ACX5448 Universal Metro Router Hardware Guide

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Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

ACX5448 Universal Metro Router Hardware Guide

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Table of Contents

List of Figures

List of Tables

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Documentation Conventions

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

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 xii 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*

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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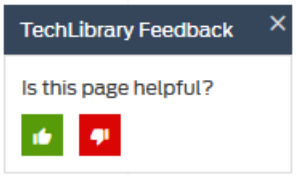

  - Click the thumbs-up icon if the information on the page was helpful to you.
  - Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.

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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
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For international or direct-dial options in countries without toll-free numbers, see https://www.juniper.net/support/requesting-support.html.

CHAPTER 1

Overview

ACX5448 System Overview

ACX5448 Universal Metro Router Description

The ACX5448 Universal Metro Routers are Juniper Networks' top-of-rack router with deep pocket buffer solutions for metro network or aggregation environments. The ACX5448 router portfolio consists of high-performance fixed-configuration routers that add higher port densities, additional scalability, and improved latency to the ACX Series.

Figure 1 on page 17 and Figure 2 on page 18 show the front and rear of a typical ACX5448 router.

Figure 1: ACX5448 Router—Front

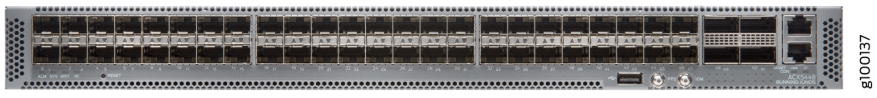


Figure 2: ACX5448 Router—Rear

For more information, see the following topics:

- Benefits of the ACX5448 Router on page 18
- Chassis Description on page 18

Benefits of the ACX5448 Router

- **Space and cost optimized**—The ACX5448 router has a 1 U form factor and is ideal for aggregating business Ethernet services in the metro with 10-Gigabit Ethernet and 100-Gigabit Ethernet performance. Its innovative design helps service providers build high-density, high-performance 100-Gigabit Ethernet infrastructures where rack space and cooling are limited.
- **High port density and performance**—The ACX5448 router has a 1 U form factor and supports 48 10-Gigabit Ethernet ports and 4 100-Gigabit Ethernet ports with a system throughput of up to 800 Gbps.

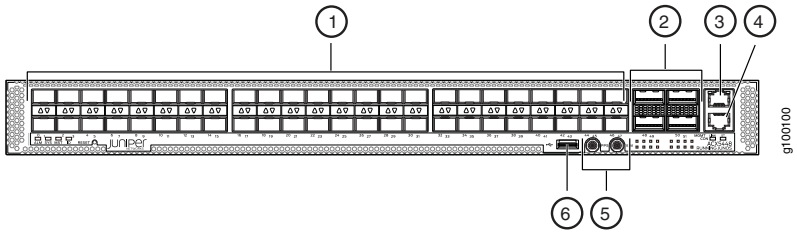
Chassis Description

The ACX5448 router offers 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. The router have a high-throughput Packet Forwarding Engine, and the performance of the control plane running on ACX5448 router is enhanced by the 1.9 Ghz six-core Intel CPU with 32 GB of memory and two 100 GB of enterprise grade solid-state drive (SSD) storage.

The ACX5448 is a 10-Gigabit Ethernet enhanced small form-factor pluggable (SFP+) top-of-rack router with 48 SFP+ ports and 4 100-Gigabit Ethernet QSFP28 ports. Each SFP+ port (**0** through **47**) can operate as a native 10-Gigabit Ethernet port or as a 1-Gigabit Ethernet port when 1-gigabit optics are inserted. Each QSFP28 port (**48** through **51**) can be configured as either a native 100-Gigabit Ethernet port, 40-Gigabit Ethernet port, four 25-Gigabit Ethernet port, or as four 10-Gigabit Ethernet port by using breakout cables. The 4 QSFP28 ports can be used as either access ports or uplink ports. The ACX5448 provides full duplex throughput of 800 Gbps. The ACX5448 has a 1 U form factor and is shipped with redundant fans and redundant power supplies. The router can be ordered with front-to-back airflow (air out or AFO) or back-to-front airflow (air in or AFI), and with AC or DC power supplies.

Figure 3 on page 19 shows the important components on the front of the ACX5448 router.

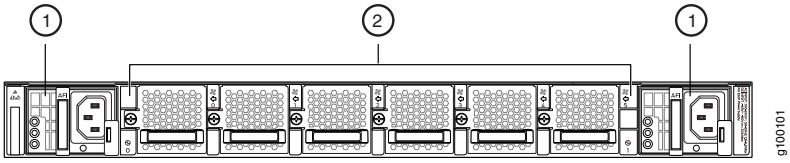
Figure 3: Front View of the ACX5448 Router



1—SFP+ ports	4—Console (**CON**) port
2—QSFP28 ports	5—**PPS** and **10M** GPS output ports
3—Management (**MGMT**) port	6—USB port

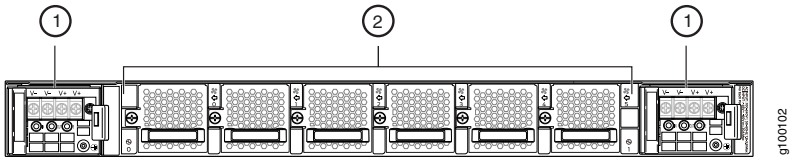
Figure 4 on page 19 and Figure 5 on page 19 shows the important components on the rear of the ACX5448 router.

Figure 4: Rear View of the AC-Powered ACX5448 Router



1—Power supply modules (AC)	2—Fan modules

Figure 5: Rear View of the DC-Powered ACX5448 Router



1—Power supply modules (DC)	2—Fan modules

The fan and power modules on the ACX5448 routers are located on the rear of the chassis. There are six slots for the fan modules and 2 slots for the power modules.

The fan module slot numbering for the six fan modules are from left to right (**0** through **5**). And, similarly the slot numbering for the two power modules are from left to right (**0** and **1**).

ACX5448 Router Models

The ACX5448 routers are available with either AC or DC power supply and with airflow-out (AFO) or airflow-in (AFI) cooling. The AFO is also sometimes known as front-to-back or port-to-FRU cooling, and similarly the AFI is sometimes known as back-to-front or FRU-to-port cooling.

Table 3 on page 20 lists the ordering or the model numbers for ACX5448 routers.

Table 3: ACX5448 Router Model Numbers and Description

Model Number	Power Supply	Airflow
ACX5448-AC-AFI	AC	Air In (back-to-front)
ACX5448-DC-AFI	DC	Air In (back-to-front)
ACX5448-AC-AFO	AC	Air Out (front-to-back)
ACX5448-DC-AFO	DC	Air Out (front-to-back)

CAUTION: Do not mix different types (AC and DC) of power supplies and different airflow modules (AFI and AFO) in the same chassis.

Field-Replaceable Units in an ACX5448 Router

Field-replaceable units (FRUs) are components that you can replace at your site. The ACX5448 FRUs are hot-insertable and hot-removable: you can remove and replace them without powering off the router or disrupting the routing function.

The following are the ACX5448 FRUs:

- Power supplies
- Fan modules
- Optical transceivers

CAUTION: Replace a failed power supply with a blank panel or new power supply within one minute of removal to prevent chassis overheating. The router 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 router with missing FRUs for longer than one minute.

NOTE: If you have a Juniper J-Care service contract, register any addition, change, or upgrade of hardware components at https://www.juniper.net/customers/csc/management/updateinstallbase.jsp. 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.

NOTE: Before removing the optical transceivers, we recommend that you disable the interface using the **set interfaces *interface-name* disable** command.

Understanding Hardware Redundancy of an ACX5448 Router Components and Functionality

The following hardware components provide redundancy on an ACX5448 router:

- Power supplies—The ACX5448 router has two power supplies. Each power supply provides power to all components in the router. If two power supplies are installed, the two power supplies provide full power redundancy to the device. If one power supply fails or is removed, the second power supply balances the electrical load without interruption.

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

  CAUTION: Do not connect both the power source feed to the same power supply input terminal.

- Cooling system—The ACX5448 router has six fan modules. If a fan module fails and is unable to keep the router within the desired temperature thresholds, chassis alarms occur and eventually the router can shut down. The router can work with one failed fan module for long duration, but for the router to work efficiently you must replace the failed fan module immediately.

ACX5448 Routers Hardware and CLI Terminology Mapping

Table 4 on page 21 describes the hardware terms used in an ACX5448 router documentation and the corresponding terms used in the Junos OS command line interface (CLI).

Table 4: CLI Equivalents of Terms Used in Documentation for an ACX5448 Router

Hardware Item (as displayed in the CLI)	Description (as displayed in the CLI)	Value (as displayed in the CLI)	Item in Documentation	Additional Information
Chassis	ACX5448	–	Router chassis	"Chassis Physical Specifications for an ACX5448 Router" on page 43
Routing Engine	Routing Engine	–	Built-in routing engine.	

Table 4: CLI Equivalents of Terms Used in Documentation for an ACX5448 Router (continued)

Hardware Item (as displayed in the CLI)	Description (as displayed in the CLI)	Value (as displayed in the CLI)	Item in Documentation	Additional Information
FPC *n*	Abbreviated name of the Flexible PIC Concentrator (FPC; an FPC is equivalent to a line card)	Value of *n* is always 0.	The router does not have actual FPCs. In this case, FPC refers to the router itself. Built-in FPC.	*Interface Naming Conventions Used in the Junos OS Operational Commands*
PIC *n*	Abbreviated name of the Physical Interface Card (PIC)	Value of *n* is a value in the range of 0-1.	The router does not have actual PIC devices; see entries for PIC 0 for the equivalent item on the router. Built-in network ports on the front panel of the router	*Interface Naming Conventions Used in the Junos OS Operational Commands*
xcvr *n*	Abbreviated name of the transceiver	*n* is a value equivalent to the number of the port in which the transceiver is installed.	Optical transceivers	*Port and Interface Specifications*
PEM *n*	Power supply	*n* is a value in the range of 0-1.	AC power supply DC power supply	"AC Power Supply for an ACX5448 Router" on page 35 "DC Power Supply for an ACX5448 Router" on page 37
Fan tray	Fan	*n* is a value in the range of 0-5.	Fan	"Cooling System and Airflow in an ACX5448 Router" on page 30

ACX5448 System Software Overview

The ACX5448 routers use the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. Junos OS is installed on an ACX5448 router's 100-gigabyte (GB) internal solid state flash drive. The same Junos OS code base that runs on an ACX5448 router also runs on all Juniper Networks QFX and EX Series switches, and J Series, MX Series, ACX Series, PTX Series and T Series routers.

For more information about which features are supported on an ACX5448 routers, see Feature Explorer.

You manage the router using the Junos OS command-line interface (CLI), accessible through the console and out-of-band management ports on the router.

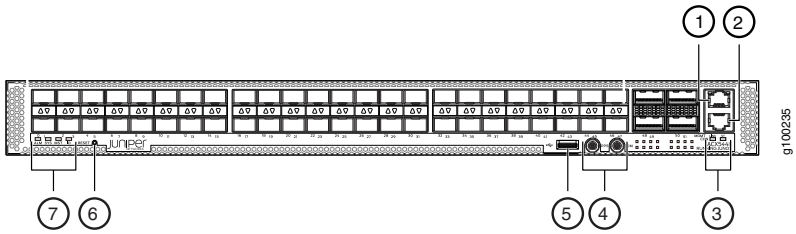
ACX5448 Chassis

Management Panel of an ACX5448 Router

The management panel of the ACX5448 router is found on the front of the router along with the interface ports.

Figure 6 on page 23 shows the management panel components on the ACX5448 router.

Figure 6: Management Panel Components on ACX5448



1—Management (**MGMT**) port	5—USB port
2—Console (**CON**) port	6—**RESET** button
3—**LINK** and **ST** LEDs	7—Status LEDs
4—**PPS** and **10M** GPS output ports	

The management panel consists of the following components:

- Status LEDs—**ALM**, **SYS**, **MST**, and **ID** LEDs
- Router product number
- Management **MGMT** port. RJ-45 connectors for 10/100/1000 BaseT. See "Connecting an ACX5448 Router to a Network for Out-of-Band Management" on page 72.
- Console **CON** port. RJ-45 port to support RS-232 serial ports.
- Link activity (left LED labeled **LINK**) and port status (right LED labeled **ST**) LEDs.
- USB port for image updates.

Port Panel of an ACX5448 Router

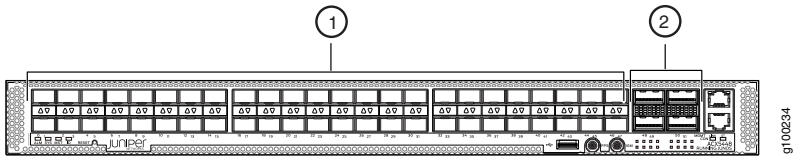
The port panel of the ACX5448 supports forty-eight SFP+ ports (**0** through **47**) that can operate as a native 10-Gigabit Ethernet port or as a 1-Gigabit Ethernet port when 1-gigabit optics are inserted.

The port panel of the ACX5448 also supports four QSFP28 ports (**48** through **51**) that can be configured as either a native 100-Gigabit Ethernet port, 40-Gigabit Ethernet port, four 25-Gigabit Ethernet port, or as four 10-Gigabit Ethernet port by using breakout cables.

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

Figure 7 on page 24 shows the port panel of a ACX5448 router.

Figure 7: ACX5448 Router Port Panel

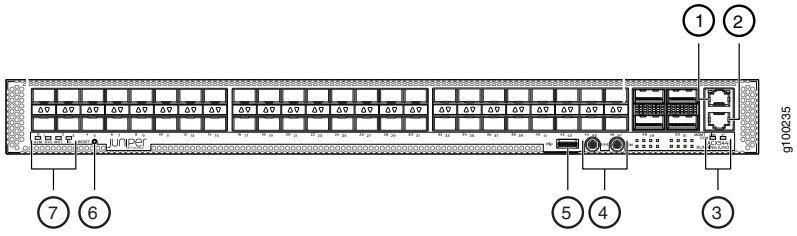


1—10–Gigabit Ethernet ports (48 SFP+ ports)	2—100–Gigabit Ethernet ports (4 QSFP28 ports)

Chassis Status LEDs on an ACX5448 Router

The ACX5448 routers has four status LEDs on the port side of the chassis (see callout 7 in Figure 8 on page 24).

Figure 8: Chassis Status LEDs on an ACX5448 Router



1—Management (**MGMT**) port	5—USB port
2—Console (**CON**) port	6—**RESET** button
3—**LINK** and **ST** LEDs	7—Status LEDs
4—**PPS** and **10M** GPS output ports	

Table 5 on page 25 describes the chassis status LEDs on an ACX5448 router, their colors and states, and the status they indicate. You can view the colors of the three LEDs remotely through the CLI by issuing the operational mode command **show chassis lcd**.

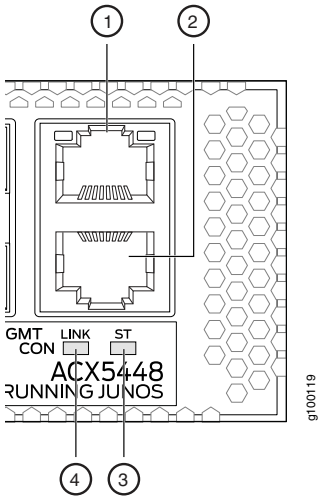
Table 5: Chassis Status LEDs on an ACX5448 Router

Name	Color	State	Description
ALM–Alarm or beacon	Unlit	Off	The router 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 router has halted. Power off the ACX5448 router 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 router to cool down. Power on the ACX5448 router 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 ACX5448 router by setting the AC power source outlet to the OFF (**O**) position, or unplugging the AC power cords. Power on the ACX5448 router and monitor the status LEDs to ensure that Junos OS boots properly.
SYS–System	Unlit	Off	The router is powered off or halted.
	Green	On steadily	Junos OS for ACX Series is loaded on the router.
MST–Master	Unlit	Off	The router is a linecard member.
	Green	On steadily	The router is a standalone router.
ID–Identification	Unlit	Off	The beacon feature is not enabled on the router. This feature is enabled using the **request chassis beacon** command.
	Blue	Blinking	The beacon feature is enabled on the router. This feature is enabled using the **request chassis beacon** command.

Management Port LEDs on an ACX5448 Router

The management ports (labeled **MGMT** for 10/100/1000 Base-T connections) on an ACX5448 router have two LEDs that indicate link status and link activity (see callout 3 in Figure 9 on page 26). The right LED indicates status; the left LED indicates link/activity.

Figure 9: Management Port LEDs on an ACX5448 Router



1—Management (**MGMT**) port	3—Status (**ST**) LED
2—Console (**CON**) port	4—Link/Activity (**LINK**) LED

Table 6 on page 26 describes the management port LEDs.

Table 6: Management Port LEDs on an ACX5448 Router

LED	Color	State	Description
LINK (Link/Activity; left)	Green	Blinking or flickering	A link is established, and there is link activity.
		On steadily	A link is established, but there is no link activity.
		Off	No link is established, there is a fault, or the link is down.
ST (Status; right)	Green	Blinking at an interval of 200 ms	Indicates that the port speed is 10 Mbps.
		Blinking at an interval of 83 ms	Indicates that the port speed is 100 Mbps.
		On steadily	Indicates that the port speed is 1000 Mbps.

Access Port and Uplink Port LEDs on an ACX5448 Router

The Link/Activity and Status LED configuration for ACX5448 routers use bi-colored LEDs. The link LED indicates link activity or a fault. The status LED indicates transceiver presence.

Table 7 on page 27 describes how to interpret the SFP+ port LEDs (**0** through **47**).

Table 7: Network Port LEDs on SFP+ Ports on an ACX5448 Router

Mode	Color	State	Description
1-Gigabit Ethernet or 10-Gigabit Ethernet	Green	On or flashing	Indicates that the port speed is 10-Gbps, and there are some activity.
	Amber	On or flashing	Indicates that the port speed is 1-Gbps, and there are some activity.
	Off	Unlit	There is no link on the port.

Table 8 on page 27 describes how to interpret the QSFP28 LEDs (**48** through **51**).

Table 8: Network Port LEDs on QSFP28 Ports on an ACX5448 Router

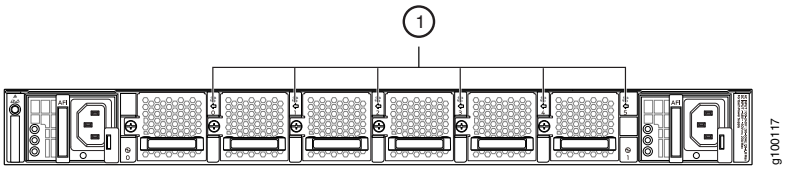
Mode	Color	State	Description
100-Gigabit Ethernet	Green	On or flashing	Indicates that the port speed is 100-Gbps, and there are some activity.
	Off	Unlit	There is no link on the port.
40-Gigabit Ethernet	Amber	On or flashing	Indicates that the port speed is 40-Gbps, and there are some activity.
	Off	Unlit	There is no link on the port.
25-Gigabit Ethernet	Green	On or flashing	Indicates that the port speed is 25-Gbps (using a 4x breakout cable), and there are some activity.
	Off	Unlit	There is no link on the port.
10-Gigabit Ethernet	Amber	On or flashing	Indicates that the port speed is 10-Gbps (using a 4x breakout cable), and there are some activity.
	Off	Unlit	There is no link on the port.

NOTE: There are four bi-color lane LEDs for each QSFP28 port and are located just below the QSFP28 ports. The first LED is used and the remaining LEDs are not used when the interface is configured at 40-Gigabit Ethernet or 100-Gigabit Ethernet, and connected to a QSFP28 transceiver. All four LEDs are used when the interface is configured at 10-Gigabit Ethernet or 25-Gigabit Ethernet, and the port is connected using an optical split cable (breakout cable) or a copper DACBO cable.

Fan Module LED on an ACX5448 Router

The ACX5448 fan module does not have any LED—the fan status LEDs are located on the ACX5448 chassis.Figure 10 on page 28 shows the location of the LED next to the fan module.

Figure 10: Fan Module LED in an ACX5448 Router



1— Fan LEDs	

Table 9 on page 28 describes the function of the fan tray LED.

Table 9: Fan Tray LED in an ACX5448 Router

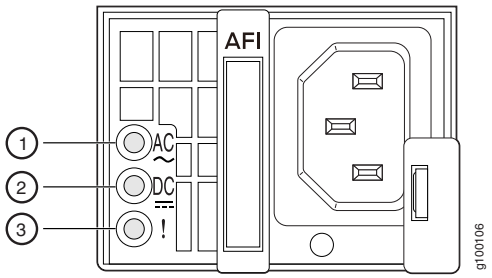
Name	Color	State	Description
Fan	Green	On steadily	The fan module is operating normally. The system has verified that the module is engaged, that the airflow is in the correct direction, and that the fan is operating correctly.
	Amber	Blinking	An error has been detected in the fan module. Replace the 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.

Power Supply LEDs on an ACX5448 Router

AC Power Supply LEDs on an ACX5448 Router

Figure 11 on page 29 shows the location of the LEDs on the power supply.

Figure 11: AC Power Supply LEDs on an ACX5448 Router



1—Input status LED	3—Fault LED
2—Output status LED	

Table 10 on page 29 describes the LEDs on the AC power supplies.

Table 10: AC Power Supply LEDs on an ACX5448 Router

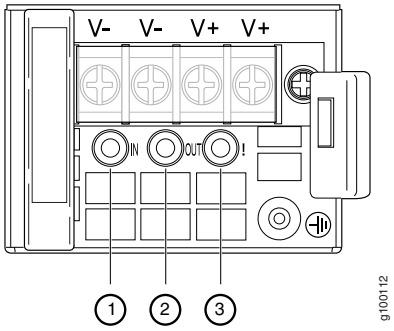
LED	Color	State	Description
AC	Unlit	Off	There is no input power to the power supply.
	Green	On steadily	There is input AC power to the power supply
DC	Unlit	Off	There is no output voltage from the power supply. Check the power supply unit.
	Green	On steadily	There is output voltage from the power supply.
! (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.

DC Power Supply LEDs on an ACX5448 Router

Figure 12 on page 30 shows the location of the LEDs on the DC power supply.

Figure 12: DC Power Supply Faceplate on an ACX5448 Router



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 11 on page 30 describes the LEDs on the DC power supplies.

Table 11: DC Power Supply LEDs on an ACX5448 Router

Name	Color	State	Description
IN	Unlit	Off	There is no input power to the power supply.
	Green	On steadily	There is input DC power to the power supply
OUT	Unlit	Off	There is no output voltage from the power supply. Check the power supply unit.
	Green	On steadily	There is output voltage from the power supply.
! (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.

Cooling System and Airflow in an ACX5448 Router

The cooling system in ACX5448 routers consists of six fan modules and a single fan in each power supply. The ACX5448 routers can be set up to work in the following airflow direction:

- Airflow In (AFI)—Air comes into the router through the vents in the field-replaceable units (FRUs)
- Airflow Out (AFO)—Air comes into the router through the vents in the front panel.

CAUTION: **Airflow In and Airflow Out fans and power supplies cannot be mixed in the same chassis.**

This topic describes:

- Fan Modules on page 31
- Fan Module and Power Supply Requirement on page 33
- Fan Module Status on page 34

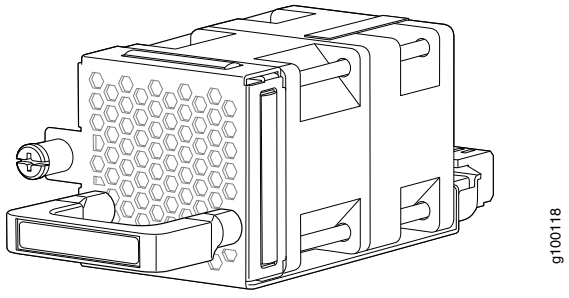
Fan Modules

The fan modules in ACX5448 routers are hot-insertable and hot-removable field-replaceable units (FRUs). The fan modules are installed in the fan module slots on the rear of the router. The ACX5448 router support six fan modules numbered **0** through **5** from left to right, with each fan module slot having a fan icon next to it.

The ACX5448 router is available with either front-to-back airflow (air out, ports-to-FRUs or AFO), or back-to-front airflow (air in, FRUs-to-ports or AFI). In AFO models, the air is pulled through the front of the chassis toward the fan trays, from where itis exhausted out of the system. Whereas in AFI models, the air is pulled through the fan trays and towards the front of thechassis, from where it is exhausted out of the system. The fan modules and the power modules are available in both AFO and AFI variants.

Figure 13 on page 31 shows the fan module.

Figure 13: Fan Module Used in ACX5448



You remove and replace a fan module from the FRU end of the chassis. The router 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 router.

Table 12 on page 32 lists the available fan module product SKUs and the direction of airflow in them.

Table 12: Fan Module in ACX5448 Routers

Fan Module	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
ACX5448-FAN-AFI	Figure 14 on page 33	**AIR IN**	Juniper Azure Blue	Air is pulled through the fan trays and towards the front of the chassis, from where it is exhausted out of the system.	You must install only power supplies that have **AIR IN** labels in routers in which the fan modules have **AIR IN** labels.
ACX5448-FAN-AFO	Figure 15 on page 33	**AIR OUT**	Juniper Gold	Air is pulled through the front of the chassis toward the fan trays, from where itis exhausted out of the system.	You must install only power supplies that have **AIR OUT** labels in routers in which the fan modules have **AIR OUT** labels.

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

Figure 14: Air In Airflow Through ACX5448 Chassis—AFI

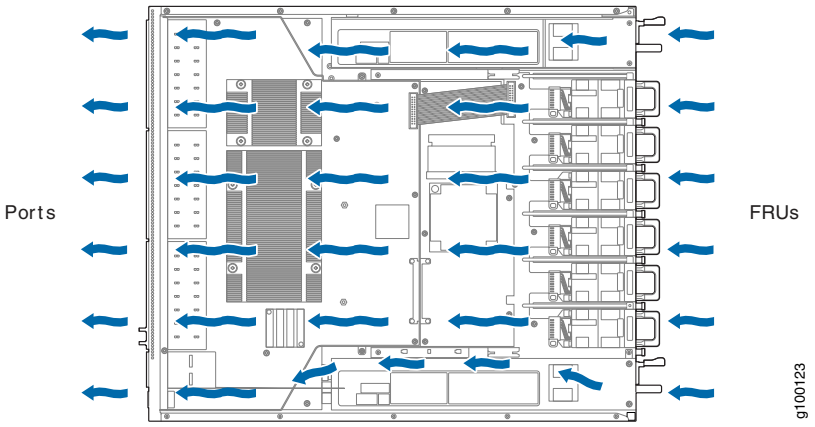
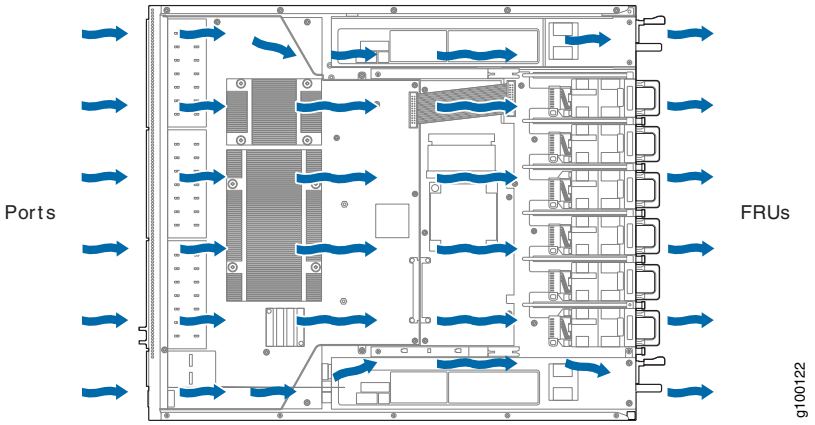


Figure 15: Air Out Airflow Through ACX5448 Chassis—AFO



Fan Module and Power Supply Requirement

Do not mix power supplies with different airflow. If the power supplies are color-coded, ensure they are either all azure blue for airflow in models or all gold for airflow out models. If the power supplies are not color-coded but have a label, ensure that the chassis is either using all airflow in (**AFI**) or using all airflow out (**AFO**).

Likewise, ensure that all fan modules have the same airflow and match the airflow of the power supplies. Fan modules are also either color-coded azure blue for airflow in orgold for airflow out.If the fan module has a label instead of being color-coded, ensure that labels (**AIR IN** and **AIR OUT**) are not mixed. If the fan modules have**AIR IN** labels, the power supplies must also have **AIR IN** labels; if the fan modules have **AIR OUT** labels, the power supplies must also have **AIR OUT** labels.

Mixing components with different airflows in the same chassis hampers the performance of the cooling system of the router 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 fan modules with different wattage. Only use the replacement fan modules that are designed for use with your product number. See Table 12 on page 32 for the correct part number for your ACX5448 router.

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

However, if you need to convert a ACX5448 device to have a different airflow, you can change the airflow pattern. To convert an **AIR IN** product SKU to an **AIR OUT** product SKU or an **AIR OUT** product SKU to a **AIR IN** product SKU, you must replace all of the fans and power supplies at one time to use the new direction. The system raises an alarm when the system is converted, which is normal.

Fan Module Status

You can check the status of fan modules through the **show system alarms** command or by looking at the LEDs next to each fan module. The fan module does not have any status LED—the fan module status LED is located on the router.

Each router has a Status LED for each fan module on the right side of the corresponding fan module slot. It indicates the status of the corresponding fan module.
Table 13 on page 34 describes the fan module Status LED in an ACX5448 router.

Table 13: Fan Module Status

LED Color	State	Description
Red	Solid	Indicates one of the following: • The fan module is not present. • 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.

ACX5448 Power System

- DC Power Supply for an ACX5448 Router on page 37
- DC Power Specifications for an ACX5448 Router on page 38

AC Power Supply for an ACX5448 Router

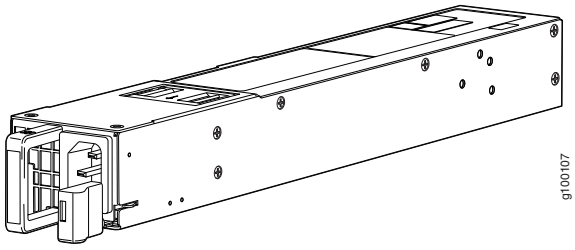
The two power supplies in ACX5448 routers are hot-removable and hot-insertable field-replaceable units (FRUs). The power supplies are installed in the router at the factory. The AC power supply in ACX5448 is 650 W. You can install replacement power supplies without powering off the router or disrupting the router function.

NOTE: Both the AFI and AFO power supplies look identical. Be sure to use the correct power supply for your chassis product SKU (see Table 14 on page 36).

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

Figure 16 on page 35 shows the AC power supply.

Figure 16: AC Power Supply in an ACX5448



The power supply provides FRU-to-port or port-to-FRU airflow depending on the product SKU you purchase. 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. 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.

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

Table 14 on page 36 shows the different power supplies and their direction of airflow.

Table 14: Airflow Direction in an ACX5448 AC Power Supplies

Power Module	Wattage	Direction of Airflow	Color of Power Supply Handle
JPSU-650W-AC-AI	650 W	Air In (back-to-front)	Juniper Azure Blue
JPSU-650W-AC-AO		Air Out (front-to-back)	Juniper Gold

AC Power Specifications for an ACX5448 Router

Table 15 on page 36 describes the AC power specifications for an ACX5448 router.

Table 15: AC Power Specifications for an ACX5448 Router

Item	Specification
AC input voltage	Operating range: • 100–240 VAC
AC input line frequency	50–60 Hz (all product SKUs)
AC input current rating	• 7.8 A at 100–120 VAC • 3.8 A at 200–240 VAC
Typical power consumption	250 W
Maximum power consumption	450 W

AC Power Cord Specifications for an ACX5448 Router

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 14.75 feet (approximately 4.5 meters) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52 and Canadian Electrical Code (CEC) Section 4-010(3). The cords that can be ordered for the ACX Series routers are in compliance.

Table 16 on page 36 lists AC power cord specifications provided for each country or region.

Table 16: AC Power Cord Specifications

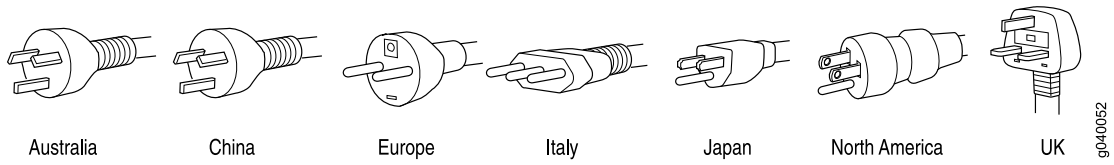
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
Argentina	250 VAC, 10 A, 50 Hz	IRAM 2073 Type RA/3	CBL-EX-PWR-C13-AR

Table 16: AC Power Cord Specifications (continued)

Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
Australia	250 VAC, 10 A, 50 Hz	AS/NZZS 3112 Type SAA/3	CBL-EX-PWR-C13-AU
Brazil	250 VAC, 10 A, 50 Hz	NBR 14136 Type BR/3	CBL-EX-PWR-C13-BR
China	250 VAC, 10 A, 50 Hz	GB 1002-1996 Type PRC/3	CBL-EX-PWR-C13-CH
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII Type VIIG	CBL-EX-PWR-C13-EU
India	250 VAC, 10 A, 50 Hz	IS 1293 Type IND/3	CBL-EX-PWR-C13-IN
Israel	250 VAC, 10 A, 50 Hz	SI 32/1971 Type IL/3G	CBL-EX-PWR-C13-IL
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16 Type I/3G	CBL-EX-PWR-C13-IT
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	SS-00259 Type VCTF	CBL-EX-PWR-C13-JP
Korea	250 VAC, 10 A, 50 Hz or 60 Hz	CEE (7) VII Type VIIGK	CBL-EX-PWR-C13-KR
North America	125 VAC, 13 A, 60 Hz	NEMA 5-15 Type N5-15	CBL-EX-PWR-C13-US
South Africa	250 VAC, 10 A, 50 Hz	SABS 164/1:1992 Type ZA/13	CBL-EX-PWR-C13-SA
Switzerland	250 VAC, 10 A, 50 Hz	SEV 6534-2 Type 12G	CBL-EX-PWR-C13-SZ
Taiwan	125 VAC, 11 A and 15 A, 50 Hz	NEMA 5-15P Type N5-15P	CBL-EX-PWR-C13-TW
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A Type BS89/13	CBL-EX-PWR-C13-UK

Figure 17 on page 37 illustrates the plug on the power cord for some of the countries or regions listed in Table 16 on page 36.

Figure 17: AC Plug Types



DC Power Supply for an ACX5448 Router

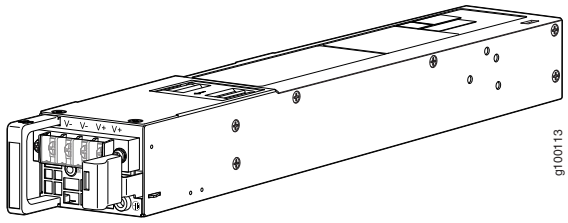
The two power supplies in ACX5448 routers are hot-removable and hot-insertable field-replaceable units (FRUs). The power supplies are installed in the router at the factory. The DC power supply in ACX5448 is 650 W with dual feeds for power resiliency. You can install replacement power supplies from the management panel without powering off the router or disrupting the router function.

NOTE: Both the AFI and AFO power supplies look identical. Be sure to use the correct power supply for your chassis product SKU (see Table 17 on page 38).

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

Figure 18 on page 38 shows the DC power supply.

Figure 18: DC Power Supply in ACX5448 Routers



NOTE: The DC power supply in the router 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.

Table 17 on page 38 shows the different power supplies and their direction of airflow.

Table 17: Airflow Direction in ACX5448 DC Power Supplies

Product Number	Wattage	Direction of Airflow	Color of Power Supply Handle
JPSU-650W-DC-AFI	650 W	Air In (back-to-front)	Juniper Azure Blue
JPSU-650W-DC-AFO		Air Out (front-to-back)	Juniper Gold

DC Power Specifications for an ACX5448 Router

Table 18 on page 39 describes the DC power specifications for DC variant of an ACX5448 router.

Table 18: DC Power Specifications for an ACX5448 Router

Item	Specifications
DC input voltage	• Rated operating voltage: –48 VDC to –60 VDC • Operating voltage range: –40.8 VDC through –72 VDC
DC input current rating	20 A maximum
Typical power consumption	250 W
Maximum power consumption	450 W

CHAPTER 2

Site Planning, Preparation, and Specifications

Site Preparation Checklist for an ACX5448 Router

The checklist in Table 19 on page 41 summarizes the tasks you need to perform when preparing a site for an ACX5448 router installation.

Table 19: 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 router tolerances.	"ACX5448 Router Environmental Requirements and Specifications" on page 44		
Power			
Measure the distance between external power sources and router installation site.			
Calculate the power consumption and requirements.	"AC Power Specifications for an ACX5448 Router" on page 36 "DC Power Specifications for an ACX5448 Router" on page 38		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the router.	"Rack Requirements for an ACX5448 Router" on page 47 "Cabinet Requirements for an ACX5448 Router" on page 46		

Table 19: 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 ACX5448 Router" on page 46		
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.	"Determining Transceiver Support for the ACX5448" on page 48 *Cable Specifications for QSFP+ and QSFP28 Transceivers*		
Plan the cable routing and management.			

ACX5448 Site Guidelines and Requirements

General Site Guidelines

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.

See Also
- Prevention of Electrostatic Discharge Damage on page 124

Site Electrical Wiring Guidelines

Table 20 on page 43 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.
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 device • Electrical hazards as a result of power surges conducted over the lines into the equipment

Chassis Physical Specifications for an ACX5448 Router

The ACX5448 router chassis is a rigid sheet-metal structure that houses the hardware components. Table 21 on page 44 summarizes the physical specifications of an ACX5448 router and it's components.

Table 21: Physical Specifications for an ACX5448 Router Chassis and FRUs

Item	Height	Width	Depth	Weight
ACX5448	1.70 in. (4.33 cm)	17.26 in. (43.84 cm)	Without fan and power module handles: 20.29 in. (51.53 cm) Without fan and power module handles: 21.81 in.(55.41 cm)	• With FRUs installed: 22.48 lb (10.2 kg) • With no FRUs installed: 16 lb (7.26 kg)
Fan tray	1.62 in. (4.11 cm)	1.59 in. (4.05 cm)	3.62 in. (9.19 cm)	0.35 lb (0.16 kg)
AC power supply	1.58 in. (4.01 cm)	2.23 in. (5.66 cm)	14.50 in. (36.83 cm)	2.2 lb (1 kg)
DC power supply	1.67 in. (4.24 cm)	2.23 in. (5.66 cm)	14.53 in. (36.91 cm)	2.2 lb (1 kg)

ACX5448 Router Environmental Requirements and Specifications

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

Follow these environmental guidelines:

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

Table 22 on page 44 provides the required environmental conditions for normal router operation.

Table 22: ACX5448 Router Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation to 6,000 feet (1,829 meters)
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing • Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing NOTE: As defined in NEBS GR-63-CORE, Issue 3, short-term events can be up to 96 hours in duration but not more than 15 days per year.
Temperature	• Normal operation ensured in temperature range of 32° F through 104° F (0° C through 40° C) • Non-operating storage temperature in shipping container: –40° F through 158° F (–40° C through 70° C)

Table 22: ACX5448 Router Environmental Tolerances (continued)

Description	Tolerance
Seismic	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 3.

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

ACX5448 Grounding Cable and Lug Specifications

For installations that require a separate grounding conductor to the chassis, the router must be adequately grounded before power is connected to ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements. To ground an ACX5448 router, connect a grounding cable to earth ground and then attach it to the chassis grounding points.

WARNING: The router 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.

WARNING: To comply with GR-1089 requirements, all intra-building copper cabling used for SFP+ and QSFP+ ports must be shielded and grounded at both ends.

CAUTION: Before router installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. See "Connecting Earth Ground to an ACX5448 Router" on page 64. A cable with an incorrectly attached lug can damage the router.

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

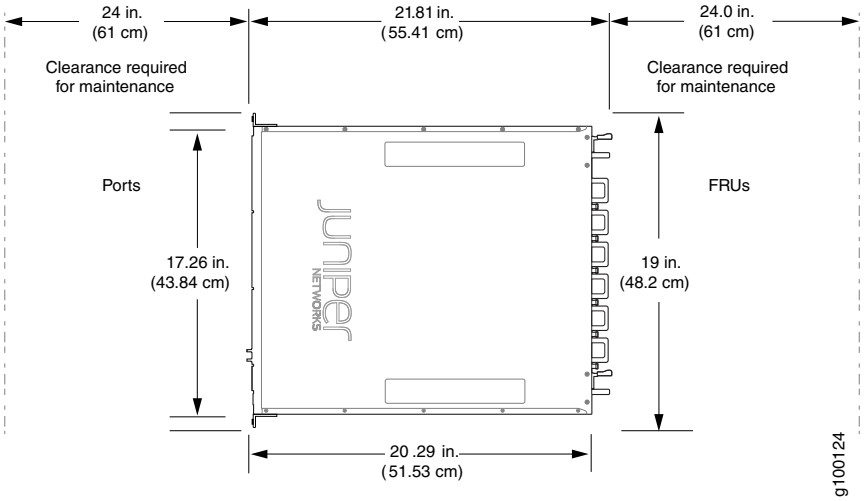
- A protective earthing terminal bracket is required for connecting the chassis to earth ground. This two-holed bracket attaches on the side of the chassis through the mounting rail and provides a protective earthing terminal for the router. The grounding points are in the form of studs sized for #10–32 pan head screws. The #10–32 pan head screws with integrated washers are not provided in the accessory kit. The grounding points are spaced at 0.63-in. (16-mm) centers.

- The grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided). The grounding lug accommodates 12 AWG (2.5 mm²) stranded wire.
- The grounding cable that you provide for the chassis must be the same size or heavier than the input wire of each power supply. Minimum recommendations are 12 AWG (2.5 mm²) stranded wire, 60° C wire, or as permitted by local code.

Clearance Requirements for Airflow and Hardware Maintenance for an ACX5448 Router

When planning the site for installing an ACX5448 router, you must allow sufficient clearance around the installed chassis (see Figure 19 on page 46).

Figure 19: Clearance Requirements for Airflow and Hardware Maintenance for an ACX5448 Router



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "Cooling System and Airflow in an ACX5448 Router" on page 30 for more information about the airflow through the chassis.
- If you are mounting an ACX5448 router 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.
- For service personnel to remove and install hardware components, and to accommodate the interface and power cable bendradius, there must be adequate space at the front and rear of the router. Allow at least 24 in. (61 cm) of space in the front andrear of the router.

Cabinet Requirements for an ACX5448 Router

You can mount an ACX5448 router in an enclosure or cabinet that contains a four-post 19-in. open 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 23 on page 47 provides the cabinet requirements and specifications for an ACX5448 router.

Table 23: Cabinet Requirements for an ACX5448 Router

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a ACX5448 router is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet airflow requirements	When you mount the router 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 router (or routers). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the router. 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 ACX5448 router fans exhaust hot air either through the vents on the port panel or through the fans and power supplies. Install the router 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 router and cabinet.

Rack Requirements for an ACX5448 Router

ACX5448 routers are designed to be installed on four-post racks.

Table 24 on page 47 provides the rack requirements and specifications for an ACX5448 router.

Table 24: Rack Requirements for an ACX5448 Router

Rack Requirement	Guidelines
Rack type	Use a four-post rack that provides bracket holes or hole patterns spaced at 1–U increments (1.75 in. or 4.45 cm) and that the rack 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	Ensure that the holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm) so that the router can be mounted in any rack that provides holes spaced at that distance.

Table 24: Rack Requirements for an ACX5448 Router (continued)

Rack Requirement	Guidelines
Rack size and strength	• Ensure that the rack complies with the standards for a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association. • Use a 800-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 (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 router chassis' external dimensions. The outer edges of the front-mounting brackets extend the width to 19 in. (48.26 cm). • Ensure that for four-post installations, the front and rear rack rails are spaced between 23.6 in. (60 cm) and 36 in. (91.4 cm) front-to-back. • Ensure that the rack is strong enough to support the weight of the router. The fully configured ACX5448 router weighs about 22.48 lb (10.2 kg). • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the router 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.

ACX5448 Network Cable and Transceiver Planning

Determining Transceiver Support for the ACX5448

You can find information about the pluggable transceivers supported on your Juniper Networks device by using the Hardware Compatibility Tool. In addition to transceiver and connector type, the optical and cable characteristics—where applicable—are documented for each transceiver. The Hardware Compatibility Tool enables you to search by product, displaying all the transceivers supported on that device, or category, by interface speed or type. The list of supported transceivers for the ACX5448 is located at https://apps.juniper.net/hct/product/#prd=ACX5448.

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.

See Also
- *Cable Specifications for QSFP+ and QSFP28 Transceivers*

Cable Specifications for QSFP+ and QSFP28 Transceivers

The 40-Gigabit Ethernet QSFP+ and 100-Gigabit Ethernet QSFP28 transceivers that are used in ACX routers use 12-ribbon multimode fiber crossover cables with female MPO connectors (SR4 optics only). The fiber can be either OM3 or OM4. These cables are not sold by Juniper Networks.

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

TIP: Ensure that you order cables with the correct polarity. Vendors refer to these crossover cables as *key up to key up*, *latch up to latch up*, *Type B*, or *Method B*. If you are using patch panels between two QSFP+ or QSFP28 transceivers, ensure that the proper polarity is maintained through the cable plant.

Table 25 on page 49 describes the signals on each fiber. Table 26 on page 50 shows the pin to pin connections for proper polarity.

Table 25: QSFP+ MPO Cable Signals

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

Table 25: QSFP+ MPO Cable Signals (continued)

Fiber	Signal
12	Rx0 (Receive)

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

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

Calculating Power Budget and Power Margin for Fiber-Optic Cables

Use the information in this topic and the specifications for your optical interface to calculate the power budget and power margin for fiber-optic cables.

TIP: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

To calculate the power budget and power margin, perform the following tasks:

1. Calculating Power Budget for Fiber-Optic Cable on page 51
2. Calculating Power Margin for Fiber-Optic Cable on page 51

Calculating Power Budget for Fiber-Optic Cable

To ensure that fiber-optic connections have sufficient power for correct operation, you need to calculate the link's power budget, which is the maximum amount of power it 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 of power budget (P_B), you assume minimum transmitter power (P_T) and minimum receiver sensitivity (P_R):

$$P_B = P_T - P_R$$

The following hypothetical power budget equation uses values measured in decibels (dB) and decibels referred to one milliwatt (dBm):

$$P_B = P_T - P_R$$

$$P_B = -15 \text{ dBm} - (-28 \text{ dBm})$$

$$P_B = 13 \text{ dB}$$

Calculating Power Margin for Fiber-Optic Cable

After calculating a link's power budget, you can calculate the power margin (P_M), which represents the amount of power available after subtracting attenuation or link loss (LL) from the power budget (P_B). A worst-case estimate of P_M assumes maximum LL:

$$P_M = P_B - LL$$

P_M greater than zero indicates that the power budget is sufficient to operate the receiver.

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 27 on page 51 lists an estimated amount of loss for the factors used in the following sample calculations. For information about the actual amount of signal loss caused by equipment and other factors, refer to vendor documentation.

Table 27: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value
Higher-order mode losses	Single-mode—None Multimode—0.5 dB
Modal and chromatic dispersion	Single-mode—None Multimode—None, if product of bandwidth and distance is less than 500 MHz-km
Connector	0.5 dB
Splice	0.5 dB

Table 27: Estimated Values for Factors Causing Link Loss (continued)

Link-Loss Factor	Estimated Link-Loss Value
Fiber attenuation	Single-mode—0.5 dB/km Multimode—1 dB/km

The following sample calculation for a 2-km-long multimode link with a power budget (P_B) of 13 dB uses the estimated values from Table 27 on page 51 to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

$P_M = 13\ dB – 2\ km\ (1\ dB/km) – 5\ (0.5\ dB) – 2\ (0.5\ dB) – 0.5\ dB$

$P_M = 13\ dB – 2\ dB – 2.5\ dB – 1\ dB – 0.5\ dB$

$P_M = 7\ dB$

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 27 on page 51 to calculate link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

$P_M = 13\ dB – 8\ km\ (0.5\ dB/km) – 7(0.5\ dB)$

$P_M = 13\ dB – 4\ dB – 3.5\ dB$

$P_M = 5.5\ dB$

In both examples, the calculated power margin is greater than zero, indicating that the link has sufficient power for transmission and does not exceed the maximum receiver input power.

Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

This topic describes signal loss, attenuation, and dispersion in fiber-optic cable.

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 52
- Attenuation and Dispersion in Fiber-Optic Cable on page 53

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 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, higher-order mode loss results. Together these factors limit the transmission distance of multimode fiber compared with single-mode fiber.

Single-mode fiber is so small in diameter that rays of light can 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 with multimode fiber, single-mode fiber has higher bandwidth and can carry signals for longer distances.

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

Attenuation and Dispersion in Fiber-Optic Cable

Correct functioning of an optical data link depends on modulated light reaching the receiver with enough power to be demodulated correctly. *Attenuation* is the reduction in power of the light signal as it is transmitted. Attenuation is caused by passive media components, such as cables, cable splices, and connectors. 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 have enough light available to overcome attenuation.

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

- Chromatic dispersion—Spreading of the signal over time resulting from the different speeds of light rays.
- Modal dispersion—Spreading of the signal over time resulting from 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 rather than modal dispersion limits 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 less than 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.

ACX5448 Management, and Console Port Specifications and Pinouts

Management Cable Specifications for ACX5448 Routers

Table 28 on page 54 lists the specifications for the cables that connect the console and management ports to management devices.

Table 28: Specifications of Cables to Connect to Management Devices

Ports	Cable Specifications	Receptacle	Additional Information
RJ-45 Console port	CAT5e UTP (unshielded twisted pair) cable	RJ-45	*Connecting a Device to a Management Console by Using an RJ-45 Connector*
Management Ethernet port	Ethernet cable with an RJ-45 connector	RJ-45	*Connecting a Device to a Network for Out-of-Band Management*

Management Port Connector Pinout Information for ACX Series Routers

The management port on an ACX Series router labeled **MGMT** uses an RJ-45 connector to connect to a management device for out-of-band management.

The port uses an autosensing RJ-45 connector to support a 10/100Base-T connection. Two LEDs indicate link/activity on the port and the administrative status of the port.

Table 29 on page 54 provides the pinout information for the RJ-45 connector for the management port.

Table 29: Management Port Connector Pinout Information

Pin	Description	Direction
1	TRD[0]-	In/Out
2	TRD[0]+	In/Out
3	TRD[1]-	In/Out
4	TRD[1]+	In/Out
5	TRD[2]-	In/Out
6	TRD[2]+	In/Out

Table 29: Management Port Connector Pinout Information (continued)

Pin	Description	Direction
7	TRD[3]-	In/Out
8	TRD[3]+	In/Out

Console/Auxiliary Port Connector Pinout on ACX Series Routers

The port on the front panel labeled **CONSOLE/AUX** is an asynchronous serial interface that accept an RJ-45 connector. Use a cable with the pinouts described in Table 30 on page 55 to connect the Routing Engine to an auxiliary or console management device.

NOTE: You must use a shielded twisted pair (STP) cable for both outdoor and indoor deployments.

Table 30: Connector Pinout for the Console/Auxiliary Port

Pin	Signal	Description	CPU	Direction
1	RTS	Request to Send	Routing Engine	Out
2	TXD	Transmit Data	1588 CPU	Out
3	TXD	Transmit Data	Routing Engine	Out
4	Ground	Signal Ground	–	–
5	Ground	Signal Ground	–	–
6	RXD	Receive Data	Routing Engine	In
7	RXD	Receive Data	1588 CPU	In
8	CTS	Clear to Send	Routing Engine	In

See Also

- Management Port Connector Pinout Information for ACX Series Routers on page 54

USB Port Specifications for an ACX Series Router

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

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

- RE-USB-4G-S

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

All USB flash drives used on ACX Series routers must have the following features:

- USB 2.0 or later.
- Formatted with a FAT or MS-DOS file system.

See Also

-

CHAPTER 3

Initial Installation and Configuration

ACX5448 Installation Overview

You can mount an ACX5448 router:

- Flush with the front of a 19-in. four-post rack. Use the standard mounting brackets provided with the router 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 ACX5448 router:

1. Follow the instructions in "Unpacking an ACX5448 Router" on page 58.

2. Determine how the device is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see "Mounting an ACX5448 Router in a Rack or Cabinet" on page 59.

3. Follow the instructions in:

   a. "Connecting Earth Ground to an ACX5448 Router" on page 64.

   b. "Connecting AC Power to an ACX5448 Router" on page 65 or "Connecting DC Power to an ACX5448 Router" on page 68, as required.

   c. *Registering Products—Mandatory for Validating SLAs*

4. "Initially Configuring the ACX5448 Router" on page 74.

Unpacking and Mounting the ACX5448

Unpacking an ACX5448 Router

The ACX5448 router chassis is a rigid sheet-metal structure that houses the hardware components. An ACX5448 router is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and quick start instructions.

CAUTION: **ACX5448 routers are maximally protected inside the shipping carton. Do not unpack the router until you are ready to begin installation.**

To unpack an ACX5448 router:

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 31 on page 58 lists the inventory of components supplied with an ACX5448 router.
5. Pull out the packing material holding the router in place.
6. Verify the chassis components received:
   - Two power supplies
   - Six fan modules
7. Save the shipping carton and packing materials in case you need to move or ship the router later.

Table 31: ACX5448 Router Parts List

Component	Quantity
Chassis with six fan modules and two power supplies	1
AC power cord (Generic, type C13 coupler) (only with AC-powered ACX5448 routers)	2

Table 31: ACX5448 Router Parts List (continued)

Component	Quantity
AC Power cord retainer clip (only with AC-powered ACX5448 routers)	2
End-user license agreement (EULA)	1
Warranty card	1
Documentation roadmap card	1
Accessory kit (see Table 32 on page 59)	1

Table 32: Accessory Box Parts List

Component	Quantity
4–Post rack-mounting kit	1
7-ft serial cable to connect the Routing Engine to a management console (DB-9 to RJ-45 adapter, straight through)	1

Mounting an ACX5448 Router in a Rack or Cabinet

You can mount an ACX5448 router 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 router to be mounted flush with the rack and still be adjustable for racks with different depths.

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 59
- Install the ACX5448 Chassis in the Rack on page 61

Before You Begin Rack Installation

Before you begin mounting a ACX5448 router 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 124.

2. Verify that the site meets the requirements described in "Site Preparation Checklist for an ACX5448 Router" on page 41.

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 42, with particular attention to *Chassis and Component Lifting Guidelines*.

5. Remove the router from the shipping carton. See "Unpacking an ACX5448 Router" on page 58.

6. Ensure that you have the following parts and tools available to mount the router in a rack:

NOTE: **The ACX5448 routers can be installed on a four-post rack or cabinet. The mounting blades, rails, and the respective screws for the four-post installation comes with the ACX5448 routers.**

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

Optional equipment: Grounding cable kit with bracket, lug, and two screws with integrated washers.

WARNING: **The 1 U ACX5448 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 routers require two people for installation, one person to lift the router into place, and another person to attach the router to the rack. If you are installing the routers 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 router.

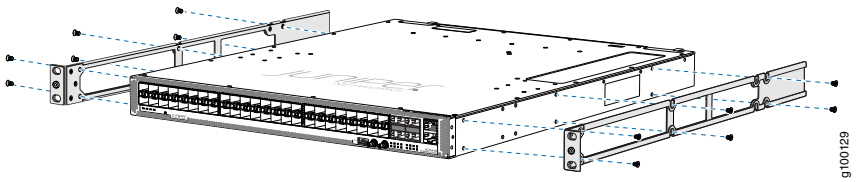
CAUTION: If you are mounting multiple routers on a rack, mount the router in the lowest position of the rack first. Proceed to mount the rest of the routers from the bottom to the top of the rack to minimize the risk of the rack toppling.

Install the ACX5448 Chassis in the Rack

To install the router in a rack or cabinet:

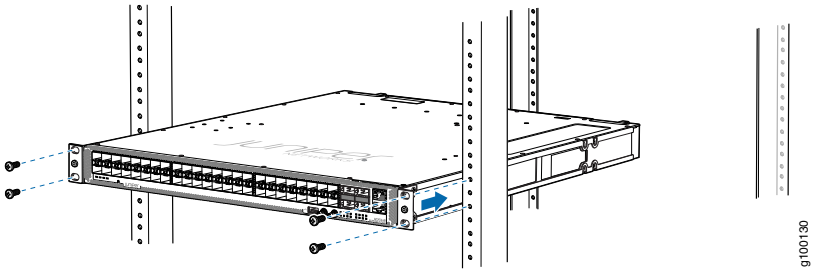
1. Position the router in front of the rack or cabinet.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and to a site ESD point.
3. Align the holes in the front mounting brackets with the holes on the side of the chassis (see Figure 20 on page 61).

Figure 20: Attaching the Mounting Brackets



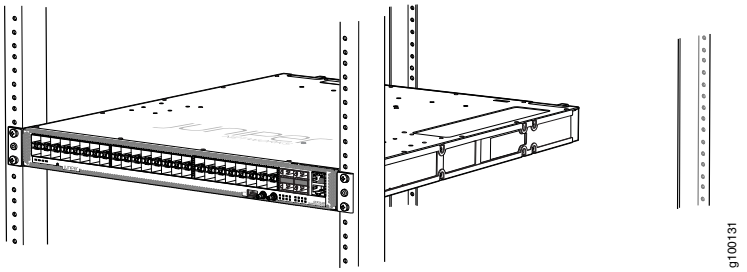
4. Using a Phillips (+) number 2 screwdriver, secure the mounting brackets to the router using the mounting screws.
5. With one person on each side, hold on to the bottom of the chassis and carefully lift it so that the mounting brackets contact the rack rails.
6. Carefully slide the router onto the mounting brackets until the front-mounting brackets attached to the chassis contact the rack rails (see Figure 21 on page 62).

Figure 21: Installing the Router in a Four-Post Rack



7. Install mounting screws into each of the open front-mounting holes aligned with the rack, starting from the bottom, and secure them tightly. Figure 22 on page 62 shows the router fully secured to the front rails of the four-post rack.

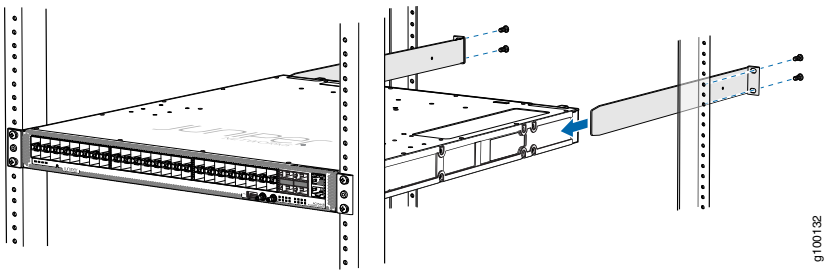
Figure 22: Router Secured by Front-Mounting Brackets



8. On the rear of the chassis, slide the rear-mounting brackets on either side of the chassis until the rear-mounting brackets contact the rack rails (see Figure 23 on page 62).

   The rear-mounting brackets on each side of the chassis are movable. You can adjust the brackets according to the depth of the rack.

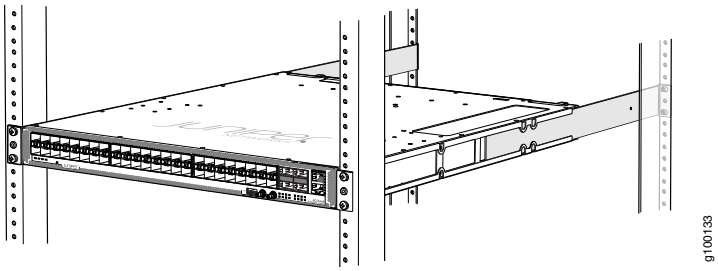
Figure 23: Installing the Rear-Mounting Brackets



9. Install mounting screws into each of the open rear-mounting holes aligned with the rack, starting from the bottom, and secure them tightly.

10. Visually inspect the alignment of the chassis. If the chassis is installed properly in the rack, all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side, and the router is level. Figure 24 on page 63 shows the router fully secured and installed in a four-post rack.

Figure 24: Router Installed in the Rack



Connecting the ACX5448 to Power

- Connecting Earth Ground to an ACX5448 Router on page 64
- Connecting AC Power to an ACX5448 Router on page 65
- Connecting DC Power to an ACX5448 Router on page 68

Connecting Earth Ground to an ACX5448 Router

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected.

A protective earthing terminal bracket is required for connecting the chassis to earth ground. This two-holed bracket attaches on the side of the chassis through the mounting rail and provides a protective earthing terminal for the router. The grounding points are in the form of studs sized for #10–32 pan head screws. The #10–32 pan head screws with integrated washers are not provided in the accessory kit. The grounding points are spaced at 0.63-in. (16-mm) centers.

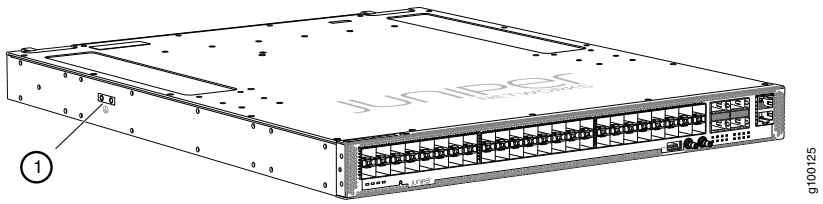
You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points by using two #10–32 pan head screws. You must provide the grounding cables.

NOTE: **The grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided). The grounding lug accommodates 12 AWG (2.5 mm²) stranded wire. The grounding cable that you provide for the chassis must be the same size or heavier than the input wire of each power supply. Minimum recommendations are 12 AWG (2.5 mm²) stranded wire, 60° C wire, or as permitted by local code.**

To ground the ACX5448 router:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the other end of the strap to an approved site ESD grounding point. See the instructions for your site.
3. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.
4. Connect the grounding cable to a proper earth ground.
5. Detach the ESD grounding strap from the site ESD grounding point.
6. Connect the grounding strap to one of the ESD points on the chassis. Figure 25 on page 65 shows the ESD point on the router.

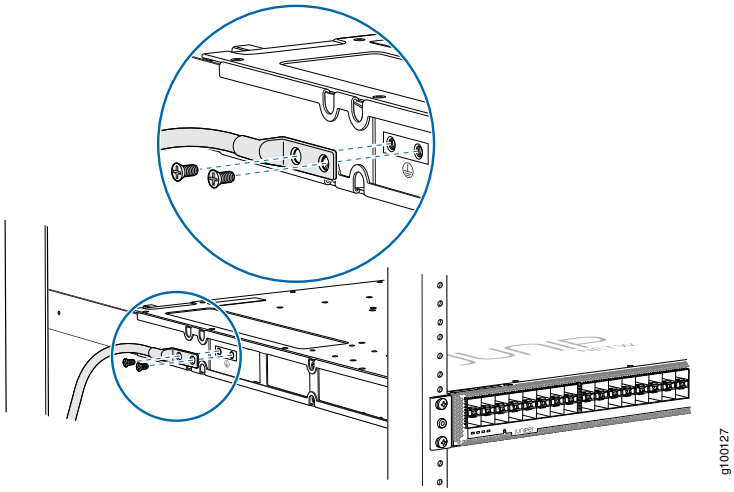
Figure 25: Grounding Point on the ACX5448 Router



1— Grounding point	

7. Place the grounding cable lug over the grounding point on the side of the chassis (see Figure 26 on page 65).

Figure 26: Connecting the Grounding Cable to ACX5448 Router



8. Secure the grounding cable lug with the screws. The holes are sized to accommodate #10–32 pan head screws.

9. Dress the grounding cable and verify that it does not touch or block access to router components, and that it does not drape where people could trip on it.

Connecting AC Power to an ACX5448 Router

The power supply in an ACX5448 router is a hot-removable and hot-insertable field-replaceable unit (FRU). You can remove and replace it without powering off the router or disrupting routing functions.

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

Before you begin connecting AC power to the router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).
- Ensure that you have connected the router chassis to earth ground.

CAUTION: Before you connect power to the router, 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 router (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 router chassis to connect to the earth ground. For instructions on connecting earth ground. The router gains additional grounding when you plug the power supply in the router into a grounded AC power outlet by using the AC power cord appropriate for your geographical location.

- Install the power supply in the chassis. For instructions on installing a power supply in a ACX5448 router.

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

To connect AC power to an ACX5448 router:

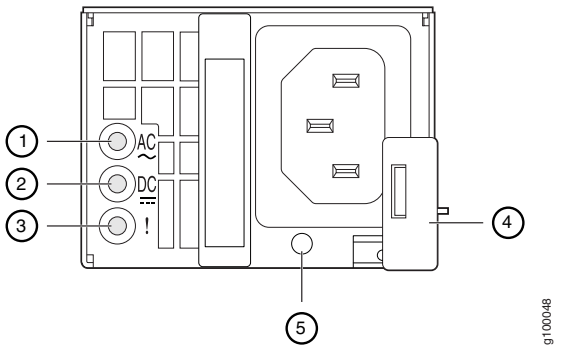
1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Power off the AC input appliance inlet on the source power supply.
3. Connect the power cord to the power supply source.

NOTE: Each power supply must be connected to a dedicated AC power feed and a dedicated customer-site 2-pole circuit breaker. We recommend that you use a dedicated customer-site circuit breaker rated for 20 A (110 VAC) or 16 A (220 VAC) minimum, or as required by local code.

4. Push the end of the AC power cord retainer strip into the hole next to the inlet on the power supply face plate on the router until it snaps into place. Ensure that the loop in the retainer strip faces toward the power cord.

   Figure 27 on page 67 shows the port on the AC power supply module where the power cord retainer is installed.

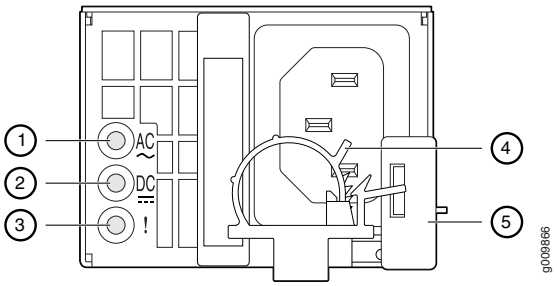
Figure 27: Power Cord Retainer Port on the AC Power Supply Module



1—Input status LED	4—Ejector lever
2—Output status LED	5—AC power cord retainer port
3—Fault LED	

Figure 28 on page 67 shows the power cord retainer installed on the AC power supply module.

Figure 28: Power Cord Retainer Installed on the AC Power Supply Module



1—Input status LED	4—AC power cord retainer installed
2—Output status LED	5—Ejector lever
3—Fault LED	

5. Press the small tab on the retainer strip to loosen the loop. Slide the loop until you have enough space to insert the power cord coupler into the inlet.

6. Insert the power cord coupler firmly into the inlet.

7. Slide the loop toward the power supply until it is snug against the base of the coupler.

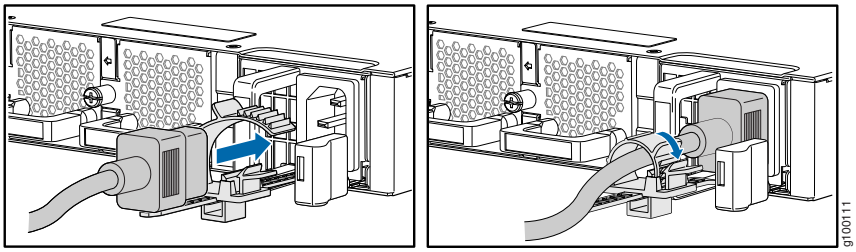
8. Press the tab on the loop and draw out the loop into a tight circle (see Figure 29 on page 68).

9. Route the power cord appropriately. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.

10. Power on the power supply at source.

11. Repeat Step 3 through Step 9 for the installing the remaining power supply.

Figure 29: Connecting an AC Power Cord to an ACX5448



Connecting DC Power to an ACX5448 Router

The power supply in an ACX5448 router is a hot-removable and hot-insertable field-replaceable unit (FRU). You can remove and replace it without powering off the router or disrupting routing functions.

WARNING: DC-powered ACX5448 routers are intended for installation only in a restricted access location.

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

Before you begin connecting DC power to the router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).
- Ensure that you have connected the router chassis to earth ground.

CAUTION: Before you connect power to the router, 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 router (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 router chassis to connect to the earth ground. For instructions on connecting earth ground.

- Install the power supply in the chassis. For instructions on installing a power supply in a ACX5448 router.

Ensure that you have the following parts and tools available:

- DC power source cables 12 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 ACX5448 router:

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

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

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

3. Ensure that the input 2-pole 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 130.

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 71).

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 71).

   The ACX5448 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 ACX5448; 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 2-pole circuit breaker.

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

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

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

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

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.

8. Replace the terminal block cover.

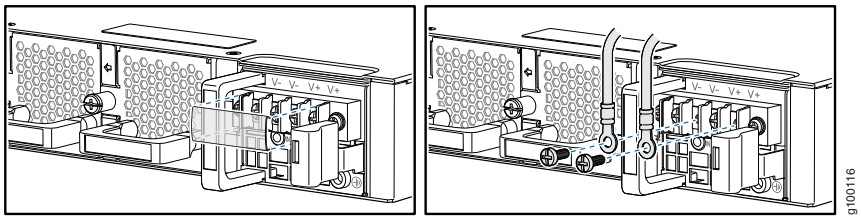
9. Close the input 2-pole circuit breaker.

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.

CAUTION: A system reboot with Routing Engine FPGA version 7.1 might not successfully boot the Junos OS software. In case of a system reboot failure, you need to power cycle the switch. To check the current FPGA version, issue the **show chassis firmware** command.

Figure 30: Connecting DC Power Cable to an ACX5448 Router



Connecting the ACX5448 to External Devices

Connecting an ACX5448 Router to a Management Console

The ACX routers has a console port with an RJ-45 connector. Use the console port to connect the device to a management console or to a console server.

Ensure that you have an RJ-45 to DB-9 rollover cable available. An RJ-45 cable with an RJ-45 to DB-9 adapter is provided with the device.

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 ACX routers, use a combination of the RJ-45 cable and RJ-45 to DB-9 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 ACX router to a management console (see Figure 31 on page 72 and Figure 32 on page 72):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**).
2. Connect the other end of the Ethernet cable into the console server (see Figure 31 on page 72) or management console (see Figure 32 on page 72).

Figure 31: Connecting the ACX Router to a Management Console Through a Console Server

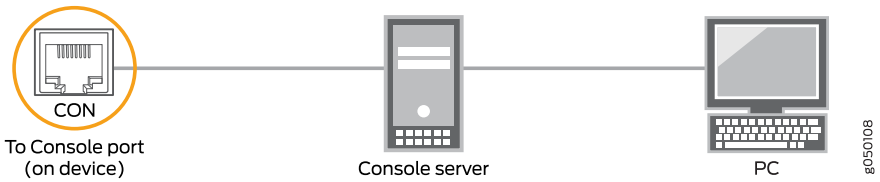


Figure 32: Connecting the ACX Router Directly to a Management Console

Connecting an ACX5448 Router to a Network for Out-of-Band Management

You can monitor and manage the ACX5448 router using a dedicated management channel. ACX5448 routers have a minimum of two management ports: a 10/100/1000BASE-T RJ-45 port and a 1-Gbps SFP ports. Some product SKUs have an additional 1-Gbps SFP port that can be used either for fiber or copper connections. Use the management ports to connect the ACX5448 router to a network for out-of-band management.

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

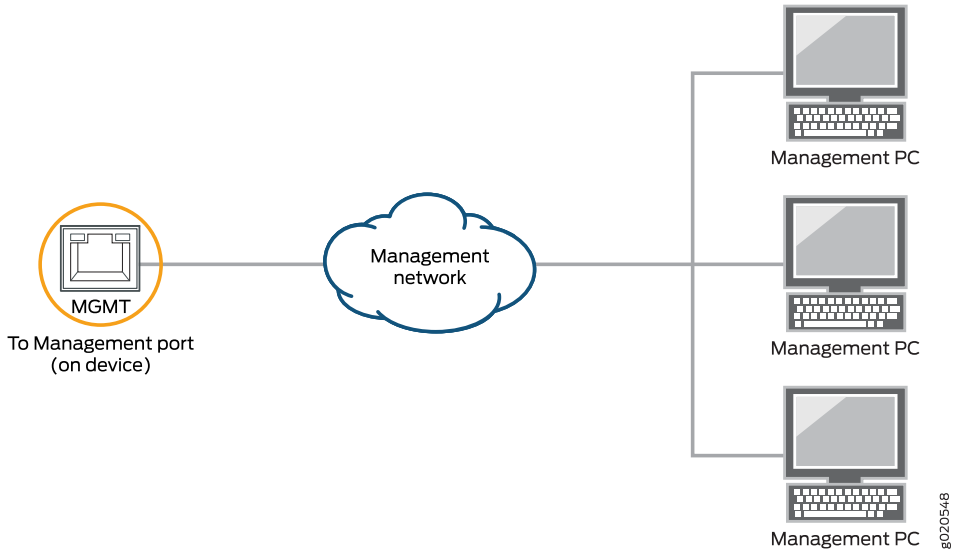
NOTE: You cannot use the management ports to perform the initial configuration of the ACX5448 router. You must configure the management ports before you can successfully connect to the ACX5448 router using these ports. See "Initially Configuring the ACX5448 Router" on page 74.

Ensure that you have an appropriate cable available. See "ACX5448 Network Cable and Transceiver Planning" on page 48.

To connect a ACX5448 router to a network for out-of-band management (see Figure 33 on page 73):

1. Connect one end of the cable to one of the management ports (labeled **C0** and **C1**) on the ACX5448 router.
2. Connect the other end of the cable to the management router (see Figure 33 on page 73).

Figure 33: Connecting a ACX5448 Router to a Network for Out-of-Band Management



Connecting an ACX5448 Router to External Clocking and Timing Devices

The router has two SMB connector ports that support 1-PPS and 10-MHz timing devices.

NOTE: Ensure that a cable of 3 m or less in length is used for the 10-MHz and 1-PPS connectors.

To connect the SMB to BNC coaxial cable to the external clocking input port:

1. Connect one end of the SMB to BNC coaxial cable to either the 1-PPS connector or the 10-MHz connector on the router.

2. Connect the other end of the SMB to BNC coaxial cable to the 1-PPS or 10-MHz measurement equipment.

NOTE: Ensure that the 10-MHz or 1-PPS source network equipment contains low voltage complementary metal oxide semiconductor (CMOS) or is compatible with low-voltage (3.3 V) transistor-transistor logic (TTL).

Initially Configuring the ACX5448 Router

You must perform the initial configuration of the ACX5448 router through the console port using the command-line interface (CLI).

Before you begin connecting and configuring an ACX5448 router, 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 router 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 router.

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

   ```
   login: root
   ```

3. Start the CLI.

   ```
   root@% cli
   ```

4. Enter configuration mode.

   ```
   root> configure
   ```

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

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

6. (Optional) Configure the name of the router. 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 router 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 front of the ACX5448 router.

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 a router through Telnet using root credentials. Root login is allowed only for SSH access.

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

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

CHAPTER 4

Maintaining Components

Maintaining ACX5448 Components

Replacing an ACX5448 Fan Module

Removing a Fan Module from an ACX5448 Router

The fan modules in ACX5448 routers are hot-removable and hot-insertable field replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing 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 a ACX5448 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).

Ensure that you have the following parts and tools available to remove a fan module from a ACX5448 router:

- ESD grounding strap

- Antistatic bag or an antistatic mat

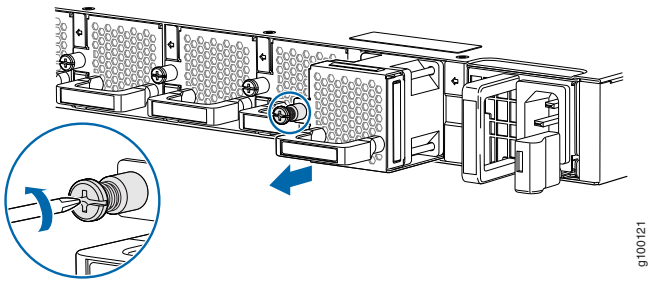
To remove a fan module from an ACX5448 router (see Figure 34 on page 78):

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 pull firmly to slide the fan module halfway out of the chassis.

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

Figure 34: Removing a Fan Module from an ACX5448 Router



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.**

Installing a Fan Module in an ACX5448 Router

The fan modules in an ACX5448 router are hot-removable and hot-insertable field replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing 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 port-to-FRU airflow (AFO) or FRU-to-port 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 a ACX5448 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).

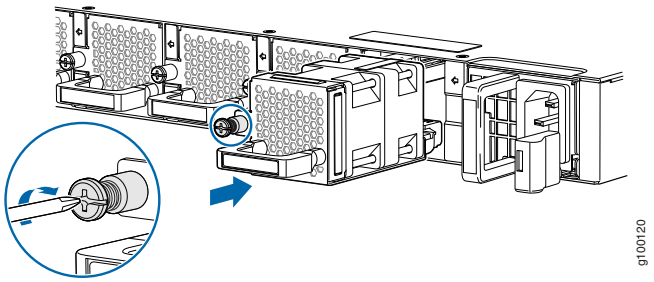
To install a fan module in an ACX5448 router (see Figure 35 on page 79):

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 router product SKU with the airflow marking on the handle to ensure that you are installing a fan module with the same airflow direction as the chassis. The fan modules are designed so that they can only be inserted into the ACX5448 product SKU that supports the same airflow type. See "Cooling System and Airflow in an ACX5448 Router" on page 30 for more information.

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

Figure 35: Installing a Fan Module in an ACX5448 Router



Replacing an ACX5448 AC Power Supply

Removing a Power Supply from an ACX5448 Router

The power supplies in an router are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.

Before you remove a power supply from a router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).

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

- 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 router (see Figure 36 on page 81):

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 router, you need to power off the router before removing the power supply. See "Powering Off an ACX5448 Router" on page 92.

3. Disconnect power to the router:
   - 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.

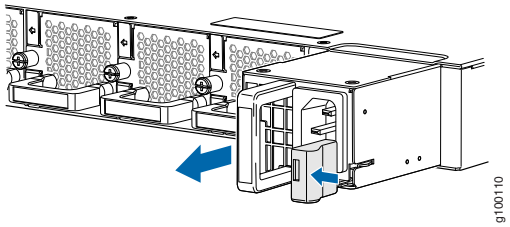
5. Slide the locking lever toward the handle until it stops.

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 36: Removing Power Supply from an ACX5448



Installing a Power Supply in an ACX5448 Router

The power supplies in an router are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.

- Before you install a power supply in a router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 124).
- 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 ACX5448 Router" on page 30 for more information.

To install a power supply in an router (see Figure 37 on page 82):

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 router and slide it in until it is fully seated and the locking lever slides into place.

4. Press the latch located on the side of the power supply to slide it into the chassis.

5. Attach the power cord to the power supply.

6. Attach the power cord to the AC power source, and switch on the dedicated customer-site 2-pole circuit breaker. Follow the instructions for your site.

7. Observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Figure 37: Installing Power Supply in an ACX5448

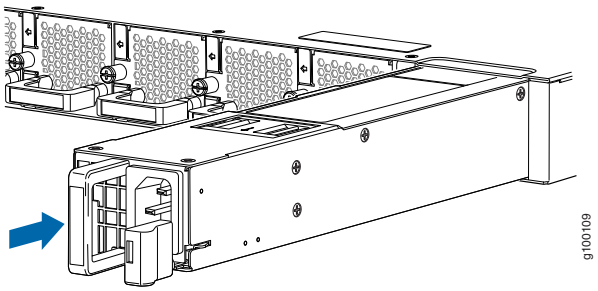
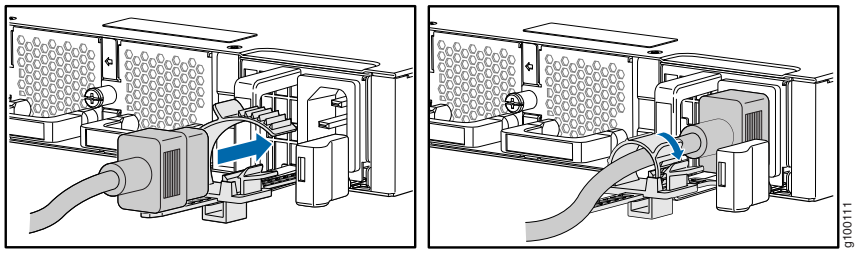


Figure 38: Installing Power Cord in an ACX5448



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

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

Replacing an ACX5448 DC Power Supply

Removing an ACX5448 DC Power Supply

Before you remove a power supply, be aware of the following:

NOTE: The minimum required number of power supply modules must be present in the router at all times.

WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the 2-pole circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

CAUTION: Do not mix AC and DC power supply modules in the same chassis.

To remove a DC power supply:

1. Switch off the dedicated customer-site 2-pole circuit breaker for the power supply being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the status LED on the power supply is not lit.
4. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
5. Remove the clear plastic cover protecting the terminal studs on the faceplate.
6. Using a socket screw driver, remove the screw from each of the DC power terminals (see Figure 39 on page 84).
7. Remove the cable lugs from the terminals.
8. Carefully move the power cables out of the way.
9. Press the latch located on the DC power supply, to release it from the chassis.
10. Pull the power supply straight out of the chassis (see Figure 40 on page 85).

Figure 39: Disconnecting the DC Power Cables

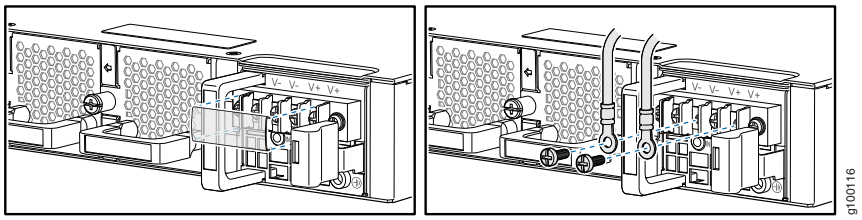
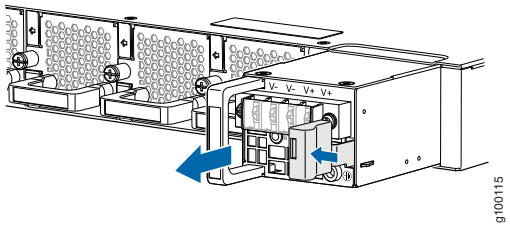


Figure 40: Removing a DC Power Supply



Installing an ACX5448 DC Power Supply

WARNING: **Before performing 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 switch handle of the circuit breaker in the off position.**

To install a DC power supply (see Figure 41 on page 86):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Using both hands, slide the DC power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate must alligned with any adjacent power supply faceplate or blank installed in the power supply slot.

4. Remove the clear plastic cover protecting the terminal on the faceplate.

5. Remove the screws from the terminals.

6. Secure each power cable lug to the terminal with the screw (see Figure 42 on page 86). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to the screw. Do not overtighten the screw (use a socket nut driver).

   a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.

   b. Secure the negative (–) DC source power cable lug to the **–48V** (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 terminal studs on each power supply.

- Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded can result in damage to the terminal.

7. Replace the clear plastic cover over the terminals on the faceplate.

8. Verify that the power cabling is correct, that the cables do not touch or block access to router components, and that they do not drape where people could trip on them.

9. Attach the power cable to the DC power source, and switch on the dedicated customer-site 2-pole circuit breaker. Follow the instructions for your site.

NOTE: If more than one power supply is being installed, turn on all power supply modules at the same time.

10. Observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Figure 41: Installing a DC Power Supply

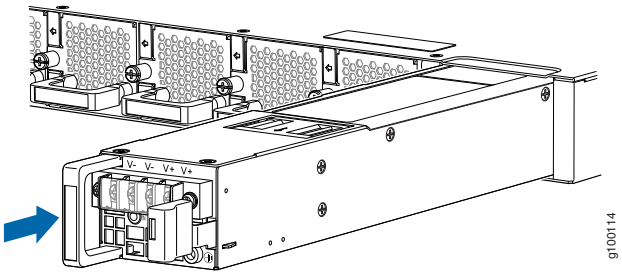
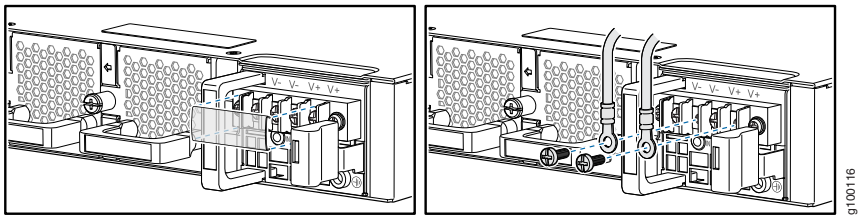


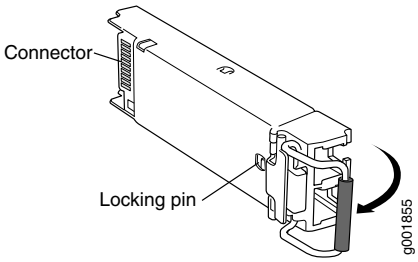
Figure 42: Connecting the DC Power Cables



Replacing a SFP+ Transceiver

Small form-factor pluggable plus transceivers (SFP+) are enhanced SFP transceivers that provides support for data rates of up to 10 Gbps for fiber-optic or copper interfaces. SFP+ transceivers are hot-insertable and hot-removable. Removing an SFP+ transceiver does not interrupt router functioning, but the removed SFP+ transceiver no longer receives or transmits data.

Figure 43: Small Form-Factor Pluggable (SFP) Transceiver



- Removing an SFP+ Transceiver on page 87
- Installing a SFP+ Transceiver on page 88

Removing an SFP+ Transceiver

To remove an SFP+ transceiver:

1. Have ready a replacement transceiver or a transceiver slot plug, an antistatic mat, and a rubber safety cap for the transceiver.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Label the cables connected to the transceiver so that you can reconnect them correctly later.

4. Remove the cable connector from the transceiver. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

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

5. Pull the ejector handle out from the transceiver to unlock the transceiver.

   CAUTION: **Make sure that you open the ejector handle completely until you hear it click. This prevents damage to the transceiver.**

Use needlenose pliers to pull the ejector handle out from the transceiver.

6. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the interface port.

7. Using your fingers, grasp the body of the transceiver, and pull it the rest of the way out of the interface port.

8. Place a rubber safety cap over the transceiver.

9. Place the removed transceiver on an antistatic mat or in an electrostatic bag.

CAUTION: **After removing a transceiver from the chassis, wait at least 30 seconds before reinserting it or inserting a transceiver into a different slot.**

Installing a SFP+ Transceiver

To install an SFP+ transceiver:

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Take each transceiver to be installed out of its electrostatic bag, and identify the slot on the component where it will be installed.

3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.

4. Carefully align the transceiver with the slots in the component. The connectors should face the component.

5. Slide the transceiver until the connector is seated in the component slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.

6. Close the ejector handle of the transceiver.

7. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

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

8. Verify that the status LEDs on the component faceplate indicate that the SFP is functioning correctly. For more information about the component LEDs, see the *MX Series Interface Module Reference*.

Replacing a QSFP28 Transceiver

28-Gbps quad small form-factor pluggable (QSFP28) transceivers are optical ACX5448 installed in an MPC, a MIC, or a router. QSFP28 transceivers are hot-insertable and hot-removable. Removing a QSFP28 transceiver does not interrupt router functioning, but the removed QSFP28 transceiver no longer receives or transmits data.

- Removing a QSFP28 Transceiver on page 89
- Installing a QSFP28 Transceiver on page 90

Removing a QSFP28 Transceiver

To remove a QSFP28 transceiver (see Figure 44 on page 90):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the QSFP28 transceiver. Have ready a rubber safety cap for the QSFP28 transceiver and the cable.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

3. Label the cable connected to the QSFP28 transceiver so that you can later reconnect it to the correct QSFP28 transceiver.

4. Disconnect the cable from the transceiver. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

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

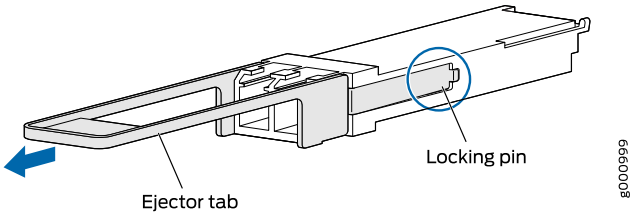
CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

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

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

6. Pull the transceiver's rubber handle straight back. The locking pins on the transceiver automatically releases the transceiver. Place the transceiver on the antistatic mat or in the electrostatic bag.

Figure 44: 28-Gbps Quad Small Form-Factor Pluggable (QSFP28) Transceiver



Installing a QSFP28 Transceiver

To install a replacement QSFP28 transceiver:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

2. Verify that a rubber safety cap covers the QSFP28 transceiver.

3. Orient the transceiver over the port in the MIC, MPC, or router so that the QSFP28 connector faces the appropriate direction.

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

5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the MPC, MIC, or router faceplate indicate that the QSFP28 transciever is functioning correctly. For more information about the MPC, MIC, or router LEDs, see the *MX Series Interface Module Reference*. You can also verify interface port functioning by issuing the **show chassis fpc pic-status** command.

Maintaining Fiber-Optic Cables

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

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 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.

Removing the ACX5448 Router

Powering Off an ACX5448 Router

Before you power off an ACX5448 router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 124.
- Ensure that you do not need to forward traffic through the router.

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

- 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 ACX5448 router:

1. Connect to the router using one of the following methods:
   - Connect a management device to the console (**CON**) port on an ACX5448 router. For instructions about connecting a management device to the console (**CON**) port, see "Connecting an ACX5448 Router to a Management Console" on page 71.
   - You can shut down the ACX5448 router 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 ACX5448 Router to a Network for Out-of-Band Management" on page 72.
2. Shut down Junos OS from the external management device by issuing the **request vmhost halt** operational mode CLI command. This command shuts down the router

gracefully and preserves system state information. A message appears on the console, confirming that the operating system has halted.

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

```
Initiating vmhost halt... ok
Initiating Junos shutdown...  shutdown: [pid 14318]
Shutdown NOW!
ok
Junos shutdown is in progress...
*** FINAL System shutdown message  ***

System going down IMMEDIATELY


...
...
Operating system  halted.
Please press any key to reboot.
```

3. Wait until a message appears on the console confirming that the operating system has halted. For more information about the command, see the CLI Explorer.

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

5. Disconnect power to the router by performing one of the following tasks:

   - AC power supply—If the AC power source outlet has a power router, set it to the OFF (**O**) position. If the AC power source outlet does not have a power router, gently pull out the male end of the power cord connected to the power source outlet.
   - DC power supply—router the circuit breaker on the panel board that services the DC circuit to the OFF position.

6. 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.

7. Uncable the router before removing it from the rack or cabinet.

Removing an ACX5448 Router from a Rack or Cabinet

If you need to relocate an installed ACX5448 router, use the procedure described in this topic.

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 ACX5448 router from a rack:

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed router in its new location and along the path to the new location.
- Read "General Safety Guidelines and Warnings" on page 104.
- Use the appropriate power off sequence to safely powered off the device. See "Powering Off an ACX5448 Router" on page 92.
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the router ports.

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 router on the rack.

To remove an ACX5448 router from a rack or cabinet:

1. Have one person support the weight of the router 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 router 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 router to your desired new location.

CHAPTER 5

Troubleshooting Hardware

Troubleshooting the ACX5448 Router

Understanding Alarm Types and Severity Classes on ACX Series Routers

Before monitoring alarms on the router, become familiar with the terms defined in Table 33 on page 95.

Table 33: Alarm Terms

Term	Definition
Alarm	Signal alerting you to conditions that might prevent normal operation. On a router, the alarm signal is the red system LED lit on the front of the chassis.
Alarm condition	Failure event that triggers an alarm.
Alarm severity	Seriousness of the alarm. The level of severity can be either major (steady red) or minor (blinking red).
Chassis alarm	Predefined alarm triggered by a physical condition on the router, such as a power failure, excessive component temperature, or media failure.
System alarm	Predefined alarm triggered by a missing rescue configuration or failure to install a license for a licensed software feature.

Alarm Types

The router supports these alarms:

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

Alarm Severity Classes

Alarms on ACX Series routers have two severity classes:

- Major (steady red)—Indicates a critical situation on the router 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 (blinking red)—Indicates a noncritical condition on the router that, if left unchecked, might cause an interruption in service or degradation in performance. A minor alarm condition requires monitoring or maintenance.

  A missing rescue configuration generates a minor system alarm.

CHAPTER 6

Contacting Customer Support and Returning the Chassis or Components

Contacting Customer Support and Returning the Chassis or Components

Returning a Hardware Component to Juniper Networks, Inc.

In the event of a hardware failure, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

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

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

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Case Manager link at https://www.juniper.net/support/ or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.
2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.
3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
   - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the component.
5. Pack the component for shipment.

Locating the Serial Number on an ACX5448 Router or Component

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

If the router is operational and you can access the command-line interface (CLI), you can list serial numbers for the router 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 router or component.

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

- Listing the Chassis and Component Details Using the CLI on page 98
- Locating the Chassis Serial Number ID Label on an ACX5448 Router on page 99
- Locating the Serial Number ID Labels on ACX5448 Power Supplies on page 100
- Locating the Serial Number ID Label on an ACX5448 Fan Module on page 100

Listing the Chassis and Component Details Using the CLI

To list the ACX5448 router and components and their serial numbers, use the **show chassis hardware** CLI operational mode command.

```
user@device> show chassis hardware
```

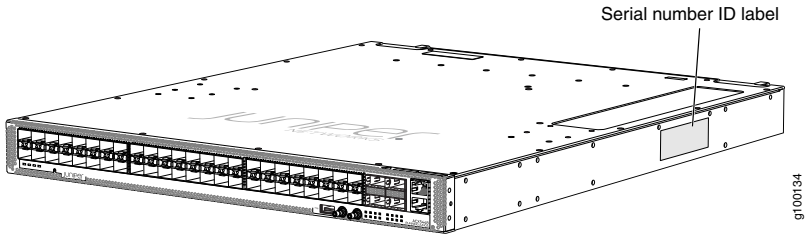
```
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                XW3618080034      ACX5448
Midplane         REV 04   650-077913   XW3618080034      ACX5448
PEM 0            REV 04   740-038949   1GA36460007       JPSU-650W-DC-AFI
PEM 1            REV 04   740-038949   1GA36460006       JPSU-650W-DC-AFI
Routing Engine           BUILTIN      BUILTIN           Routing Engine
DFEB
FPC 0                    BUILTIN      BUILTIN           FPC BUILTIN
  MIC 0                                                 48x1GE/48x10GE
    PIC 0                BUILTIN      BUILTIN           48x1GE/48x10GE
      Xcvr 3     REV 01   740-031980   193363A00601      SFP+-10G-SR
      Xcvr 45    REV 01   740-031980   AP30QZH           SFP+-10G-SR
  MIC 1                                                 16x10/25GE 4x40/100GE
    PIC 1                BUILTIN      BUILTIN           16x10/25GE 4x40/100GE
      Xcvr 0     REV 01   740-065632   1ACS22362SJ       QSFP28-100G-AOC-5M
      Xcvr 2     REV 01   740-058734   1ACQ114502X       QSFP-100GBASE-SR4
Fan Tray 0                                             Fan Tray ACX5448 0, Back
 to Front Airflow - AFI
Fan Tray 1                                             Fan Tray ACX5448 1, Back
 to Front Airflow - AFI
Fan Tray 2                                             Fan Tray ACX5448 2, Back
 to Front Airflow - AFI
Fan Tray 3                                             Fan Tray ACX5448 3, Back
 to Front Airflow - AFI
Fan Tray 4                                             Fan Tray ACX5448 4, Back
 to Front Airflow - AFI
Fan Tray 5                                             Fan Tray ACX5448 5, Back
 to Front Airflow - AFI
```

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 ACX5448 Router

On the ACX5448 router product SKUs, the serial number ID label is located on the right side of the port panel. See Figure 45 on page 99 for examples of where to find the serial number ID.

Figure 45: Location of the Serial Number ID Label on a ACX5448

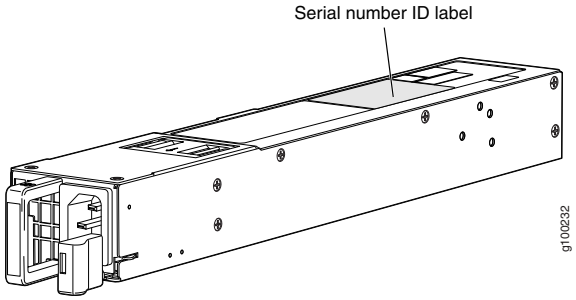


Locating the Serial Number ID Labels on ACX5448 Power Supplies

The power supplies installed in an ACX5448 are field-replaceable units (FRUs). For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

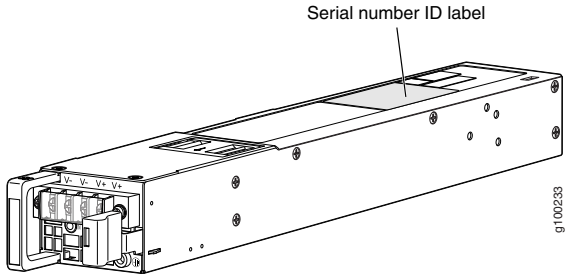
- AC power supply—The serial number ID label is on the top of the AC power supply. See Figure 46 on page 100.

Figure 46: ACX5448 AC Power Supply Serial Number Location



- DC power supply—The serial number ID label is on the top of the DC power supply. See Figure 47 on page 100.

Figure 47: ACX5448 DC Power Supply Serial Number Location

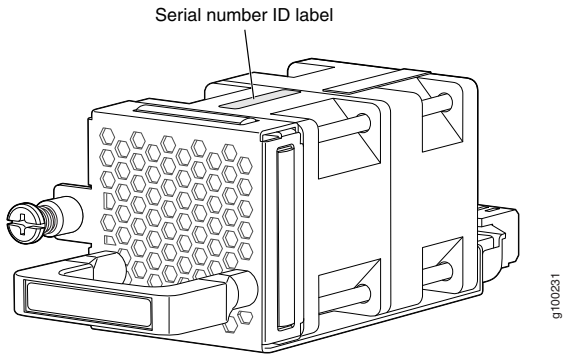


Locating the Serial Number ID Label on an ACX5448 Fan Module

The fan modules installed in an ACX5448 are field-replaceable units (FRUs). For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

Fan module–The serial number ID label is located at the base of the fan module. See Figure 48 on page 101.

Figure 48: ACX5448 Fan Module Serial Number Location



Contacting Customer Support to Obtain Return Material Authorization

If you are returning a device or hardware component to Juniper Networks for repair or replacement, obtain a Return Material Authorization (RMA) number from Juniper Networks Technical Assistance Center (JTAC).

After locating the serial number of the device or hardware component you want to return, open a Case with Juniper Networks Technical Assistance Center (JTAC) on the Web or by telephone.

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

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

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

- Case Manager at CSC: https://www.juniper.net/cm/
- Telephone: +1-888-314-JTAC1-888-314-5822, toll free in U.S., Canada, and Mexico

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

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

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

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: **Do not stack any of the hardware components.**

CHAPTER 7

Safety and Compliance Information

- Compliance Statements for EMC Requirements on page 136
- Compliance Statements for Environmental Requirements on page 137

General Safety Guidelines and Warnings

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

- Perform only the procedures explicitly described in the hardware documentation for this device. Make sure that only authorized service personnel perform other system services.
- Keep the area around the device clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which could become caught in the device.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the device only when it is properly grounded.
- 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.
- Some parts of the chassis, including AC and DC power supply surfaces, power supply unit handles, SFB card handles, and fan tray handles might become hot. The following label provides the warning of the hot surfaces on the chassis:

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

Definitions of Safety Warning Levels

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

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

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

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 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

- *Laser and LED Safety Guidelines and Warnings for the ACX5000 Router*
- *Laser and LED Safety Guidelines and Warnings for the QFX Series*
- *Laser and LED Safety Guidelines and Warnings for the PTX10008 and PTX10016*

Qualified Personnel Warning

WARNING: Only trained and qualified personnel should install or replace the device.

Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

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

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.

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

- *PTX5000 AC Power Electrical Safety Guidelines*
- *PTX5000 AC Power Electrical Safety Warnings*
- *PTX1000 DC Power Electrical Safety Guidelines*
- *PTX3000 DC Power Electrical Safety Guidelines*
- *PTX5000 DC Power Electrical Safety Guidelines*

Warning Statement for Norway and Sweden

WARNING: **The equipment must be connected to an earthed mains socket-outlet.**

Advarsel Apparatet skal kobles til en jordet stikkontakt.

Varning! Apparaten skall anslutas till jordat nätuttag.

Fire Safety Requirements

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

In addition, you should establish procedures to protect your equipment in the event of a fire emergency. Juniper Networks products should be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available

in the event of a fire in the vicinity of the equipment and that all local fire, safety, and electrical codes and ordinances be observed when you install and operate your equipment.

Fire Suppression

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

Fire Suppression Equipment

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

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers). The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and difficult to clean. In addition, in the presence of minute amounts of moisture, monoammonium phosphate can become highly corrosive and corrodes most metals.

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

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

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

Installation Instructions Warning

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

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

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

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.

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 104
- Laser and LED Safety Guidelines and Warnings on page 116
- *Laser and LED Safety Guidelines and Warnings for the ACX5000 Router*

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

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

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

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

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

Ramp Warning

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

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

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

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.

Rack-Mounting and Cabinet-Mounting Warnings

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

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

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

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

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.

- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

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

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

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

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

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

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

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

- El Juniper Networks switch debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.
- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

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

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

Grounded Equipment Warning

WARNING: 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.

Varning! Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.

Radiation from Open Port Apertures Warning

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, deverá evitar a exposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

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

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

Laser and LED Safety Guidelines and Warnings

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

Observe the following guidelines and warnings:

- General Laser Safety Guidelines on page 116
- Class 1 Laser Product Warning on page 117
- Class 1 LED Product Warning on page 117
- Laser Beam Warning on page 118

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.

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.

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.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

WARNING: Do not stare into the laser beam or view it directly with optical instruments.

Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

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

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

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

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

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

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

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

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

Maintenance and Operational Safety Guidelines and Warnings

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

- Battery Handling Warning on page 118
- Jewelry Removal Warning on page 119
- Lightning Activity Warning on page 121
- Operating Temperature Warning on page 121
- Product Disposal Warning on page 123

Battery Handling Warning

WARNING: Replacing a battery incorrectly might result in an explosion. Replace a battery only with the same or equivalent type recommended by

the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

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

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

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.

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.

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. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats

waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

Varoitus Ettei Juniper Networks switch-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

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.

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.

General Electrical Safety Guidelines and Warnings

WARNING: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS 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.

CAUTION: Before removing or installing components of a device, connect an electrostatic discharge (ESD) grounding strap to an ESD point and wrap and fasten the other end of the strap around your bare wrist. Failure to use an ESD grounding strap could result in damage to the device.

- 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 equipment that appears to be damaged.

Prevention of Electrostatic Discharge Damage

Device components that are shipped in antistatic bags are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap when you are handling components that are subject to ESD damage, and make sure that it is in direct contact with your skin.

  If a grounding strap is not available, hold the component in its antistatic bag (see Figure 49 on page 125) 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.

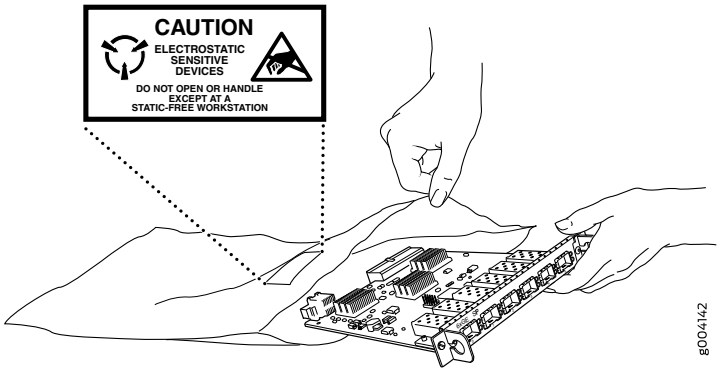
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  If no grounding strap is available, touch the exposed, bare metal of the device to ground yourself before handling the component.

- Avoid contact between the component that is subject to ESD damage and your clothing. ESD voltages emitted from clothing can damage components.

- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an antistatic bag (see Figure 49 on page 125). If you are returning a component, place it in an antistatic bag before packing it.

Figure 49: 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.

Site Electrical Wiring Guidelines

Table 20 on page 43 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 34: 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.
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 device • Electrical hazards as a result of power surges conducted over the lines into the equipment

AC Power Electrical Safety Guidelines

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.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.
- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

WARNING: The attached power cable is only for this product. Do not use the cable for another product.

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

g017253

AC Power Disconnection Warning

WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

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.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut på vekselstrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden.

DC Power Disconnection Warning

WARNING: Before performing any of the DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the device handle of the circuit breaker in the OFF position.

Waarschuwing Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

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.

Aviso Antes de executar um dos seguintes procedimentos, certifique-se que desligou a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF (Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

¡Atención! Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

Varning! Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejpa fast överspänningsskyddets omkopplare i FRÅN-läget.

DC Power Grounding Requirements and Warning

An insulated grounding conductor that is identical in size to the grounded and ungrounded branch circuit supply conductors but is identifiable by green and yellow stripes is installed as part of the branch circuit that supplies the device. The grounding conductor is a separately derived system at the supply transformer or motor generator set.

WARNING: When you install the device, the ground connection must always be made first and disconnected last.

Waarschuwing Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.

Varoitus Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.

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.

DC Power Wiring Sequence Warning

WARNING: Wire the DC power supply using the appropriate lugs. When connecting power, the proper wiring sequence is ground to ground, +RTN to +RTN, then –48 V to –48 V. When disconnecting power, the proper wiring sequence is –48 V to –48 V, +RTN to +RTN, then ground to ground. Note that the ground wire must always be connected first and disconnected last.

Waarschuwing De juiste bedradingsvolgorde verbonden is aarde naar aarde, +RTN naar +RTN, en –48 V naar – 48 V. De juiste bedradingsvolgorde losgemaakt is en –48 naar –48 V, +RTN naar +RTN, aarde naar aarde.

Varoitus Oikea yhdistettava kytkentajarjestys on maajohto maajohtoon, +RTN varten +RTN, –48 V varten – 48 V. Oikea irrotettava kytkentajarjestys on –48 V varten – 48 V, +RTN varten +RTN, maajohto maajohtoon.

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, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

Varning! Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, –48 V till –48 V. Korrekt kopplas kopplingssekvens ar –48 V till –48 V, +RTN till +RTN, jord till jord.

DC Power Wiring Terminations Warning

WARNING: When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kooltaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

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.

Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. für einen geschlossenen Regelkreis oder gabelförmig, mit nach oben gerichteten Kabelschuhen zu verwenden. Diese Abschlüsse sollten die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare trecce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las

lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

Varning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

Multiple Power Supplies Disconnection Warning

WARNING: The network device has more than one power supply connection. All connections must be removed completely to remove power from the unit completely.

Waarschuwing Deze eenheid heeft meer dan één stroomtoevoerverbinding; alle verbindingen moeten volledig worden verwijderd om de stroom van deze eenheid volledig te verwijderen.

Varoitus Tässä laitteessa on useampia virtalähdekytkentöjä. Kaikki kytkennät on irrotettava kokonaan, jotta virta poistettaisiin täysin laitteesta.

Attention Cette unité est équipée de plusieurs raccordements d'alimentation. Pour supprimer tout courant électrique de l'unité, tous les cordons d'alimentation doivent être débranchés.

Warnung Diese Einheit verfügt über mehr als einen Stromanschluß; um Strom gänzlich von der Einheit fernzuhalten, müssen alle Stromzufuhren abgetrennt sein.

Avvertenza Questa unità ha più di una connessione per alimentatore elettrico; tutte le connessioni devono essere completamente rimosse per togliere l'elettricità dall'unità.

Advarsel Denne enheten har mer enn én strømtilkobling. Alle tilkoblinger må kobles helt fra for å eliminere strøm fra enheten.

Aviso Este dispositivo possui mais do que uma conexão de fonte de alimentação de energia; para poder remover a fonte de alimentação de energia, deverão ser desconectadas todas as conexões existentes.

¡Atención! Esta unidad tiene más de una conexión de suministros de alimentación; para eliminar la alimentación por completo, deben desconectarse completamente todas las conexiones.

Varning! Denna enhet har mer än en strömförsörjningsanslutning; alla anslutningar måste vara helt avlägsnade innan strömtillförseln till enheten är fullständigt bruten.

TN Power Warning

WARNING: The device is designed to work with a TN power system.

Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

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.

¡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.

Action to Take After an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.
2. Disconnect power from the device.
3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, then call for help.

Agency Approvals for an ACX5448 Router

The ACX5448 router complies with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1 Information Technology Equipment - Safety
  - UL 60950-1 (2nd Edition) Information Technology Equipment - Safety

  - IEC 60950-1: 2005/A2:2013 Information Technology Equipment – Safety CB Scheme
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment classification and requirements
  - CAN/CSA C22.2 No. 62368-1-2014, Audio/Video, Information and Communication Technology Equipment – Safety
  - UL 62368-1, Audio/Video, Information and Communication Technology Equipment – Safety
  - IEC 62368-1: 2014 Audio/Video, Information and Communication Technology Equipment – Safety CB Scheme
- EMC
  - EN 300 386 V1.6.1 (2012-09) Electromagnetic compatibility and Radio spectrum Matters (ERM) Telecommunication network equipment
  - EN 300 386 V2.1.1 (2016-07) Telecommunication network equipment; EMC requirements; Harmonized Standard covering the essential requirements of the Directive 2014/30/EU
  - EN 55032:2012 (CISPR 32:2012) Electromagnetic compatibility of multimedia equipment - Emission requirements
  - EN 55024:2010 (CISPR 24:2010) Information technology equipment - Immunity characteristics - Limits and methods of measurement
  - GR-1089-CORE Issue 7 EMC and Electrical Safety for Network Telecommunications Equipment
  - IEC/EN 61000 Immunity Test
  - AS/NZS CISPR 32:2015 Australia/New Zealand Radiated and Conducted Emissions
  - FCC 47 CFR Part 15 USA Radiated and Conducted Emissions
  - ICES-003 Canada Radiated and Conducted Emissions
  - VCCI-CISPR 32:2016 Japanese Radiated and Conducted Emissions
  - BSMI CNS 13438 Taiwan Radiated and Conducted Emissions (at 10 Meter)
  - KN32/KN35 Korea Radiated Emission and Immunity Characteristics (at 10 Meter)
  - KN61000 Korea Immunity Test
  - TEC/SD/DD/EMC-221/05/OCT-16 India EMC standard

Compliance Statements for NEBS

- 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 (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.

Compliance Statements for EMC Requirements

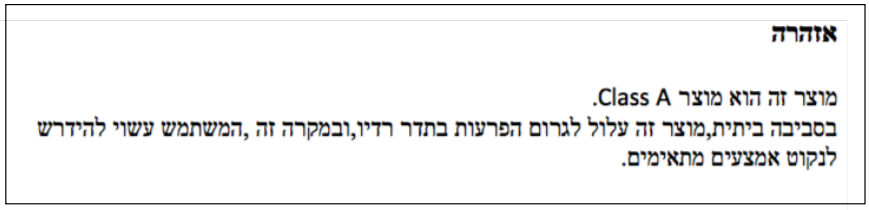
Canada

CAN ICES-3 (A)/NMB-3(A)

European Community

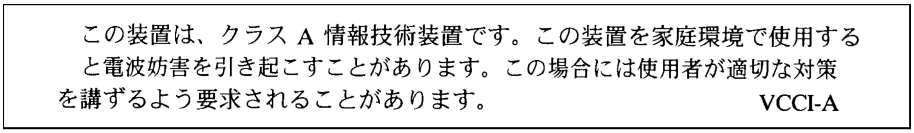
This is a Class A product. In a domestic environment, this product might cause radio interference in which case the user might be required to take adequate measures.

Israel



Translation from Hebrew—Warning: This product is Class A. In residential environments, the product might cause radio interference, and in such a situation, the user might be required to take adequate measures.

Japan



The preceding translates as follows:

This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this product is used near a radio or television receiver in a domestic environment, it might cause radio interference. Install and use the equipment according to the instruction manual. VCCI-A.

United States

The hardware 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 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 the user will be required to correct the interference at his own expense.

Compliance Statements for Environmental Requirements

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.