warning on page 223
- DC Power Grounding Requirements and Warning on page 224
- DC Power Wiring Sequence Warning on page 225
- DC Power Wiring Terminations Warning on page 227
- *Connecting DC Power to an EX2200 Switch*
- *Connecting DC Power to an EX2300 Switch*
- *Connecting DC Power to an EX3200 Switch*
- *Connecting DC Power to an EX3400 Switch*
- *Connecting DC Power to an EX4200 Switch*
- *Connecting DC Power to an EX4300 Switch*
- *Connecting DC Power to an EX4500 Switch*
- *Connecting DC Power to an EX4550 Switch*
- Connecting DC Power to an EX4600 Switch on page 123
- *Connecting DC Power to an EX6200 Switch*
- *Connecting DC Power to an EX8200 Switch*
- *Connecting DC Power to an EX9204 Switch*
- *Connecting DC Power to an EX9208 Switch*
- *Connecting DC Power to an EX9214 Switch*
- *Connecting DC Power to an OCX1100 Switch*
- *Connecting DC Power to an XRE200 External Routing Engine*
- *Connecting DC Power to a QFX3500, QFX3600, or QFX3600-I Device*
- *Connecting DC Power to a QFX5100 Device*
- *Connecting DC Power to a QFX10002*
- *Connecting DC Power to a QFX10000*
- *Connecting DC Power to a QFX5200*

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DC Power Disconnection Warning

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

This topic also applies to hardware devices in the QFX Series and to OCX1100 switches.

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.

Attention 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.

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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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- DC Power Electrical Safety Guidelines on page 220
- DC Power Grounding Requirements and Warning on page 224
- DC Power Wiring Sequence Warning on page 225
- DC Power Wiring Terminations Warning on page 227

DC Power Grounding Requirements and Warning

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

This topic also applies to hardware devices in the QFX Series and to OCX1100 switches.

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.**

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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.

Attention Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

Warnung Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- DC Power Electrical Safety Guidelines on page 220
- DC Power Disconnection Warning on page 223
- DC Power Wiring Sequence Warning on page 225
- DC Power Wiring Terminations Warning on page 227

DC Power Wiring Sequence Warning

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

This topic also applies to hardware devices in the QFX Series and to OCX1100 switches.

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

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sequence is –48 V to –48 V, +RTN to +RTN, then ground to ground. Note that the ground wire must always be connected first and disconnected last.

Waarschuwing De juiste bedradingsvolgorde verbonden is aarde naar aarde, +RTN naar +RTN, en –48 V naar – 48 V. De juiste bedradingsvolgorde losgemaakt is en –48 naar –48 V, +RTN naar +RTN, aarde naar aarde.

Varoitus Oikea yhdistettava kytkentajarjestys on maajohto maajohtoon, +RTN varten +RTN, –48 V varten – 48 V. Oikea irrotettava kytkentajarjestys on –48 V varten – 48 V, +RTN varten +RTN, maajohto maajohtoon.

Attention Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis –48 V à –48 V. En débranchant la puissance, l'ordre approprié de câblage est –48 V à –48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, –48 V til – 48 V. Riktig frakoples tilkoplingssekvens er –48 V til – 48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces –48 V a –48 V. Al desconectar potencia, la secuencia apropiada del cableado es –48 V a –48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

¡Atención! Wire a fonte de alimentação de DC Usando os talões apropriados na 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,

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+RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

Varning! Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, –48 V till –48 V. Korrekt kopplas kopplingssekvens ar –48 V till –48 V, +RTN till +RTN, jord till jord.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- DC Power Electrical Safety Guidelines on page 220
- DC Power Disconnection Warning on page 223
- DC Power Grounding Requirements and Warning on page 224
- DC Power Wiring Terminations Warning on page 227

DC Power Wiring Terminations Warning

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches and the XRE200 External Routing Engine.

This topic also applies to hardware devices in the QFX Series and to OCX1100 switches.

WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

Attention 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.

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Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. für einen geschlossenen Regelkreis oder gabelförmig, mit nach oben gerichteten Kabelschuhen zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- DC Power Electrical Safety Guidelines on page 220
- DC Power Disconnection Warning on page 223
- DC Power Grounding Requirements and Warning on page 224
- DC Power Wiring Sequence Warning on page 225

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Multiple Power Supplies Disconnection Warning

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 also applies to hardware devices in the QFX Series and to OCX1100 switches.

WARNING: For a device that has 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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- AC Power Electrical Safety Guidelines on page 217
- DC Power Electrical Safety Guidelines on page 220

TN Power Warning

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 also applies to hardware devices in the QFX Series, to OCX1100 switches, and to NFX250 devices.

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.

Attention 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.

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¡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.

Related Documentation

- General Safety Guidelines and Warnings on page 181
- General Electrical Safety Guidelines and Warnings on page 213
- Grounded Equipment Warning on page 199
- Multiple Power Supplies Disconnection Warning on page 229

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CHAPTER 29

Agency Approvals and Compliance Statements

- Agency Approvals for EX Series Switches on page 231
- Compliance Statements for EMC Requirements for EX Series Switches on page 232
- Compliance Statements for Acoustic Noise for EX Series Switches on page 236

Agency Approvals for EX Series Switches

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

These hardware devices comply with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1 Information Technology Equipment
  - UL 60950-1 Information Technology Equipment
  - EN 60950-1 Information Technology Equipment
  - IEC 60950-1 Information Technology Equipment
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment classification and requirements
- EMC
  - FCC 47CFR Part 15 Class A (USA)
  - EN 55022 Class A Emissions (Europe)
  - ICES-003 Class A
  - VCCI Class A (Japan)
  - AS/NZS CISPR 22 Class A (Australia/New Zealand)
  - CISPR 22 Class A
  - EN 55024
  - EN 300386

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- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common Immunity
- EN 61000-4-11 Voltage Dips and Sags

Related Documentation

- Compliance Statements for EMC Requirements for EX Series Switches on page 232
- Compliance Statements for Acoustic Noise for EX Series Switches on page 236

Compliance Statements for EMC Requirements for EX Series Switches

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

This topic describes the EMC requirements for these hardware devices for:

- Canada on page 232
- European Community on page 233
- Israel on page 233
- Japan on page 233
- Korea on page 234
- United States on page 234
- FCC Part 15 Statement on page 234
- Nonregulatory Environmental Standards on page 235

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

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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.

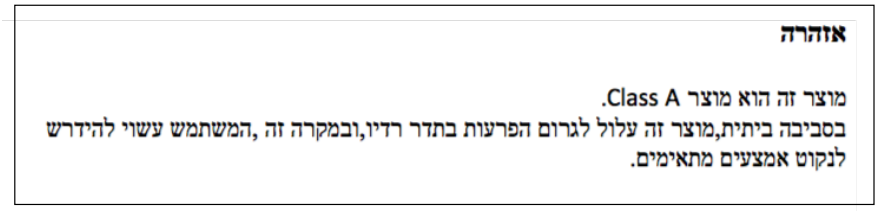
CAUTION: **Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.**

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.

European Community

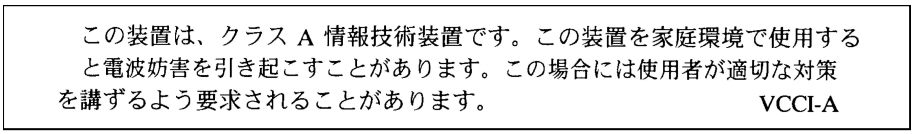
This is a Class A device. In a domestic environment this device might cause radio interference, in which case the user needs to take adequate measures.

Israel



Translation from Hebrew–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

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Korea

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Korean Class A Warning g040913

The preceding translates as follows:

This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home

United States

The device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users need to correct the interference at their own expense.

FCC Part 15 Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, might cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

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Nonregulatory Environmental Standards

NEBS compliance—These EX Series switches are Network Equipment Building System (NEBS) compliant:

- EX2200-24T and EX2200-48T
- EX3200-24T, EX3200-48T
- EX3300-24T, EX3300-48T
- EX4200-24T, EX4200-24F, EX4200-24F-S, EX4200-48T and EX4200-48T-S
- EX4300-24T, EX4300-24T-S, EX4300-24P, EX4300-24P-S, EX4300-32F, EX4300-32F-S, EX4300-48T, EX4300-48T-AFI, EX4300-48T-S, EX4300-48P, and EX4300-48P-S
- All EX4500 switches with AC power supplies
- EX4550-32T-AFO, EX4550-32T-AFI, EX4550-32F-AFO, EX4550-32F-AFI, and EX4550-32F-S
- EX4600-40F and EX4600-40F-S
- All EX6200 switches

NOTE: **For the EX6200-48P line cards, the intrabuilding ports must use shielded intrabuilding cabling or wiring that is grounded at both ends.**

- All EX8200 switches

These switches meet the following NEBS compliance standards:

- SR-3580 NEBS Criteria Levels (Level 4 Compliance)
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment
- GR-63-CORE: NEBS, Physical Protection
  - The equipment is suitable for installation as part of the Common Bonding Network (CBN).
  - The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
  - The battery return connection is to be treated as an Isolated DC return (DC-I), as defined in GR-1089-CORE.

Related Documentation

- Agency Approvals for EX Series Switches on page 231
- Compliance Statements for Acoustic Noise for EX Series Switches on page 236

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Compliance Statements for Acoustic Noise for EX Series Switches

This topic applies to hardware devices in the EX Series product family, which includes EX Series switches, the EX Series Redundant Power System (RPS), and the XRE200 External Routing Engine.

Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäss EN ISO 7779

Translation:

The emitted sound pressure is below 70 dB(A) per EN ISO 7779.

Related Documentation

- Agency Approvals for EX Series Switches on page 231
- Compliance Statements for EMC Requirements for EX Series Switches on page 232

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