

# ACX5448, ACX5448-D, and ACX5448-M Universal Metro Routers Hardware Guide

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# About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the ACX5448 Router.

After completing the installation and basic configuration procedures covered in this guide, refer to the Junos OS documentation for information about further software configuration.

## RELATED DOCUMENTATION

| [ACX5448 Quick Start](#)

# 1

CHAPTER

## Overview

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# ACX5448, ACX5448-D, and ACX5448-M System Overview

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## ACX5400 Universal Metro Router Description

### IN THIS SECTION

- [Benefits of ACX5400 Routers | 4](#)
- [ACX5448, ACX5448-D, and ACX5448-M System Overview | 4](#)

The Juniper Networks ACX5400 Universal Metro Routers are top-of-rack routers with deep packet buffer solutions for metro network or aggregation environments. The ACX5400 router portfolio consists of high-performance, fixed-configuration, 1 U routers that add higher port densities, additional scalability, and improved latency to the ACX Series. The routers have a high-throughput Packet Forwarding Engine, which provides full duplex throughput of 800 Gbps.

The ACX5400 line of routers are available in three variants:

- ACX5448
- ACX5448-D
- ACX5448-M

For information about supported software features on ACX5400 routers, see [Feature Explorer](#).

[Figure 1 on page 3](#) and [Figure 2 on page 3](#) show the front and rear, respectively, of a typical ACX5448 router.

**Figure 1: ACX5448 Router—Front**



8100137

**Figure 2: AC-Powered ACX5448 Router—Rear**



8100138

[Figure 3 on page 3](#) and [Figure 4 on page 3](#) show the front and rear, respectively, of a typical ACX5448-D router.

**Figure 3: ACX5448-D Router—Front**



8100564

**Figure 4: AC-Powered ACX5448-D Router—Rear**



8100565

[Figure 5 on page 4](#) and [Figure 6 on page 4](#) show the front and rear, respectively, of a typical ACX5448-M router.

Figure 5: ACX5448-M Router—Front



Figure 6: AC-Powered ACX5448-M Router—Rear



## Benefits of ACX5400 Routers

- **Optimized space**—The ACX5400 router has a 1 U form factor and is ideal for Ethernet service aggregation. Its innovative design helps service providers build high-density, high-performance 100-Gigabit Ethernet infrastructures where rack space and cooling are limited.
- **High performance**
  - The 52 ports on the ACX5448 router support 10-Gbps and 100-Gbps speeds providing a total throughput of up to 800 Gbps. The router provides full metro Ethernet and IP/MPLS VPN services in a space-optimized platform.
  - The innovative design of the ACX5448-D helps service providers develop converged packet optical solutions.
- **Simplified network architecture**— The ACX5400 line of routers simplify access and aggregation architectures by eliminating unnecessary layers and network overlays, resulting in significant operational savings.
- **Advanced security capabilities**— The ACX5448-M router supports advanced security capabilities such as Media Access Control Security (MACsec) on the 10-Gigabit or 1-Gigabit Ethernet ports to protect against potential network vulnerabilities.

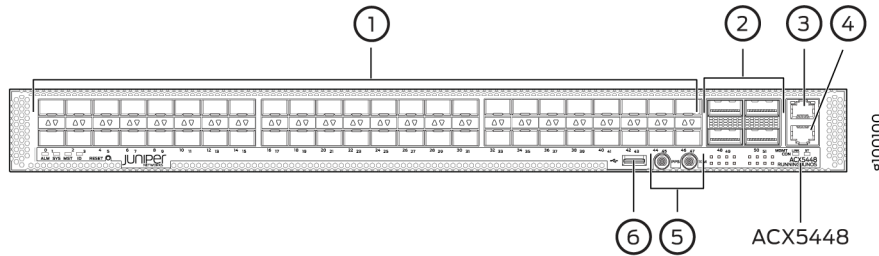
## ACX5448, ACX5448-D, and ACX5448-M System Overview

The ACX5400 routers have a high-throughput Packet Forwarding Engine, and the performance of the control plane running on ACX5400 routers is enhanced by the 1.9-GHz six-core Intel CPU with 32-GB of memory and two 100-GB enterprise-grade solid-state drives (SSDs) for storage.

We ship the ACX5400 routers with redundant fans and redundant power supply modules (PSMs). You can order the routers with front-to-back airflow (airflow out or AFO) or back-to-front airflow (airflow in or AFI), and with AC or DC PSMs.

Figure 7 on page 5 shows the important components on the front of the ACX5448 router.

**Figure 7: Front View of the ACX5448 Router**



1– SFP and SFP+ ports

4– Console (**CON**) port

2– QSFP28 ports

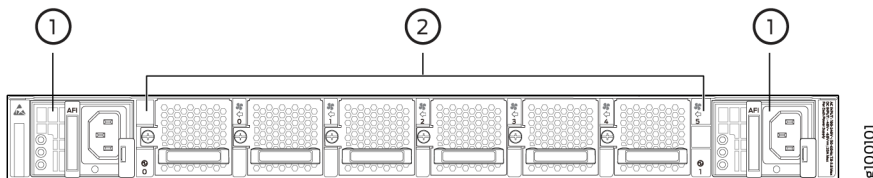
5– **PPS** and **10M** GPS output ports

3– Management (**MGMT**) port

6– USB port

Figure 8 on page 5 and Figure 9 on page 5 shows the important components on the rear of the ACX5448 routers.

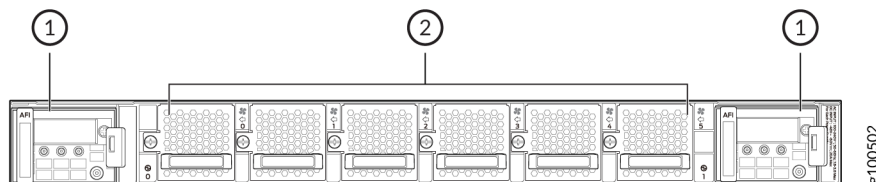
**Figure 8: Rear View of the AC-Powered ACX5448 Router**



1– Power supply modules (AC)

2– Fan modules

**Figure 9: Rear View of the DC-Powered ACX5448 Router**



1– Power supply modules (DC)

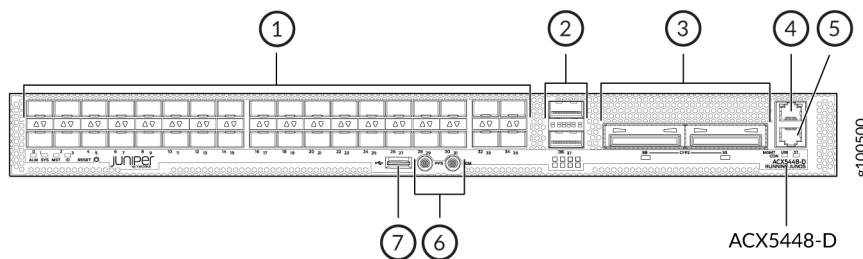
2– Fan modules

The fan modules and PSMs on the ACX5448 routers are installed in slots on the rear of the chassis. The chassis has six slots for the fan modules and two slots for the PSMs.

The six fan modules are numbered **0** through **5** from left to right. Similarly, the two PSMs are numbered **0** and **1**.

Figure 10 on page 6 shows the important components on the front of the ACX5448-D router.

**Figure 10: Front View of the ACX5448-D Router**



1– SFP and SFP+ ports

5– Console (**CON**) port

2– QSFP28 ports

6– **PPS** and **10M** GPS output ports

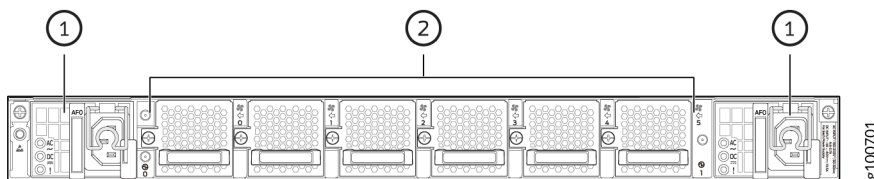
3– CFP2 ports

7– USB port

4– Management (**MGMT**) port

Figure 11 on page 6 and Figure 12 on page 7 show the important components on the rear of the ACX5448-D routers.

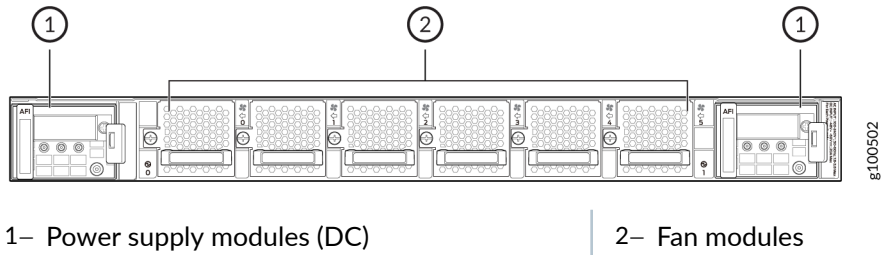
**Figure 11: Rear View of the AC-Powered ACX5448-D Router**



1– Power supply modules (AC)

2– Fan modules

**Figure 12: Rear View of the DC-Powered ACX5448-D Router**



1– Power supply modules (DC)

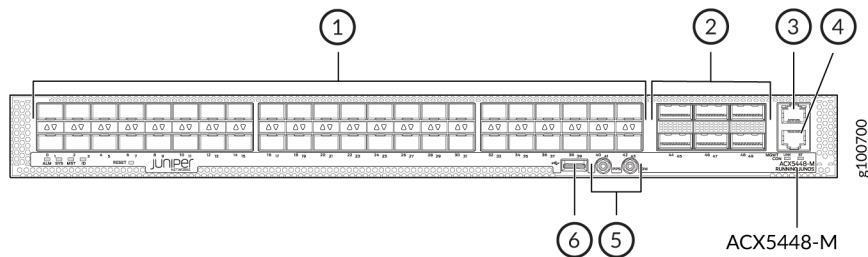
2– Fan modules

The fan modules and PSMs on the ACX5448-D routers are installed in slots on the rear of the chassis. The chassis has six slots for the fan modules and two slots for the PSMs.

The six fan modules are numbered **0** through **5** from left to right. Similarly, the two PSMs are numbered **0** and **1**.

[Figure 13 on page 7](#) shows the important components on the front of the ACX5448-M router.

**Figure 13: Front View of the ACX5448-M Router**



1– SFP and SFP+ ports

4– Console (**CON**) port

2– QSFP28 ports

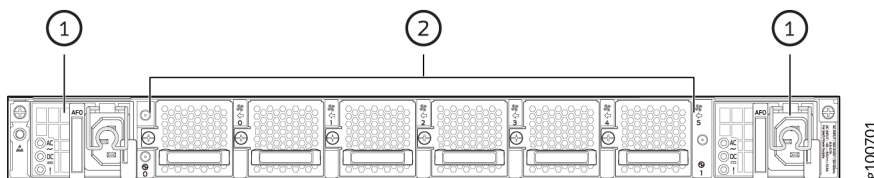
5– **PPS** and **10M** GPS output ports

3– Management (**MGMT**) port

6– USB port

[Figure 14 on page 7](#) and [Figure 15 on page 8](#) show the important components on the rear of the ACX5448-M routers.

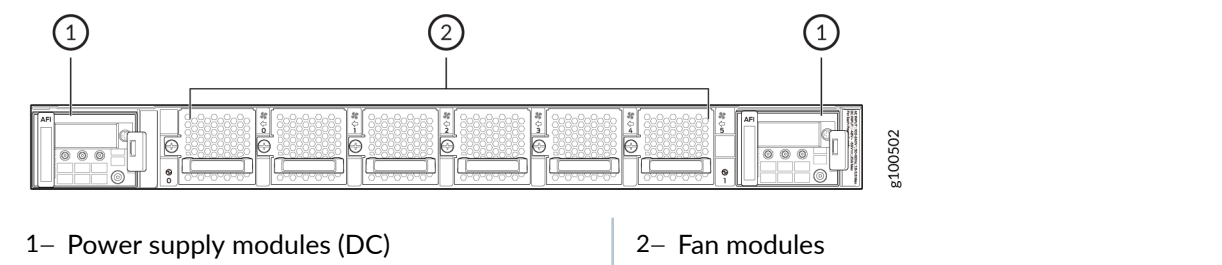
**Figure 14: Rear View of the AC-Powered ACX5448-M Router**





1– Power supply modules (AC)	2– Fan modules
------------------------------	----------------

Figure 15: Rear View of the DC-Powered ACX5448-M Router



The fan modules and PSMs on the ACX5448-M routers are installed in slots on the rear of the chassis. The chassis has six slots for the fan modules and two slots for the PSMs.

The six fan modules are numbered **0** through **5** from left to right. Similarly, the two PSMs are numbered **0** and **1**.

Figure 16 on page 8 shows the important components on the front of the ACX5448-M-LT router.

Figure 16: Front View of the ACX5448-M-LT Router

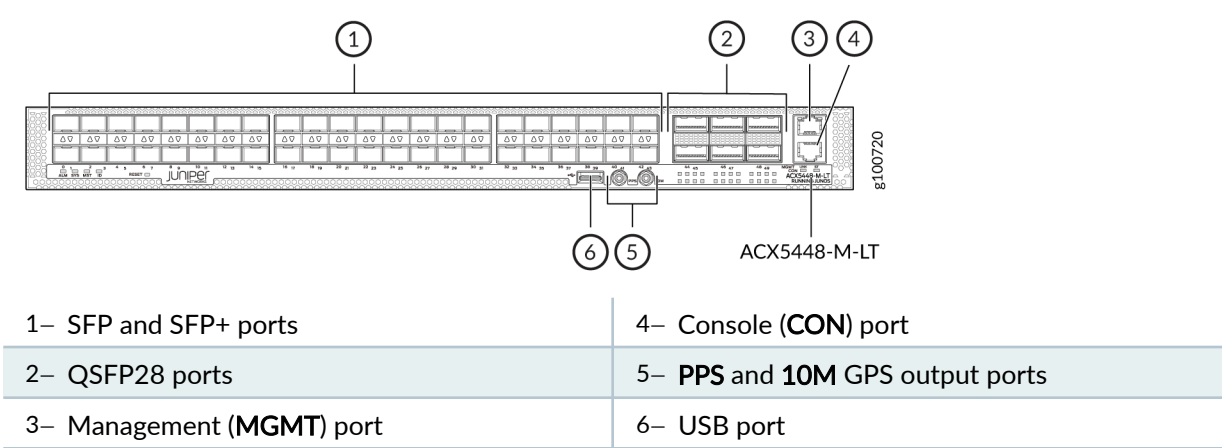
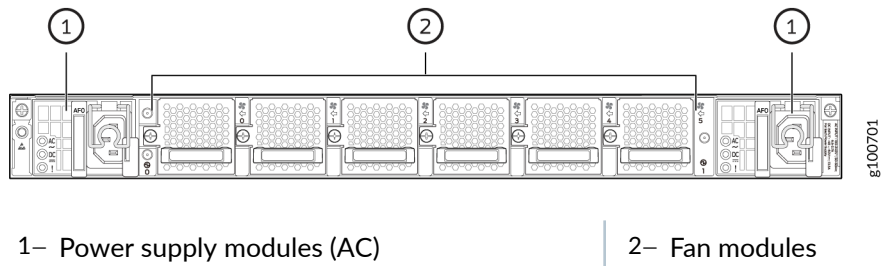
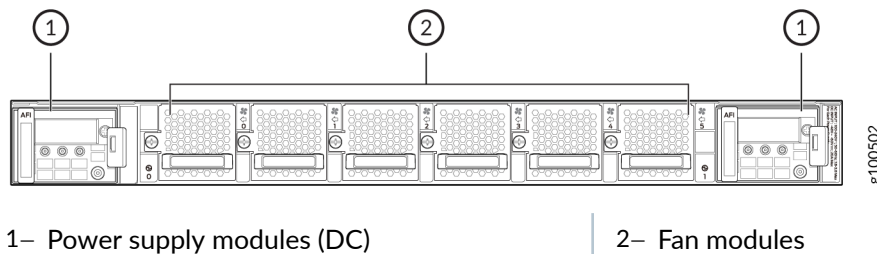


Figure 17 on page 9 and Figure 18 on page 9 show the important components on the rear of the ACX5448-M-LT routers.

**Figure 17: Rear View of the AC-Powered ACX5448-M-LT Router**



**Figure 18: Rear View of the DC-Powered ACX5448-M-LT Router**



The fan modules and PSMs on the ACX5448-M-LT routers are installed in slots on the rear of the chassis. The chassis has six slots for the fan modules and two slots for the PSMs.

The six fan modules are numbered **0** through **5** from left to right. Similarly, the two PSMs are numbered **0** and **1**.

The electrostatic discharge (ESD) point on the router is located on the rear of the chassis. [Figure 19 on page 10](#) shows the ESD point on the ACX5448 router and [Figure 20 on page 10](#) shows the ESD point on the ACX5448-D and ACX5448-M routers.



**CAUTION:** Before removing or installing components, attach an ESD strap to an ESD point, and wrap and fasten the other end of the strap around your bare wrist. Failure to use an ESD strap can result in damage to the hardware components.

Figure 19: ESD Point on the ACX5448 Router

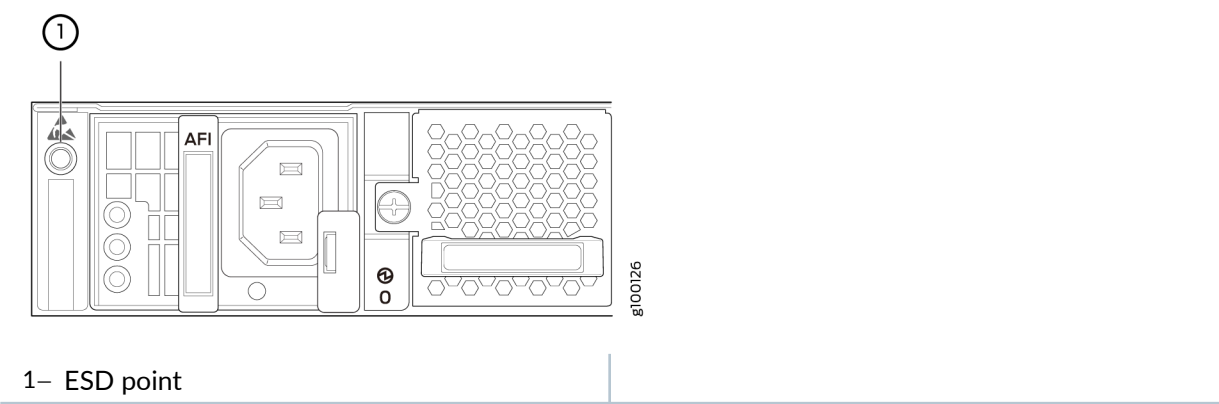
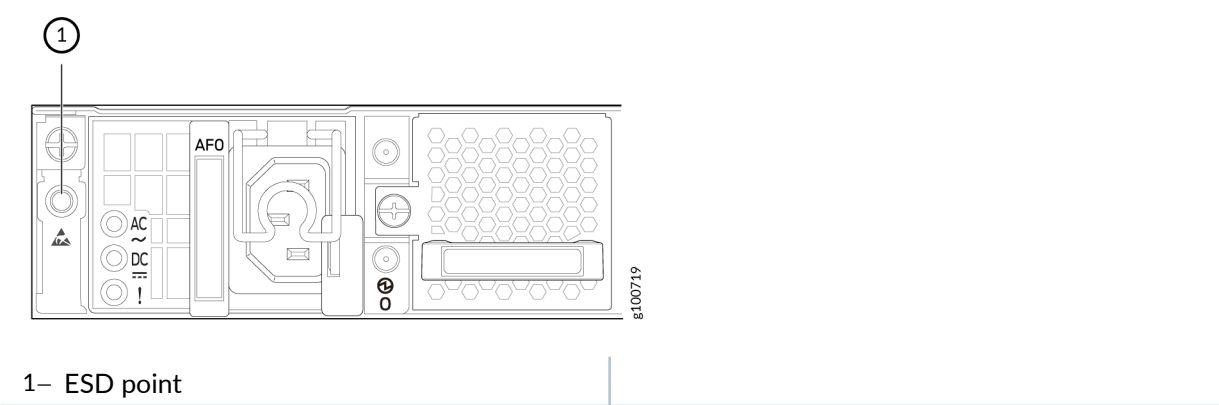


Figure 20: ESD Point on the ACX5448-D and ACX5448-M Router



## ACX5400 Router Models

The ACX5400 line of routers are available with either AC or DC power supply modules (PSMs) and with either airflow-out (AFO) or airflow-in (AFI) cooling. AFO is also known as front-to-back or port-to-FRU cooling; similarly AFI is known as back-to-front or FRU-to-port cooling.

[Table 1 on page 11](#) lists the model numbers for ACX5448 routers.

**Table 1: ACX5448 Router Model Numbers and Description**

Model Number	Power Supply	Airflow
ACX5448-AC-AFI	AC	Airflow in (back-to-front)
ACX5448-DC-AFI	DC	Airflow in (back-to-front)
ACX5448-AC-AFO	AC	Airflow out (front-to-back)
ACX5448-DC-AFO	DC	Airflow out (front-to-back)

[Table 2 on page 11](#) lists the model numbers for ACX5448-D routers.

**Table 2: ACX5448-D Router Model Numbers and Description**

Model Number	Power Supply	Airflow
ACX5448-D-AC-AFI	AC	Airflow in (back-to-front)
ACX5448-D-DC-AFI	DC	Airflow in (back-to-front)
ACX5448-D-AC-AFO	AC	Airflow out (front-to-back)
ACX5448-D-DC-AFO	DC	Airflow out (front-to-back)

[Table 3 on page 11](#) lists the model numbers for ACX5448-M routers.

**Table 3: ACX5448-M Router Model Numbers and Description**

Model Number	Power Supply	Airflow
ACX5448-M-AC-AFI	AC	Airflow in (back-to-front)
ACX5448-M-DC-AFI	DC	Airflow in (back-to-front)

**Table 3: ACX5448-M Router Model Numbers and Description (Continued)**

Model Number	Power Supply	Airflow
ACX5448-M-AC-AFO	AC	Airflow out (front-to-back)
ACX5448-M-DC-AFO	DC	Airflow out (front-to-back)
ACX5448-M-AC-AFO-L	AC	Airflow out (front-to-back)
ACX5448-M-DC-AFO-L	DC	Airflow out (front-to-back)
ACX5448-M-AC-AFI-L	AC	Airflow in (back-to-front)
ACX5448-M-DC-AFI-L	DC	Airflow in (back-to-front)

The ACX5448-M-LT router supports only Junos Limited image. The Junos Limited image does not have data-plane encryption and is intended only for countries in the Eurasian Customs Union because these countries have import restrictions on software containing data-plane encryption. Unlike the Junos Worldwide image, the Junos Limited image supports control plane encryption through Secure Shell (SSH) and Secure Sockets Layer (SSL), thus allowing secure management of the system.



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

## Field-Replaceable Units in ACX5400 Routers

Field-replaceable units (FRUs) are components that you can replace at your site. The ACX5400 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 ACX5400 FRUs:

- Power supply modules (PSMs)
- Fan modules
- Optical transceivers



**CAUTION:** Replace a failed PSM with a new PSM within one minute of removal to prevent chassis overheating. The router continues to operate with only one PSM 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.

## Hardware Redundancy of ACX5400 Router Components and Functionality

The following hardware components provide redundancy on ACX5400 routers:

- Power supply modules (PSMs)—The ACX5400 routers have two PSMs. Each PSM provides power to all components in the router. If two PSMs are installed, they provide full power redundancy to the device. If one PSM fails or if you remove one PSM, then the second PSM balances the electrical load without interruption.

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



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

- Cooling system—The ACX5400 routers have six fan modules. If a fan module fails and is unable to keep the router within the desired temperature thresholds, chassis alarms occur and the router can

eventually shut down. The router can work with one failed fan module for a long duration, but for the router to work efficiently you must replace the failed fan module immediately.

## ACX5400 Routers Hardware and CLI Terminology Mapping

Table 4 on page 14 describes the hardware terms used in ACX5400 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 ACX5400 Routers**

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 ACX5448-D ACX5448-M	–	Router chassis	<a href="#">"Chassis Physical Specifications for ACX5400 Routers" on page 53</a>
Routing Engine	Routing Engine	–	Built-in Routing Engine.	
FPC <i>n</i>	Abbreviated name of the Flexible PIC Concentrator (FPC; an FPC is equivalent to a line card)	Value of <i>n</i> is always 0.	The router does not have actual FPCs. In this case, FPC refers to the router itself.  Built-in FPC.	<i>Interface Naming Conventions Used in the Junos OS Operational Commands</i>
PIC <i>n</i>	Abbreviated name of the Physical Interface Card (PIC)	Value of <i>n</i> is a value in the range of 0-1.	The router does not have actual PIC devices; see entries for PIC <i>n</i> for the equivalent item on the router.  Built-in network ports on the front panel of the router are mapped to logical PICs.	<i>Interface Naming Conventions Used in the Junos OS Operational Commands</i>

**Table 4: CLI Equivalents of Terms Used in Documentation for ACX5400 Routers (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
xcvr <i>n</i>	Abbreviated name of the transceiver	<i>n</i> is a value equivalent to the number of the port in which the transceiver is installed.	Optical transceivers	<i>Port and Interface Specifications</i>
PEM <i>n</i>	Power supply	<i>n</i> is a value in the range of 0–1.	AC power supply module DC power supply module	"AC Power Supply for ACX5400 Routers" on page 41  "DC Power Supply for ACX5400 Routers" on page 45
Fan tray	Fan	<i>n</i> is a value in the range of 0-5.	Fan	"Cooling System and Airflow in ACX5448, ACX5448-D, and ACX5448-M Routers" on page 35

## ACX5400 System Software Overview

The ACX5400 routers run the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. Junos OS is installed on an ACX5400 router's 100-gigabyte (GB) internal solid-state flash drive. The same Junos OS code base that runs on an ACX5400 router also runs on all Juniper Networks QFX and EX Series switches, SRX Series Firewalls, and on MX Series, ACX Series, and PTX Series routers.

For information about supported software features on ACX5400 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, ACX5448-D, and ACX5448-M Chassis

## IN THIS SECTION

- Management Panel of ACX5400 Routers | 16
- Port Panel of ACX5400 Routers | 18
- Chassis Status LEDs on ACX5400 Routers | 24
- Management Port LEDs on ACX5400 Routers | 27
- Network Port LEDs on ACX5400 Routers | 29
- Fan Status LEDs on ACX5400 Routers | 31
- Power Supply LEDs on ACX5400 Routers | 32

The front panel on the ACX5400 chassis contains LEDs for the router components, a reset button, management and console ports, and network ports. On the front panel, you can view status and troubleshooting information at a glance.

The rear panel of the router has slots for the power supply modules (PSMs) and fan modules. The power and fan modules are installed from the rear of the router.

## Management Panel of ACX5400 Routers

The management panel of ACX5400 routers is found on the front of the router.

[Figure 21 on page 16](#) shows the management panel components on an ACX5448 router.

**Figure 21: Management Panel Components on ACX5448**

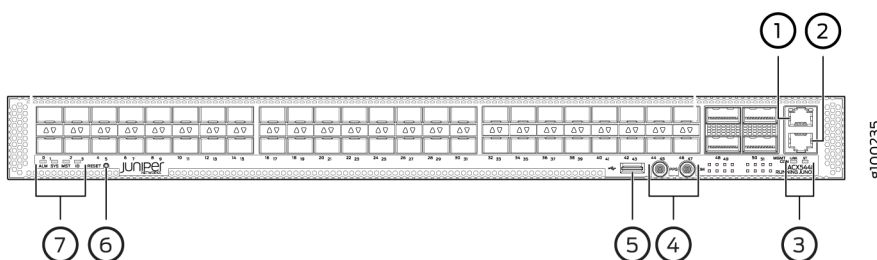


Figure 22 on page 17 shows the management panel components on an ACX5448-D router.

Figure 22: Management Panel Components on ACX5448-D

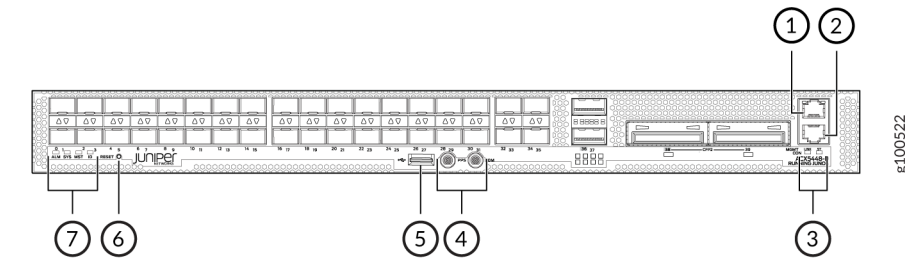
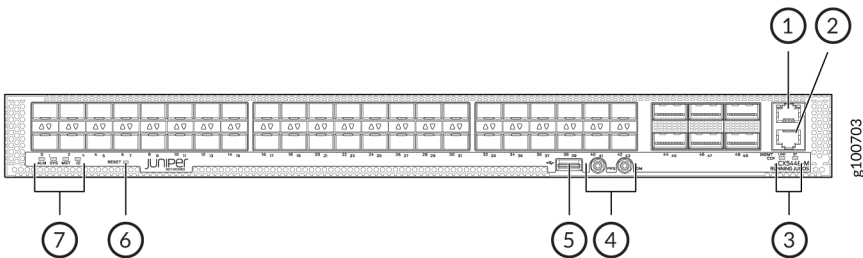


Figure 23 on page 17 shows the management panel components on ACX5448-M routers.

Figure 23: Management Panel Components on ACX5448-M



1– Management ( <b>MGMT</b> ) port	5– USB port
2– Console ( <b>CON</b> ) port	6– <b>RESET</b> button
3– <b>LINK</b> and <b>ST</b> LEDs	7– Status LEDs
4– <b>PPS</b> and <b>10M</b> 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 10/100/1000BASE-T. See ["Connect an ACX5400 Router to a Network for Out-of-Band Management"](#) on page 99.
- Console (**CON**) port— RJ-45 connector 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.

- Reset button to reset the device.
- Two SMB connector ports that support 1-PPS and 10-MHz timing devices.

## Port Panel of ACX5400 Routers

### IN THIS SECTION

- Port Panel of an ACX5448 Router | 18
- Port Panel of an ACX5448-D Router | 19
- Port Panel of an ACX5448-M Router | 23

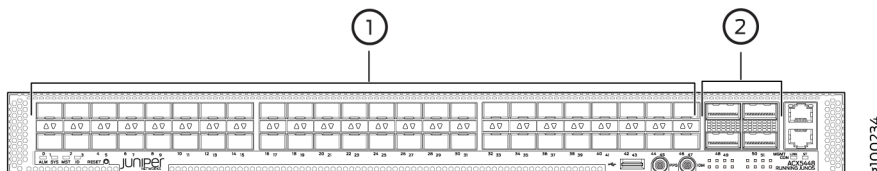
### Port Panel of an ACX5448 Router

The port panel of the ACX5448 router has the following port configurations:

- Forty-eight 10-Gigabit or 1-Gigabit Ethernet ports (ports **0** through **47**) that operate at 10-Gbps speed with SFP+ transceivers or at 1-Gbps speed when you use SFP optics.
- Four 100-Gigabit Ethernet ports (ports **48** through **51**) that support quad small form-factor pluggable 28 (QSFP28) transceivers. You can channelize these ports into four 25-Gbps interfaces using breakout cables (and channelization configuration). These ports also support 40-Gbps speed, when you use QSFP+ optics. You can channelize these 40-Gbps ports into four 10-Gbps interfaces using breakout cables (and channelization configuration).

[Figure 24 on page 18](#) shows the port panel of an ACX5448 router.

**Figure 24: ACX5448 Router Port Panel**



1– 1-Gigabit/10-Gigabit Ethernet ports (48 SFP + or SFP ports)	2– 100-Gigabit Ethernet ports (4 QSFP28 ports)
--	--

Port Panel of an ACX5448-D Router

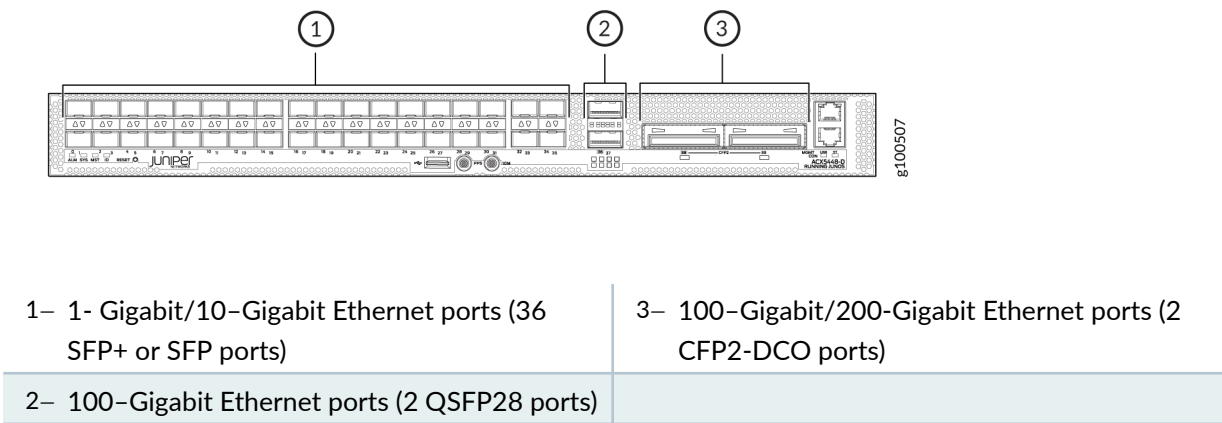
The port panel of the ACX5448-D router has the following port configurations:

- Thirty-six 10-Gigabit or 1-Gigabit Ethernet ports (**0** through **35**, mapped to CLI PIC 0) that operate at 10-Gbps speed with SFP+ transceivers or at 1-Gbps speed when you use SFP optics.
- Two 100-Gigabit Ethernet ports (**36** and **37**, mapped to CLI PIC 1) that support QSFP28 transceivers. You can channelize these ports into four 25-Gbps interfaces using breakout cables (and channelization configuration). These ports also support 40-Gbps speed, when you use QSFP+ optics. You can channelize these 40-Gbps ports into four 10-Gbps interfaces using breakout cables (and channelization configuration).
- Two 200-Gigabit Ethernet ports (**38** and **39**, mapped to logical PIC 2) that support 200-gigabit CFP2-DCO transceivers.

**NOTE:** One QSFP28 port (port **36**) and one CFP2-DCO port (port **38**) can operate as multiplexer ports.

Figure 25 on page 19 shows the port panel of an ACX5448-D router.

Figure 25: ACX5448-D Router Port Panel



## Port, Interface, and PIC Mapping

The ACX5448-D does not have a physical FPC or PIC. FPC 0 refers to the router. The ports on the front panel are mapped to logical PICs as follows:

- Ports **0–35** mapped to PIC 0 (interfaces xe-0/0/0 through xe-/0/0/35)
- Ports **36** and **37** mapped to PIC 1 (interfaces et-0/1/0 and et-0/1/1)
- Ports **38** and **39** mapped to PIC 2 (interfaces ot-0/2/0 and ot-0/2/1)

For each CFP2-DCO optical module installed in ports **38** and **39**, one optical transport (ot-) interface is created. Therefore, the ACX5448-D supports two ot- interfaces—ot-0/2/0 and ot-0/2/1. You can map two 100-Gigabit Ethernet (et-) interfaces to each ot- interface, depending on the configured rate—100 Gbps or 200 Gbps—for the CFP2-DCO module. As a result, four et- interfaces are possible—et-0/2/0, et-0/2/1, et-0/2/2, and et-0/2/3.

The optical interface to et mapping is displayed in the following table:

ot- interface	Port Number	Modulation Format	Mapped et interface(s)
ot-0/2/0	Port <b>38</b>	QPSK-100G	et-0/2/0
		8QAM-200G	et-0/2/0 et-0/2/1
		16QAM-200G	et-0/2/0 et-0/2/1
ot-0/2/1	Port <b>39</b>	QPSK-100G	et-0/2/2
		8QAM-200G	et-0/2/2 et-0/2/3
		16QAM-200G	et-0/2/2 et-0/2/3

## Default Port Configuration on ACX5448-D

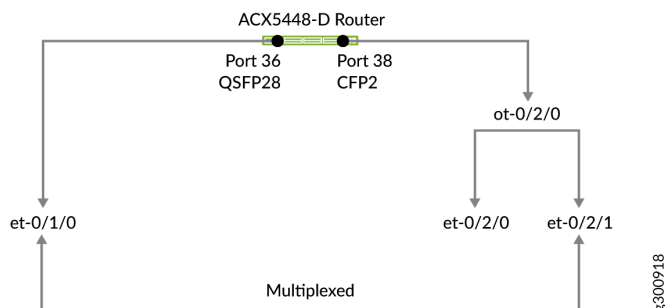
By default (factory-default configuration), when you power on an ACX5448-D router, the following port combinations are available:

- 36 SFP+ ports (ports **0** through **35**)—These ports can operate as native 10-Gigabit Ethernet interfaces or as 1-Gigabit Ethernet interfaces when you use 1-gigabit optics.
- Two QSFP28 ports (**36** and **37**)—The interface for port **36** is not created. However, you can configure port **37** as native 100-Gigabit or 40-Gigabit Ethernet interfaces, or channelize these ports into four 25-Gigabit Ethernet or 10-Gigabit Ethernet interfaces, respectively, by using CLI configuration and breakout cables.
- Two CFP2 ports (**38** and **39**)—You can configure each of the CFP2 ports as a 200-Gigabit Ethernet port.

## Multiplexing on ACX5448-D Routers

As we have seen in the preceding sections, the et-0/1/0 interface is created for QSFP28 port **36** and the ot-0/2/0 interface is created for CFP2 port **38**. The ot-0/2/0 interface is mapped to the et-interfaces et-0/2/0 and et-0/2/1.

The QSFP28 port **36** (interface et-0/1/0) and the CFP2 port **38** (interface et-0/2/1) operate as multiplexer (also called mux) ports.



When you start up the router, the et-0/1/0 interface on port **36** is not created by default. However, the interface et-0/2/0 (on port **38**) is always available. You can enable the et-0/1/0 interface (on port **36**) by running the `set chassis fpc 0 cfp-to-et` command and restarting the FPC by executing the `restart chassis-control` command. (This configuration deletes the interface et-0/2/1 on port **38**.)

Therefore, you can change the factory-default port combination for the QSFP28 and CFP2 ports to the following:

- QSFP28 ports **36** and **37**—Enable the et-0/1/0 interface on port **36**. You can configure ports **36** and **37** as native 100-Gigabit or 40-Gigabit Ethernet interfaces, or channelize them into four 25-Gigabit

Ethernet or 10-Gigabit Ethernet interfaces, respectively, by using CLI configuration and breakout cables.

- CFP2 ports **38** and **39**—Configure port **38** as a 100-Gigabit Ethernet port and port **39** as a 200-Gigabit Ethernet port.

## Enable Multiplexing by Changing the Default Configuration

In the factory-default configuration, the interface for port **36** is not created. You need to enable it and then operate it as a multiplexed port **38** (interface et-0/2/1). To change the factory-default port combination and enable the et-0/1/0 interface (port **36**):

1. Include the `set chassis fpc 0 cfp-to-et` command at the [edit] hierarchy level in the configuration mode.

```
[edit]
user@host# set chassis fpc 0 cfp-to-et
```

2. Commit the configuration.

```
[edit]
user@host# commit
```

3. Restart the FPC.

```
user@host> restart chassis-control
```

This configuration deletes the et-0/2/1 interface (on port **38**) and creates the et-0/1/0 interface (on port **36**). After you change the factory-default port combination, the modified port combination will become the default port combination when you power on the device.

**NOTE:** Before changing this default behavior, plan to handle disruption of services.

## LED Behavior for CFP2 Ports

[Table 5 on page 23](#) summarizes the LED port behavior for CFP2 DCO ports.

**Table 5: LED behavior for CFP2 ports**

Mode	Color	State	Description	First et- port status	Second et- port status	First et- traffic	Second et- traffic
200G	Green	On	Indicates that the port is up and the port speed is 200 Gbps but there is no traffic passing.	Up	Up	Off	Off
200G	Green	Flashing	Indicates that the port speed is 200 Gbps, and there is some activity.	Up	Up	On	On
100G	Amber	On	Indicates that the port is up and the port speed is 100 Gbps but there is no traffic passing.	Up	Down	Off	Off
				Down	Up	Off	Off
100G	Amber	Flashing	Indicates that the port is up and the port speed is 100 Gbps and there is some activity.	Up	Down	On	Off
				Down	Up	Off	On
				Up	Up	On	Off
				Up	Up	Off	On
	Unlit	Off	There is no link on the port.				

**NOTE:** The first et- interface in [Table 5 on page 23](#) refers to the et-0/2/0 interface (port 38) or the et-0/2/2 interface (port 39). Similarly, the second et interface refers to the et-0/2/1 interface (port 38) or the et-0/2/3 interface (port 39).

## Port Panel of an ACX5448-M Router

The port panel of the ACX5448-M router has the following port configurations:

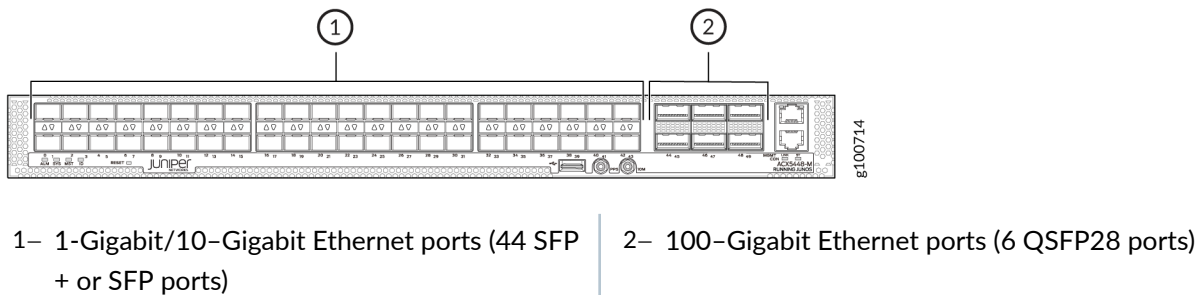


- Forty-four 10-Gigabit or 1-Gigabit Ethernet ports (**0** through **43**) that support small form-factor pluggable plus (SFP+) transceivers. These ports can also operate at 1-Gbps speed when you use 1-gigabit SFP optics.
- Six 100-Gigabit Ethernet ports (**44** through **49**) that support quad small form-factor pluggable 28 (QSFP28) transceivers. You can channelize these ports into four 25-Gbps interfaces using breakout cables (and channelization configuration). These ports also support 40-Gbps speed, when you use QSFP+ optics. You can channelize these 40-Gbps ports into four 10-Gbps interfaces using breakout cables (and channelization configuration).

**NOTE:** The ACX5448-M routers support advanced security capabilities such as Media Access Control Security (MACsec). MACsec is supported only on the forty-four 10-Gigabit or 1-Gigabit Ethernet ports.

Figure 26 on page 24 shows the port panel of an ACX5448-M router.

**Figure 26: ACX5448-M Router Port Panel**



## Chassis Status LEDs on ACX5400 Routers

The ACX5400 routers have four status LEDs on the front side of the chassis (see callout 7 in [Figure 27 on page 25](#)).

Figure 27: Chassis Status LEDs on an ACX5448 Router

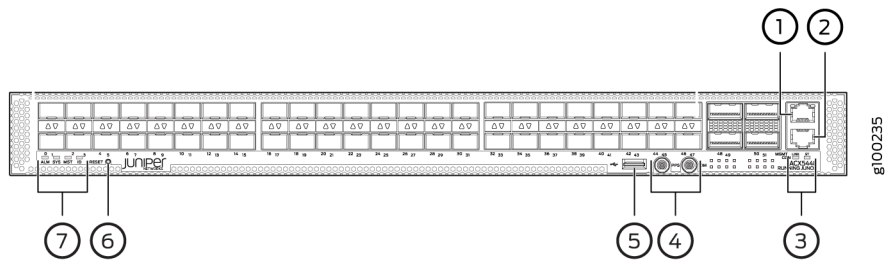


Figure 28: Chassis Status LEDs on an ACX5448-D Router

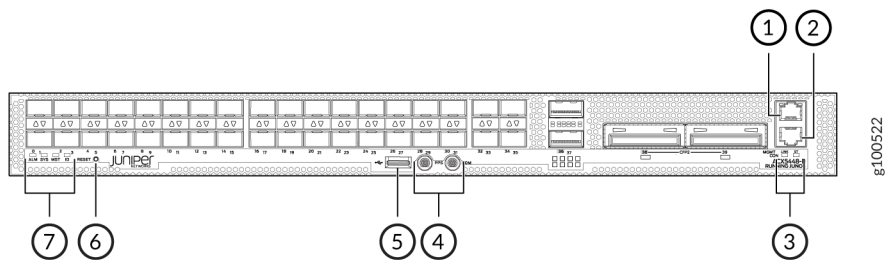
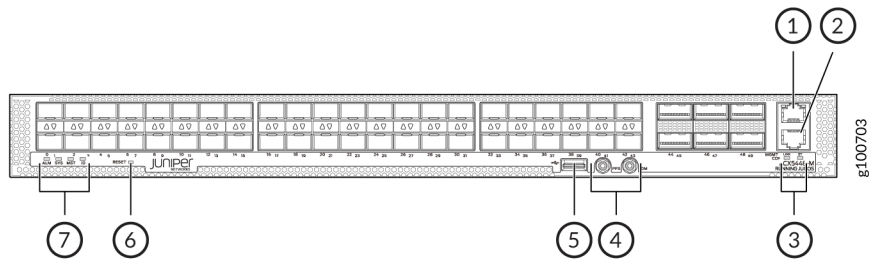


Figure 29: Chassis Status LEDs on an ACX5448-M Router



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

Table 6 on page 26 describes the chassis status LEDs on ACX5400 routers, 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 6: Chassis Status LEDs on ACX5400 Routers

Name	Color	State	Description
<b>ALM</b> —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 router by setting the AC power source outlet to the off (O) position and unplugging the AC power cords. Correct any voltage or site temperature issues, and allow the router to cool down. Power on the 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 router by setting the AC power source outlet to the off (O) position and unplugging the AC power cords. Power on the router and monitor the status LEDs to ensure that Junos OS boots properly.
<b>SYS</b> —System	Unlit	Off	The router is powered off or halted.
	Green	On steadily	Junos OS for ACX Series is loaded on the router.
<b>MST</b> —Primary	Unlit	Off	The router is a linecard member.
	Green	On steadily	The router is a standalone router.

Table 6: Chassis Status LEDs on ACX5400 Routers (*Continued*)

Name	Color	State	Description
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 ACX5400 Routers

The management ports (labeled **MGMT**) for 10/100/1000BASE-T connections on ACX5400 routers have two LEDs that indicate link status and link activity (see callout 3 and 4 in [Figure 30 on page 27](#)). The right LED indicates status; the left LED indicates link activity.

Figure 30: Management Port LEDs on an ACX5448 Router

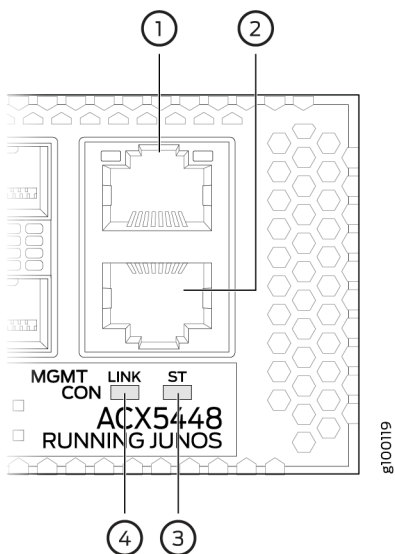


Figure 31: Management Port LEDs on an ACX5448-D Router

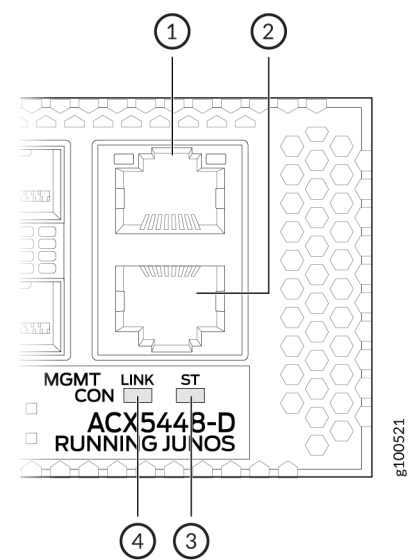
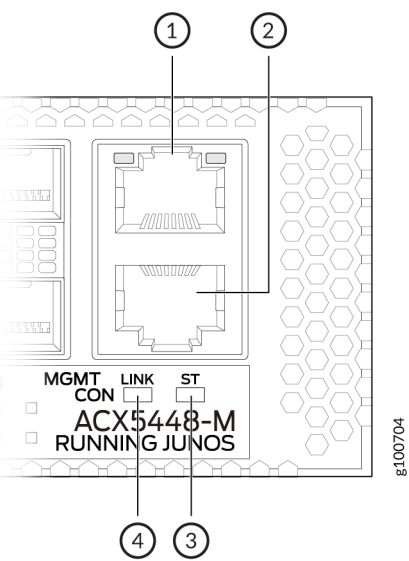


Figure 32: Management Port LEDs on an ACX5448-M Router



1– Management ( <b>MGMT</b> ) port	3– Status ( <b>ST</b> ) LED
2– Console ( <b>CON</b> ) port	4– Link activity ( <b>LINK</b> ) LED

Table 7 on page 29 describes the management port LEDs.

**Table 7: Management Port LEDs on ACX5400 Routers**

LED	Color	State	Description
<b>LINK</b> (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.
<b>ST</b> (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.

## Network Port LEDs on ACX5400 Routers

The ACX5400 routers use bicolored LEDs to indicate link activity on and status of network ports. The link LED indicates link activity or a fault. The status LED indicates transceiver presence.

[Table 8 on page 29](#) describes how to interpret the SFP+ port LEDs.

**Table 8: Network Port LEDs on SFP+ Ports for ACX5400 Routers**

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 is some activity.
	Amber	On or flashing	Indicates that the port speed is 1 Gbps, and there is some activity.

**Table 8: Network Port LEDs on SFP+ Ports for ACX5400 Routers (Continued)**

Mode	Color	State	Description
	Off	Unlit	There is no link on the port.

Table 9 on page 30 describes how to interpret the QSFP28 LEDs.

**Table 9: Network Port LEDs on QSFP28 Ports for ACX5400 Routers**

Mode	Color	State	Description
100-Gigabit Ethernet	Green	On or flashing	Indicates that the port speed is 100 Gbps, and there is 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 is 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 breakout cable), and there is 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 breakout cable), and there is some activity.
	Off	Unlit	There is no link on the port.

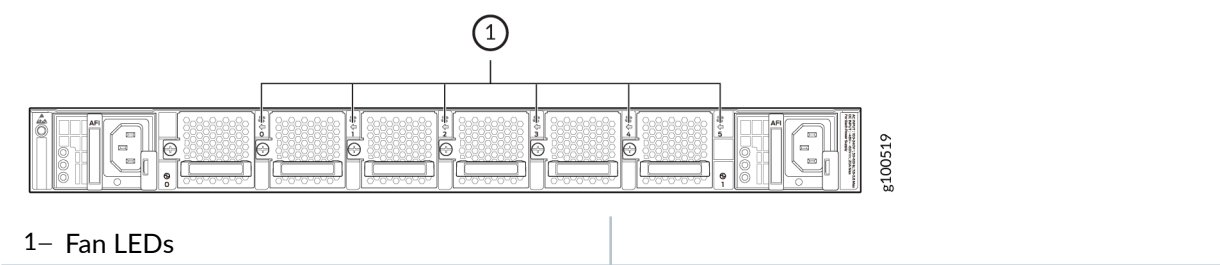
**NOTE:** There are four bicolor lane LEDs for each QSFP28 port that are located just below the QSFP28 ports. The first LED is used and the remaining LEDs are not used when the port is configured as a 40-Gigabit Ethernet or 100-Gigabit Ethernet interface, and connected to a QSFP28 transceiver. All four LEDs are used when the port is configured as a 10-Gigabit Ethernet

or 25-Gigabit Ethernet interface, and the port is connected using an optical split cable (breakout cable) or a direct attach copper breakout (DACBO) cable.

## Fan Status LEDs on ACX5400 Routers

The fan modules on ACX5400 routers do not have any LEDs—the fan status LEDs are located next to the fan module slots on the ACX5400 chassis. [Figure 33 on page 31](#) shows the location of the LED next to the fan module.

Figure 33: Fan Status LEDs on ACX5400 Routers



[Table 10 on page 31](#) describes the function of the fan status LED.

Table 10: Fan Status LED on ACX5400 Routers

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.
	Red	On steadily	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 ACX5400 Routers

IN THIS SECTION

- AC Power Supply LEDs on ACX5400 Routers | 32
- DC Power Supply LEDs on ACX5400 Routers | 34

## AC Power Supply LEDs on ACX5400 Routers

Figure 34 on page 32 shows the location of the LEDs on the ACX5448 power supply module (PSM).

Figure 34: AC Power Supply LEDs on an ACX5448 Router

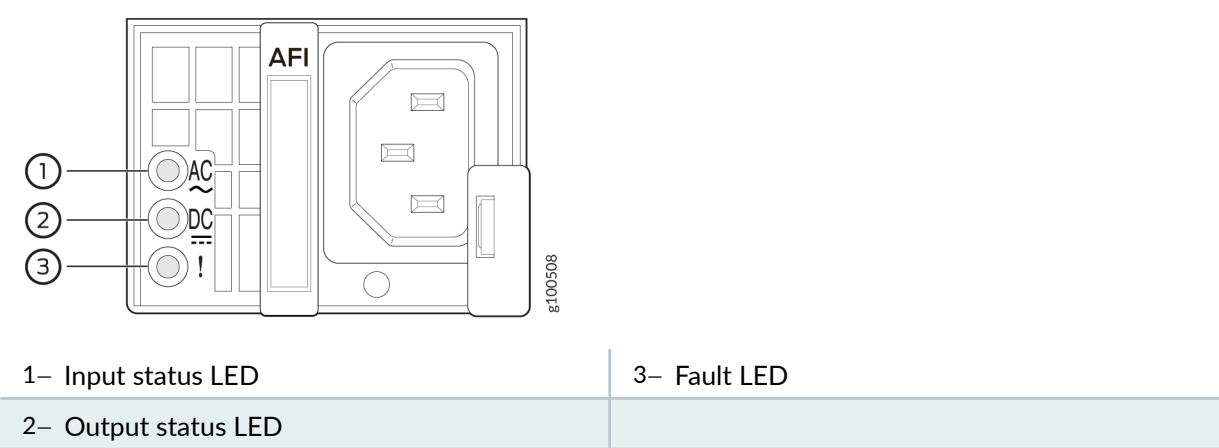


Figure 35 on page 33 shows the location of the LEDs on the ACX5448-D and ACX5448-M PSM (see callouts 1, 2, and 3).

Figure 35: AC Power Supply LEDs on an ACX5448-D and ACX5448-M Router

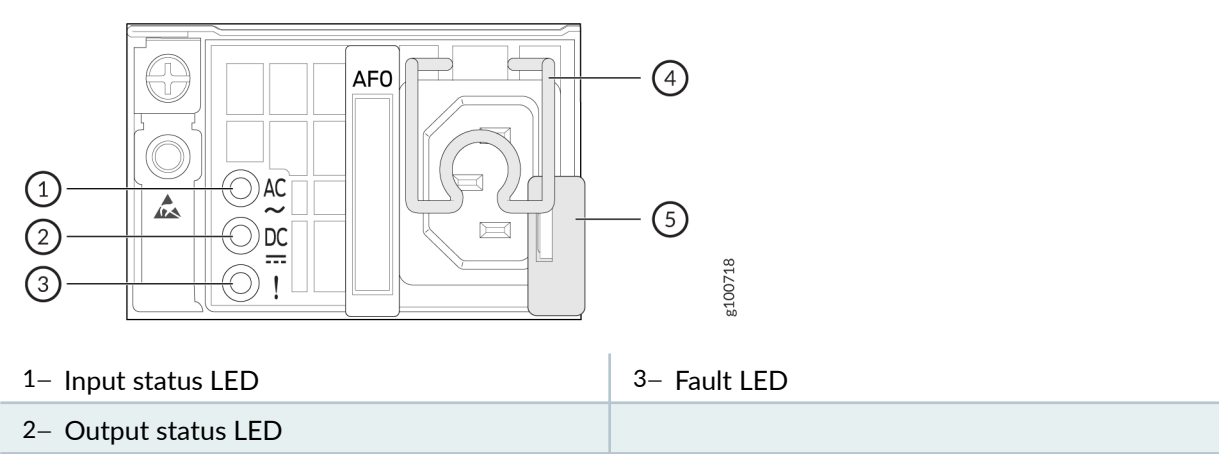


Table 11 on page 33 describes the LEDs on the AC PSMs.

Table 11: AC Power Supply Module LEDs on ACX5400 Routers

LED	Color	State	Description
AC	Unlit	Off	There is no input power to the PSM.
	Green	On steadily	There is input AC power to the PSM
DC	Unlit	Off	There is no output voltage from the PSM. Check the PSM.
	Green	On steadily	There is output voltage from the PSM.
! (fault)	Amber	On steadily	An error is detected in the PSM. Replace the PSM as soon as possible. To maintain proper airflow through the chassis, leave the PSM 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 PSM is installed properly, but the power supply has an internal failure.

DC Power Supply LEDs on ACX5400 Routers

Figure 36 on page 34 shows the location of the LEDs on the DC PSM.

Figure 36: DC Power Supply Faceplate on ACX5400 Routers

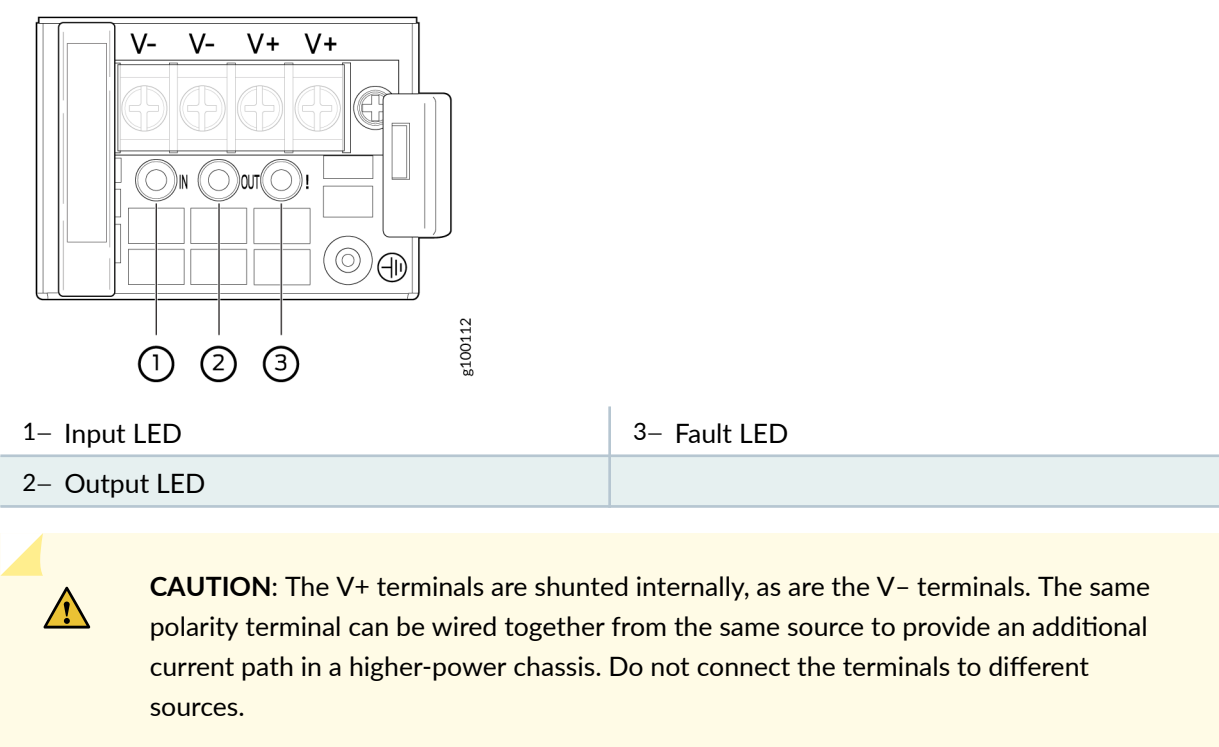


Table 12 on page 34 describes the LEDs on the DC PSMs.

Table 12: DC Power Supply LEDs on ACX5400 Routers

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

Table 12: DC Power Supply LEDs on ACX5400 Routers (*Continued*)

Name	Color	State	Description
	Green	On steadily	There is output voltage from the PSM.
! (fault)	Amber	On steadily	An error is detected in the PSM. Replace the PSM as soon as possible. To maintain proper airflow through the chassis, leave the PSM installed in the chassis until you are ready to replace it.

## Cooling System and Airflow in ACX5448, ACX5448-D, and ACX5448-M Routers

### IN THIS SECTION

- [Fan Modules | 36](#)
- [Fan Module and Power Supply Requirement | 38](#)
- [Fan Module Status | 39](#)

The cooling system in ACX5400 routers consists of six fan modules and a single fan in each power supply module (PSM). The ACX5400 routers can be set up to work in the following airflow directions:

- 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:** Do not mix fan modules and PSMs with AFO and AFI labels in the same chassis.

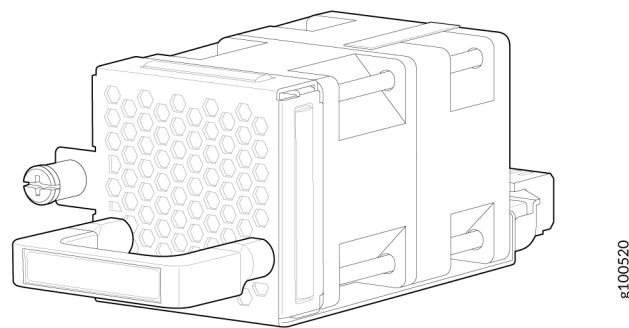
## Fan Modules

The fan modules in ACX5400 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 ACX5400 routers 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 ACX5400 routers are available with either front-to-back airflow (airflow out, ports-to-FRUs, or AFO), or back-to-front airflow (airflow in, FRUs-to-ports, or AFI). In AFO models, the air is pulled through the front of the chassis toward the fan modules, from where it is exhausted out of the chassis. In AFI models, the air is pulled through the fan modules and toward the front of the chassis, from where it is exhausted out of the chassis. The fan modules and the power modules are available in both AFO and AFI models.

Figure 37 on page 36 shows an ACX5400 fan module.

Figure 37: Fan Module Used in ACX5400 Routers



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 13 on page 37 lists the available fan modules and the direction of airflow in them.

**Table 13: Fan Module in ACX5400 Routers**

Fan Module	Airflow Diagram	Label on the Fan Module Handle	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
ACX5448-FAN-AFI ACX5448-D-FAN-AFI	<a href="#">Figure 38 on page 38</a>	<b>AIR IN</b>	Juniper Azure Blue	Air is pulled through the fan modules and toward the front of the chassis, from where it is exhausted out of the chassis.	You must install PSMs that have <b>AIR IN</b> labels only in those routers in which the fan modules have <b>AIR IN</b> labels.
ACX5448-FAN-AFO ACX5448-D-FAN-AFO	<a href="#">Figure 39 on page 38</a>	<b>AIR OUT</b>	Juniper Gold	Air is pulled through the front of the chassis toward the fan modules, from where it is exhausted out of the chassis.	You must install PSMs that have <b>AIR OUT</b> labels only in those routers in which the fan modules have <b>AIR OUT</b> 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 38: Air In Airflow Through ACX5400 Chassis—AFI

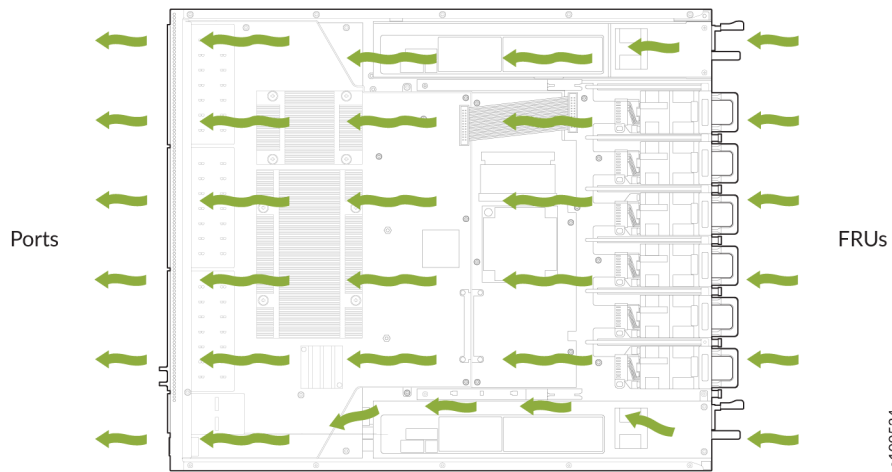
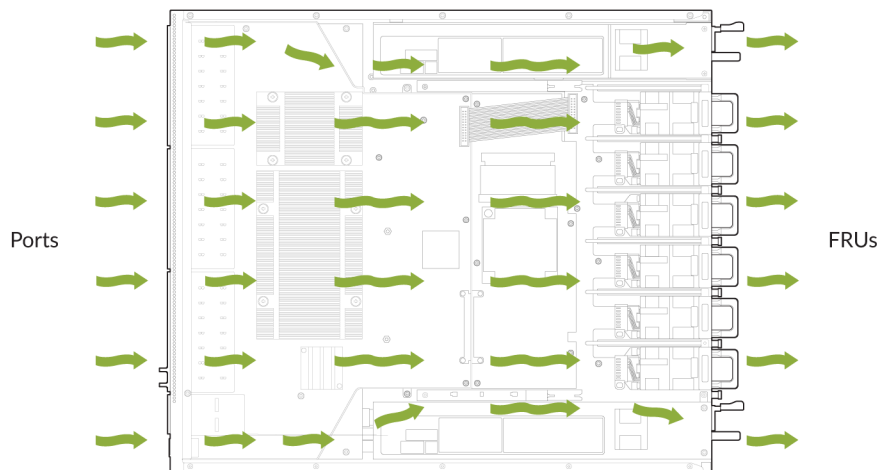


Figure 39: Air Out Airflow Through ACX5400 Chassis—AFO



## Fan Module and Power Supply Requirement

Do not mix PSMs with different airflow. If the PSMs are color-coded, ensure they are either all azure blue for the airflow-in (AFI) models or all gold for airflow-out (AFO) models. If the PSMs 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 PSMs. Fan modules are also color-coded either azure blue for airflow in or gold 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 color of the PSM handle must be azure blue; if the fan modules have **AIR OUT** labels, the color of the PSM handle must be gold.

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 13 on page 37](#) for the correct part number for your ACX5400 router.

However, if you need to convert an ACX5400 device to have a different airflow, you can change the airflow pattern. To convert an **AIR IN** product model to an **AIR OUT** product model or an **AIR OUT** product model to a **AIR IN** product model, you must replace all of the fan modules and PSMs at one time to use the new direction.

**NOTE:** You must power off the device before replacing all the fans and power supplies and then power on the device. If you replace the fans or power supplies without powering off the device, the system will raise an alarm.

## 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 chassis.

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 14 on page 40](#) describes the fan module status LED in an ACX5400 router.



**Table 14: Fan Module Status**

LED Color	State	Description
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.
Red	On steadily	An error has been detected in the fan module. Replace the fan module as soon as possible. Either the fan has failed or it is seated incorrectly. To maintain proper airflow through the chassis, leave the fan module installed in the chassis until you are ready to replace it.

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

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

## ACX5448, ACX5448-D, and ACX5448-M Power System

### IN THIS SECTION

- [AC Power Supply for ACX5400 Routers | 41](#)
- [AC Power Specifications for ACX5400 Routers | 43](#)
- [AC Power Cord Specifications for ACX5400 Routers | 44](#)
- [DC Power Supply for ACX5400 Routers | 45](#)
- [DC Power Specifications for ACX5400 Routers | 47](#)

## AC Power Supply for ACX5400 Routers

The ACX5448 AC router operates at 650 W while the ACX5448-D and ACX5448-M AC routers need 850 W. The two power supply modules (PSMs) in ACX5400 routers are hot-removable and hot-insertable field-replaceable units (FRUs). The PSMs are installed in the router at the factory. You can replace the PSMs without powering off the router or disrupting the router function.

**NOTE:** Both the AFI and AFO PSMs look identical. Be sure to use the correct PSM for your chassis product model (see [Table 15 on page 42](#) for ACX5448 routers and [Table 16 on page 43](#) for ACX5448-D and ACX5448-M routers).



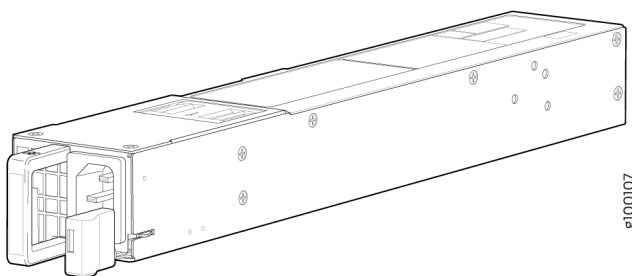
**CAUTION:** Do not mix PSMs with different airflow in the same chassis. The system raises an alarm when a PSM having a different airflow is inserted into the chassis.



**CAUTION:** Do not mix AC and DC PSMs in the same chassis.

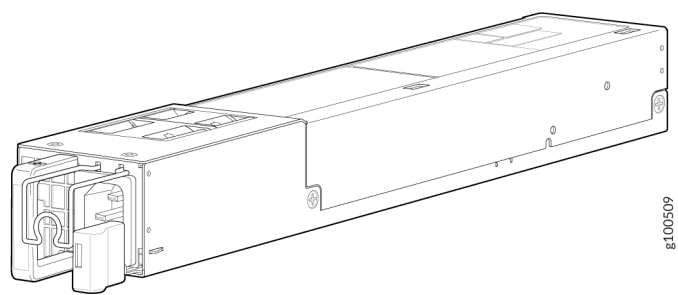
[Figure 40 on page 41](#) shows the AC PSM in ACX5448 routers.

**Figure 40: AC PSM in an ACX5448 Router**




[Figure 41 on page 42](#) shows the AC PSM in ACX5448-D and ACX5448-M routers.

Figure 41: AC PSM in ACX5448-D and ACX5448-M Routers



The PSMs provide FRU-to-port or port-to-FRU airflow depending on the product model you purchase. The PSMs either have labels on the handles that indicate the direction of airflow or have color-coded handles with a fan icon. A PSM with the label **AFI** or a blue handle denotes FRU-to-port airflow. A PSM with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.



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

Table 15 on page 42 and Table 16 on page 43 show the different PSMs and their direction of airflow.

Table 15: Airflow Direction in AC PSM for ACX5448

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

**Table 16: Airflow Direction in AC PSM for ACX5448-D and ACX5448-M**

Power Supply Modules	Wattage	Direction of Airflow	Color of Power Supply Module Handle
JPSU-850W-AC-AFI	850 W	Airflow in (back-to-front)	Juniper Azure Blue
JPSU-850W-AC-AFO		Airflow out (front-to-back)	Juniper Gold

## AC Power Specifications for ACX5400 Routers

Table 17 on page 43 describes the AC power specifications for ACX5400 routers.

**Table 17: AC Power Specifications for ACX5400 Routers**

Item	Specifications for ACX5448	Specifications for ACX5448-D	Specifications for ACX5448-M
AC input voltage	Operating range: <ul style="list-style-type: none"> <li>100–240 VAC</li> </ul>	Operating range: <ul style="list-style-type: none"> <li>100–240 VAC</li> </ul>	Operating range: <ul style="list-style-type: none"> <li>100–240 VAC</li> </ul>
AC input line frequency	50–60 Hz (all product models)	50–60 Hz (all product models)	50–60 Hz (all product models)
AC input current rating	<ul style="list-style-type: none"> <li>7.8 A at 100–120 VAC</li> <li>3.8 A at 200–240 VAC</li> </ul>	<ul style="list-style-type: none"> <li>5.6 A at 100–120 VAC</li> <li>2.3 A at 200–240 VAC</li> </ul>	<ul style="list-style-type: none"> <li>6.5 A at 100–120 VAC</li> <li>2.7 A at 200–240 VAC</li> </ul>
Typical power consumption	250 W	340 W	300 W
Maximum power consumption	450 W	550 W	550 W

## AC Power Cord Specifications for ACX5400 Routers

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

**NOTE:** In North America, AC power cords must not exceed 4.5 meters 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 ACX series power cords comply with the standards.

Table 18 on page 44 lists AC power cord specifications provided for each country or region.

**Table 18: AC Power Cord Specifications**

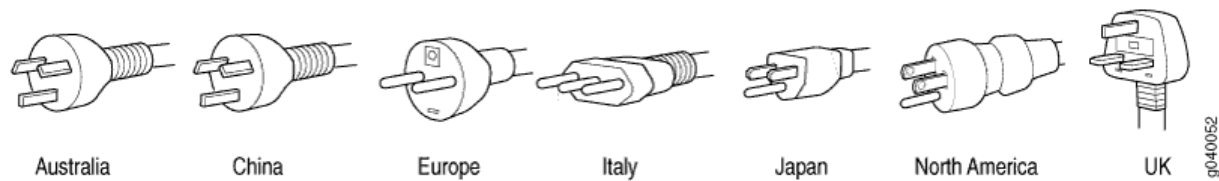
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
Argentina	250 VAC, 10 A, 50 Hz	IRAM 2073 Type RA/3	CBL-EX-PWR-C13-AR
Australia	250 VAC, 10 A, 50 Hz	AS/NZZS 3112 Type SAA/3	CBL-EX-PWR-C13-AU
Brazil	250 VAC, 10 A, 50 Hz	NBR 14136 Type BR/3	CBL-EX-PWR-C13-BR
China	250 VAC, 10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

Table 18: AC Power Cord Specifications (Continued)

Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number
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 42 on page 45 illustrates the plug on the power cord for some of the countries or regions listed in Table 18 on page 44.

Figure 42: AC Plug Types



## DC Power Supply for ACX5400 Routers

The two power supply modules (PSMs) in ACX5400 routers are hot-removable and hot-insertable field-replaceable units (FRUs). The PSMs are installed in the router at the factory. The DC power supply in

ACX5448 is 650 W and ACX5448-D and ACX5448-M is 850 W with dual feeds for power resiliency. You can install replacement PSMs without powering off the router or disrupting the router function.

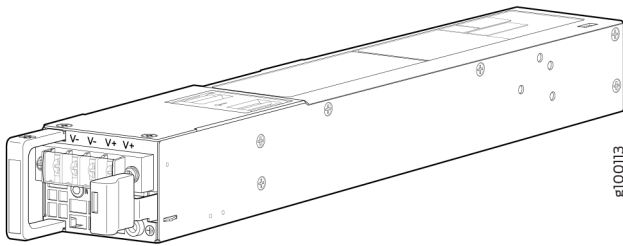
**NOTE:** Both the AFI and AFO PSMs look identical. Be sure to use the correct PSM for your chassis product model. You can identify the AFI and AFO PSMs by checking the color of the PSM handles (see [Table 19 on page 47](#)).



**CAUTION:** Do not mix PSMs with different airflow. The system raises an alarm when a PSM with a different airflow is inserted into the chassis.

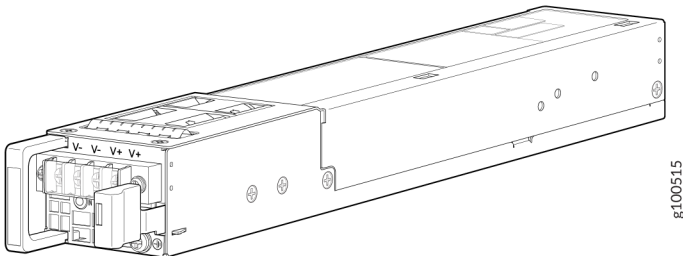
[Figure 43 on page 46](#) shows the DC PSM in ACX5448 routers.

**Figure 43: DC PSM in an ACX5448 router**



[Figure 44 on page 46](#) shows the DC PSM in ACX5448-D and ACX5448-M routers.

**Figure 44: DC PSM in ACX5448-D and ACX5448-M Routers**



**NOTE:** The DC PSM 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 together, as are the V– terminals.

Table 19 on page 47 and Table 20 on page 47 show the different PSMs and their direction of airflow.

**Table 19: Airflow Direction in DC PSM for ACX5448**

Power Supply Module Number	Wattage	Direction of Airflow	Color of Power Supply Module Handle
JPSU-650W-DC-AI	650 W	Airflow in (back-to-front)	Juniper Azure Blue
JPSU-650W-DC-AO		Airflow out (front-to-back)	Juniper Gold

**Table 20: Airflow Direction in DC PSM for ACX5448-D and ACX5448-M routers**

Power Supply Module Number	Wattage	Direction of Airflow	Color of Power Supply Module Handle
JPSU-850W-DC-AFI	850 W	Airflow in (back-to-front)	Juniper Azure Blue
JPSU-850W-DC-AFO		Airflow out (front-to-back)	Juniper Gold

## DC Power Specifications for ACX5400 Routers

Table 21 on page 48 describes the DC power specifications for routers.



**Table 21: DC Power Specifications for ACX5400 Routers**

Item	Specifications for ACX5448	Specifications for ACX5448-D	Specifications for ACX5448-M
DC input voltage	<ul style="list-style-type: none"> <li>Rated operating voltage: -48 VDC through -60 VDC</li> <li>Operating voltage range: -40.8 VDC through -72 VDC</li> </ul>	<ul style="list-style-type: none"> <li>Rated operating voltage: -48 VDC through -60 VDC</li> <li>Operating voltage range: -43.2 VDC through -72 VDC</li> </ul>	<ul style="list-style-type: none"> <li>Rated operating voltage: -48 VDC through -60 VDC</li> <li>Operating voltage range: -43.2 VDC through -72 VDC</li> </ul>
DC input current rating	9.8 A maximum	11.4 A maximum	13.5 A maximum
Typical power consumption	250 W	340 W	300 W
Maximum power consumption	450 W	525 W	550 W

# 2

CHAPTER

## Site Planning, Preparation, and Specifications

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Site Preparation Checklist for ACX5448, ACX5448-D, and ACX5448-M Routers | 50

ACX5448, ACX5448-D, and ACX5448-M Site Guidelines and Requirements | 51

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ACX5448, ACX5448-D, and ACX5448-M Management and Console Port Specifications and Pinouts | 69

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# Site Preparation Checklist for ACX5448, ACX5448-D, and ACX5448-M Routers

The checklist in [Table 22 on page 50](#) summarizes the tasks you need to perform when preparing a site for an ACX5400 router installation.

**Table 22: Site Preparation Checklist**

Item or Task	For More Information	Performed by	Date
<b>Environment</b>			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	<a href="#">"ACX5400 Router Environmental Requirements and Specifications" on page 55</a>		
<b>Power</b>			
Measure the distance between external power sources and router installation site.			
Calculate the power consumption and requirements.	<a href="#">"AC Power Specifications for ACX5400 Routers" on page 43</a>  <a href="#">"DC Power Specifications for ACX5400 Routers" on page 47</a>		
<b>Rack or Cabinet</b>			
Verify that your rack or cabinet meets the minimum requirements for the installation of the router.	<a href="#">"Rack Requirements for ACX5400 Routers" on page 60</a>  <a href="#">"Cabinet Requirements for ACX5400 Routers" on page 59</a>		

Table 22: Site Preparation Checklist (*Continued*)

Item or Task	For More Information	Performed by	Date
Plan rack or cabinet location, including required space clearances.	<a href="#">"Clearance Requirements for Airflow and Hardware Maintenance for ACX5400 Routers" on page 58</a>		
Secure the rack or cabinet to the floor and building structure.			
<b>Cables</b>			
Acquire cables and connectors: <ul style="list-style-type: none"> <li>Determine the number of cables needed based on your planned configuration.</li> <li>Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.</li> </ul>	<a href="#">"Determining Transceiver Support for ACX5400" on page 62</a>  <i>Cable Specifications for QSFP+ and QSFP28 Transceivers</i>		
Plan the cable routing and management.			

## ACX5448, ACX5448-D, and ACX5448-M Site Guidelines and Requirements

### IN THIS SECTION

- [General Site Guidelines | 52](#)
- [Site Electrical Wiring Guidelines | 52](#)

- Chassis Physical Specifications for ACX5400 Routers | 53
- ACX5400 Router Environmental Requirements and Specifications | 55
- ACX5400 Grounding Cable and Lug Specifications | 56
- Clearance Requirements for Airflow and Hardware Maintenance for ACX5400 Routers | 58
- Cabinet Requirements for ACX5400 Routers | 59
- Rack Requirements for ACX5400 Routers | 60

## General Site Guidelines

Efficient device operation requires proper site planning and maintenance. It also requires proper layout of the equipment, rack or cabinet, and wiring closet.

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

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

## Site Electrical Wiring Guidelines

Table 23 on page 53 describes the factors you must consider while planning the electrical wiring at your site.



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

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

**Table 23: Site Electrical Wiring Guidelines**

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

## Chassis Physical Specifications for ACX5400 Routers

The ACX5400 router chassis is a rigid sheet-metal structure that houses the hardware components. [Table 24 on page 54](#), [Table 25 on page 54](#), and [Table 26 on page 55](#) summarize the physical specifications of ACX5448, ACX5448-D, and ACX5448-M routers and their components.

**Table 24: 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 module and power supply module (PSM) handles: 20.29 in. (51.53 cm)  With fan module and PSM handles: 21.81 in. (55.41 cm)	<ul style="list-style-type: none"> <li>With FRUs installed: 22.48 lb (10.2 kg)</li> <li>With no FRUs installed: 16 lb (7.26 kg)</li> </ul>
Fan module	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 PSM	1.58 in. (4.01 cm)	2.23 in. (5.66 cm)	14.50 in. (36.83 cm)	2.2 lb (1 kg)
DC PSM	1.67 in. (4.24 cm)	2.23 in. (5.66 cm)	14.53 in. (36.91 cm)	2.2 lb (1 kg)

**Table 25: Physical Specifications for an ACX5448-D Router Chassis and FRUs**

Item	Height	Width	Depth	Weight
ACX5448-D	1.70 in. (4.33 cm)	17.26 in. (43.84 cm)	Without fan module and PSM handles: 20.29 in. (51.53 cm)  With fan module and PSM handles: 21.81 in. (55.41 cm)	<ul style="list-style-type: none"> <li>With FRUs installed: 23.14 lb (10.5 kg)</li> <li>With no FRUs installed: 16.76 lb (7.6 kg)</li> </ul>
Fan module	1.62 in. (4.11 cm)	1.59 in. (4.05 cm)	3.62 in. (9.19 cm)	0.33 lb (0.15 kg)
AC PSM	1.58 in. (4.01 cm)	2.23 in. (5.66 cm)	14.50 in. (36.83 cm)	2.2 lb (1 kg)

**Table 25: Physical Specifications for an ACX5448-D Router Chassis and FRUs *(Continued)***

Item	Height	Width	Depth	Weight
DC PSM	1.67 in. (4.24 cm)	2.23 in. (5.66 cm)	14.53 in. (36.91 cm)	2.2 lb (1 kg)

**Table 26: Physical Specifications for an ACX5448-M Router Chassis and FRUs**

Item	Height	Width	Depth	Weight
ACX5448-M	1.70 in. (4.33 cm)	17.26 in. (43.84 cm)	Without fan module and power supply module handles: 24.0 in. (61.0 cm)  With fan module and power supply module handles: 25.5 in. (64.8 cm)	<ul style="list-style-type: none"> <li>With FRUs installed: 26.12 lb (11.85 kg)</li> <li>With no FRUs installed: 19.73 lb (8.95 kg)</li> </ul>
Fan module	1.62 in. (4.11 cm)	1.59 in. (4.05 cm)	3.62 in. (9.19 cm)	0.33 lb (0.15 kg)
AC PSM	1.58 in. (4.01 cm)	2.23 in. (5.66 cm)	14.50 in. (36.83 cm)	2.2 lb (1 kg)
DC PSM	1.67 in. (4.24 cm)	2.23 in. (5.66 cm)	14.53 in. (36.91 cm)	2.2 lb (1 kg)

## ACX5400 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 27 on page 56 provides the required environmental conditions for normal router operation.

**Table 27: ACX5400 Router Environmental Tolerances**

Description	Tolerance
Altitude	No performance degradation to 6,000 feet (1,829 meters)
Relative humidity	<p>Normal operation ensured in relative humidity range of 5% through 90%, noncondensing</p> <ul style="list-style-type: none"> <li>• Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing</li> </ul> <p><b>NOTE:</b> As defined in NEBS GR-63-CORE, short-term events can be up to 96 hours in duration but not more than 15 days per year.</p>
Temperature	<ul style="list-style-type: none"> <li>• Normal operation ensured in temperature range of 32° F through 104° F (0° C through 40° C)</li> <li>• Non-operating storage temperature in shipping container: -40° F through 158° F (-40° C through 70° C)</li> </ul>
Seismic	Complies with Zone 4 earthquake requirements according to NEBS GR-63-CORE.

**NOTE:** Install ACX Series devices only in restricted-access 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.

## ACX5400 Grounding Cable and Lug Specifications

For installations that require a separate grounding conductor to the chassis, you must ground the router properly before connecting power to ensure proper operation and to meet safety and electromagnetic

interference (EMI) requirements. To ground an ACX5400 router, connect a grounding cable to earth ground and then attach it to the chassis grounding points.



**WARNING:** The router is a pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal provided on the chassis and on the DC power supply module in addition to the grounding pin of the AC power supply cord. Under all circumstances, use this grounding connection to ground the chassis. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.



**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 [Connect Earth Ground to ACX5400 Routers](#). A cable with an incorrectly attached lug can damage the router.

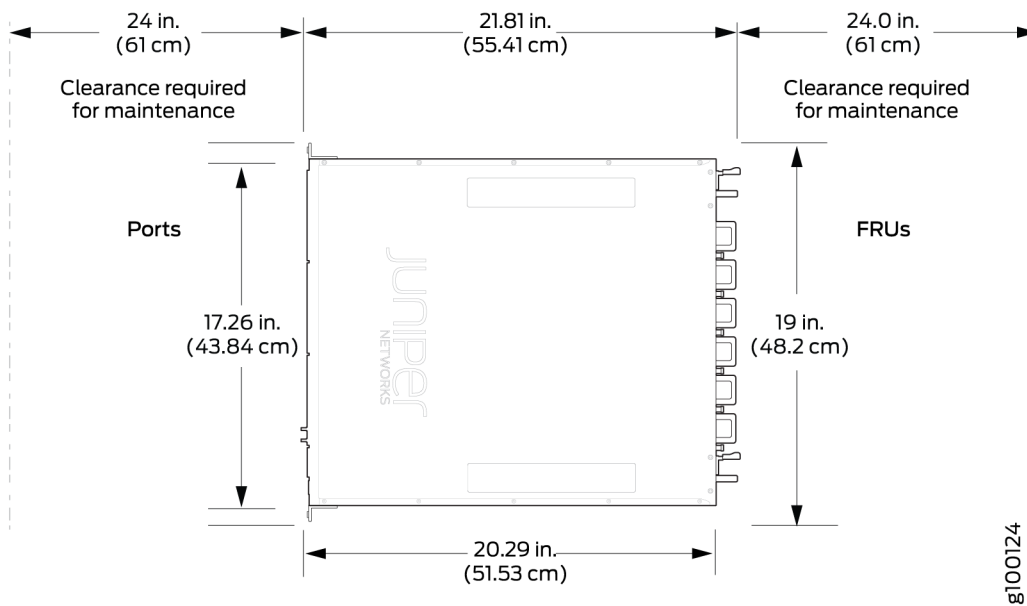
Before connecting the router to earth ground, review the following information:

- You require a protective earthing terminal bracket 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. (You need to provide these screws with integrated washers as we do not ship them in the accessory kit). The grounding points are spaced at 0.63-in. (16-mm) centers.
- For an ACX5448 router, the grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided). The grounding lug accommodates 12 AWG (2.5 mm<sup>2</sup>) stranded wire.
- For an ACX5448 router, 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 mm<sup>2</sup>) stranded wire, 60° C wire, or as permitted by local code.
- For ACX5448-D and ACX5448-M routers, the grounding lug required is a Panduit LCD10-10A-L or equivalent. The grounding lug accommodates 12 AWG (2.5 mm<sup>2</sup>) , 90° C temperature-rated stranded wire.

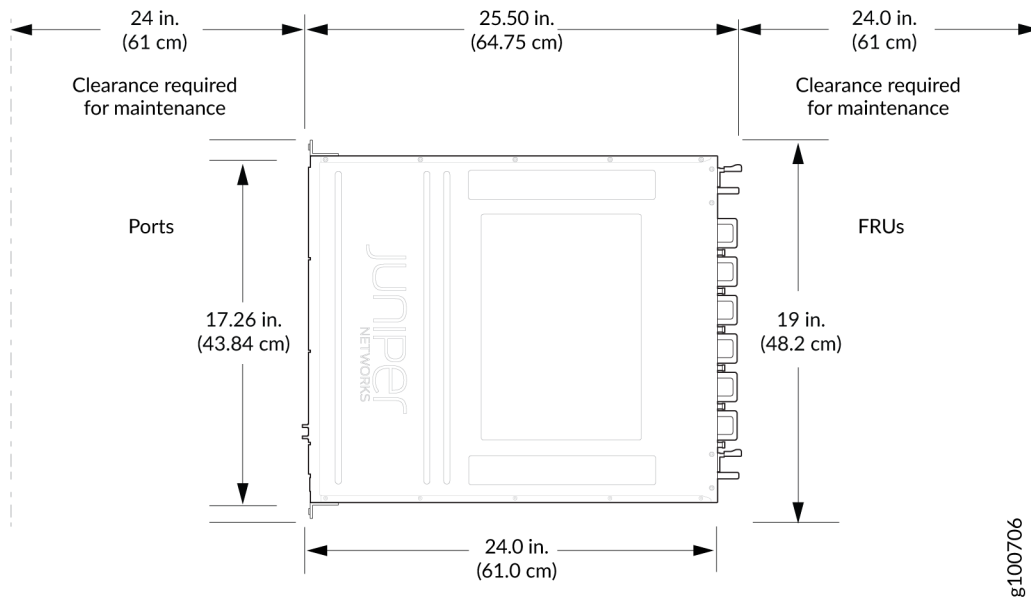
## Clearance Requirements for Airflow and Hardware Maintenance for ACX5400 Routers

When planning the site for installing an ACX5400 router, you must allow sufficient clearance around the installed chassis (see [Figure 45 on page 58](#) and [Figure 46 on page 59](#)).

**Figure 45: Clearance Requirements for Airflow and Hardware Maintenance for ACX5448 and ACX5448-D Routers**



**Figure 46: Clearance Requirements for Airflow and Hardware Maintenance for ACX5448-M Routers**



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See ["Cooling System and Airflow in ACX5448, ACX5448-D, and ACX5448-M Routers"](#) on page 35 for more information about the airflow through the chassis.
- If you are mounting an ACX5400 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 bend radius, there must be adequate space at the front and rear of the router. Allow at least 24 in. (61 cm) of space both at the front and the rear of the router.

## Cabinet Requirements for ACX5400 Routers

You can mount an ACX5400 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 28 on page 60](#) provides the cabinet requirements and specifications for an ACX5400 router.

**Table 28: Cabinet Requirements for ACX5400 Routers**

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating an ACX5400 router is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet airflow requirements	<p>When you mount the router in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating.</p> <ul style="list-style-type: none"> <li>• Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the router (or routers).</li> <li>• 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.</li> <li>• The ACX5400 router fans exhaust hot air either through the vents on the port panel or through the fan modules and PSMs. 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.</li> <li>• Route and dress all cables to minimize the blockage of airflow to and from the chassis.</li> <li>• Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the router and cabinet.</li> </ul>

## Rack Requirements for ACX5400 Routers

The ACX5400 routers are designed to be installed on four-post racks.

[Table 29 on page 61](#) provides the rack requirements and specifications for ACX5400 routers.

Table 29: Rack Requirements for ACX5400 Routers

Rack Requirement	Guidelines
Rack type	<p>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.</p> <p>A U is the standard rack unit defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310-D) published by the Electronics Industry Association.</p>
Mounting bracket hole spacing	<p>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.</p>
Rack size and strength	<ul style="list-style-type: none"> <li>• Ensure that the rack complies with the standards for a 19-in. rack as defined in <i>Cabinets, Racks, Panels, and Associated Equipment</i> (document number EIA-310-D) published by the Electronics Industry Association.</li> <li>• Use an 800-mm rack as defined in the four-part <i>Equipment Engineering (EE) European telecommunications standard for equipment practice</i> (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (<a href="http://www.etsi.org">http://www.etsi.org</a>).</li> </ul> <p>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.</p> <ul style="list-style-type: none"> <li>• 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).</li> <li>• Ensure that for four-post installations, the front and rear rack rails are spaced between 23.25 in. (59 cm) and 30.6 in. (77.7 cm) front-to-back.</li> <li>• 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), the ACX5448-D router weighs 23.14 lb (10.5 kg), and the ACX5448-M router weighs 26.12 lb (11.85 kg).</li> <li>• Ensure that the spacing of rails and adjacent racks allows for proper clearance around the router and rack.</li> </ul>

**Table 29: Rack Requirements for ACX5400 Routers (Continued)**

Rack Requirement	Guidelines
Rack connection to building structure	<ul style="list-style-type: none"> <li>Secure the rack to the building structure.</li> <li>If earthquakes are a possibility in your geographical area, secure the rack to the floor.</li> <li>Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.</li> </ul>

## ACX5448, ACX5448-D, and ACX5448-M Network Cable and Transceiver Planning

### IN THIS SECTION

- Determining Transceiver Support for ACX5400 | 62
- Cable Specifications for QSFP+ and QSFP28 Transceivers | 63
- Calculating Power Budget and Power Margin for Fiber-Optic Cables | 65
- Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion | 68

### Determining Transceiver Support for ACX5400

You can find information about the pluggable transceivers and connector types supported on your Juniper Networks device by using the Hardware Compatibility Tool. The tool also documents the optical and cable characteristics, where applicable, for each transceiver. You can search for transceivers by product—and the tool displays all the transceivers supported on that device—or by category, interface speed, or type. The list of supported transceivers for the ACX5400 is located at <https://apps.juniper.net/hct/product/#prd=ACX5448>.



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

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

## SEE ALSO

*Cable Specifications for QSFP+ and QSFP28 Transceivers*

## Cable Specifications for QSFP+ and QSFP28 Transceivers

The 40GbE quad small form-factor pluggable plus (QSFP+) and 100GbE quad small form-factor pluggable 28 (QSFP28) transceivers that are used in ACX Series routers use 12-ribbon multimode fiber crossover cables with MPO socket connectors (SR4 optics only). The fiber can be either OM3 or OM4. Juniper Networks does not sell these cables.



**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+ transceivers or two QSFP28 transceivers, ensure that the proper polarity is maintained through the cable plant.



Table 30 on page 64 describes the signals on each fiber. Table 31 on page 64 shows the pin-to-pin connections for proper polarity.

Table 30: QSFP+ MPO Cable Signals

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

Table 31: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

Pin	Pin
1	12

Table 31: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts (*Continued*)

Pin	Pin
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

### IN THIS SECTION

- [How to Calculate Power Budget for Fiber-Optic Cables | 66](#)
- [How to Calculate Power Margin for Fiber-Optic Cables | 66](#)

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:

## How to Calculate Power Budget for Fiber-Optic Cables

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):

$$P_B = P_T - P_R$$

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

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

## How to Calculate Power Margin for Fiber-Optic Cables

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 32 on page 67](#) 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 32: 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
Faulty connector	0.5 dB
Splice	0.5 dB
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 32 on page 67](#). This example calculates 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:

$$P_M = P_B - LL$$

$$P_M = 13 \text{ dB} - 2 \text{ km (1 dB/km)} - 5 (0.5 \text{ dB}) - 2 (0.5 \text{ dB}) - 0.5 \text{ dB}$$

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

$$P_M = 7 \text{ dB}$$

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 32 on page 67](#). This example calculates 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:

$$P_M = P_B - LL$$

$$P_M = 13 \text{ dB} - 8 \text{ km (0.5 dB/km)} - 7(0.5 \text{ dB})$$

$$P_M = 13 \text{ dB} - 4 \text{ dB} - 3.5 \text{ dB}$$

$$P_M = 5.5 \text{ dB}$$

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.

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

### IN THIS SECTION

- [Signal Loss in Multimode and Single-Mode Fiber-Optic Cable | 68](#)
- [Attenuation and Dispersion in Fiber-Optic Cable | 68](#)

### 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, ACX5448-D, and ACX5448-M

### Management and Console Port Specifications and Pinouts

#### IN THIS SECTION

- [Management Cable Specifications for ACX5400 Routers | 70](#)
- [Management Port Connector Pinout Information for ACX Series Routers | 70](#)
- [Console Port Connector Pinout on ACX5400 Routers | 71](#)
- [USB Port Specifications for an ACX Series Router | 72](#)

## Management Cable Specifications for ACX5400 Routers

Table 33 on page 70 lists the specifications for the cables that connect the console and management ports to management devices.

**Table 33: 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	<i>Connect a Device to a Management Console Using an RJ-45 Connector</i>
Management Ethernet port	Ethernet cable with an RJ-45 connector	RJ-45	<i>Connect a Device to a Network for Out-of-Band Management</i>

## Management Port Connector Pinout Information for ACX Series Routers

The management port—labeled **MGMT**—on an ACX Series router 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 34 on page 70 provides the pinout information for the RJ-45 connector for the management port.

**Table 34: Management Port Connector Pinout Information**

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

**Table 34: Management Port Connector Pinout Information (Continued)**

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

## Console Port Connector Pinout on ACX5400 Routers

The port labeled **CON** on the front panel is an asynchronous serial interface that accept an RJ-45 connector. Use a cable with the pinouts described in [Table 35 on page 71](#) to connect the Routing Engine to a console management device.

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

**Table 35: Connector Pinout for the Console Port**

Pin	Signal	Description	CPU	Direction
3	TXD	Transmit Data	Routing Engine	Out
4	Ground	Signal Ground	–	–
5	Ground	Signal Ground	–	–



Table 35: Connector Pinout for the Console Port *(Continued)*

Pin	Signal	Description	CPU	Direction
6	RXD	Receive Data	Routing Engine	In

## 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 that is 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. The 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 meet the following requirements:

- USB 2.0 or later
- Formatted with a FAT32 or MS-DOS file system

# 3

CHAPTER

## Initial Installation and Configuration

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ACX5448, ACX5448-D, and ACX5448-M Installation Overview | 74

Unpacking and Mounting ACX5448, ACX5448-D, and ACX5448-M | 74

Connect ACX5448, ACX5448-D, and ACX5448-M to Power | 84

Connect ACX5448, ACX5448-D, and ACX5448-M to External Devices | 97

Perform Initial Software Configuration for the ACX5448, ACX5448-D, and ACX5448-M Routers | 100

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# ACX5448, ACX5448-D, and ACX5448-M

## Installation Overview

You can mount ACX5400 routers:

- 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 ACX5400 router:

1. Follow the instructions in ["Unpack an ACX5400 Router" on page 75](#).
2. Determine how the device is to be mounted.  
For instructions on flush or recessed mounting, see ["Mount an ACX5400 Router in a Rack or Cabinet" on page 76](#).
3. Follow the instructions in:
  - a. [Connect Earth Ground to ACX5400 Routers](#).
  - b. ["Connect AC Power to an ACX5400 Router" on page 89](#) or ["Connect DC Power to an ACX5400 Router" on page 93](#), as required.
  - c. *Register Products—Mandatory to Validate SLAs*
4. ["Perform Initial Software Configuration for the ACX5448, ACX5448-D, and ACX5448-M Routers" on page 100](#).

## Unpacking and Mounting ACX5448, ACX5448-D, and ACX5448-M

### IN THIS SECTION

- [Unpack an ACX5400 Router | 75](#)
- [Mount an ACX5400 Router in a Rack or Cabinet | 76](#)

## Unpack an ACX5400 Router

The ACX5400 router chassis is a rigid sheet-metal structure that houses the hardware components. We ship the ACX5400 router in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and quick start instructions.



**CAUTION:** ACX5400 routers are maximally protected inside the shipping carton. Do not unpack the router until you are ready to begin installation.

To unpack an ACX5400 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 36 on page 75](#) lists the inventory of components that we supply with an ACX5400 router.
5. Pull out the packing material holding the router in place.
6. Verify the chassis components received:
  - Two power supply modules (PSMs)
  - Six fan modules
7. Save the shipping carton and packing materials in case you need to move or ship the router later.

**Table 36: ACX5400 Router Parts List**

Component	Quantity
Chassis with six fan modules and two PSMs	1
AC power cord (generic, type C13 coupler) (only with AC-powered ACX5400 routers)	2
AC Power cord retainer clip (only with AC-powered ACX5400 routers)	2
End User License Agreement (EULA)	1

**Table 36: ACX5400 Router Parts List (Continued)**

Component	Quantity
Warranty card	1
Documentation roadmap card	1
Accessory kit (see <a href="#">Table 37 on page 76</a> )	1

**Table 37: Accessory Box Parts List**

Component	Quantity
Four-Post rack-mounting kit	1

## Mount an ACX5400 Router in a Rack or Cabinet

### IN THIS SECTION

- [Before You Begin Rack Installation | 76](#)
- [Install the ACX5400 Router in the Rack | 78](#)

You can mount an ACX5400 router in 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.

Space the front and rear rack rails between 23.25 in. (59 cm) and 30.6 in. (77.7 cm) front-to-back.

### Before You Begin Rack Installation

Before you begin mounting an ACX5400 router in the rack or cabinet:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See *Prevention of Electrostatic Discharge Damage*.
2. Verify that the site meets the requirements described in ["Site Preparation Checklist for ACX5448, ACX5448-D, and ACX5448-M Routers"](#) on page 50.
3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.
4. Read *General Site Guidelines*, with particular attention to *Chassis and Component Lifting Guidelines*.
5. Remove the router from the shipping carton. See ["Unpack an ACX5400 Router"](#) on page 75.
6. Ensure that you have the following parts and tools available to mount the router in a rack:

**NOTE:** You can mount the ACX5400 router in a four-post rack or cabinet. We include the mounting blades, rails, and the respective screws for the four-post installation with the ACX5400 chassis in the shipping carton.

- ESD grounding strap (not provided).
- Blades, rails, or brackets (provided).
- 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 mounting installation blades to the rack (not provided).
- Appropriate screwdriver for the mounting screws (not provided).
- Two power cords with plugs appropriate for 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:** You must ensure rack support on all four corners of the 1 U ACX5400 router. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.



**CAUTION:** The router requires 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 PSMs and fan modules to minimize the weight before attempting to install the router.



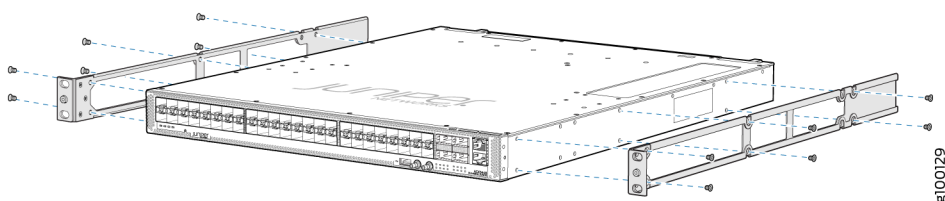
**CAUTION:** If you are mounting multiple routers on a rack, mount the router in the lowest position of the rack first. Proceed to mount the rest of the routers from the bottom to the top of the rack to minimize the risk of the rack toppling.

## Install the ACX5400 Router in the Rack

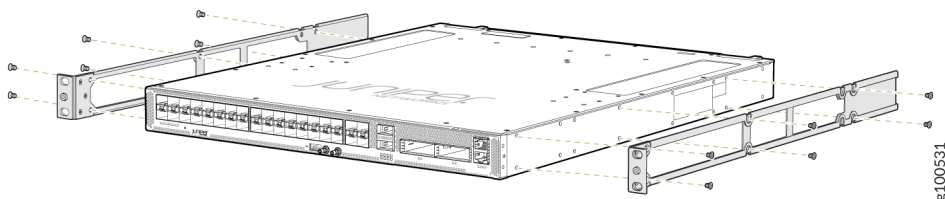
To install the router in a four-post rack or cabinet:

1. Position the router in front of the rack or cabinet.
2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
3. Align the holes in the front-mounting rails with the holes on the side of the chassis (see [Figure 47](#) on page 78 for ACX5448, [Figure 48](#) on page 78 for ACX5448-D, and [Figure 49](#) on page 79 for ACX5448-M).

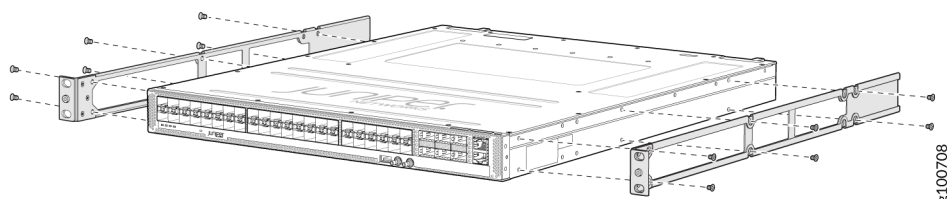
**Figure 47: Install the Mounting Rails on an ACX5448 Router**



**Figure 48: Install the Mounting Rails on an ACX5448-D Router**

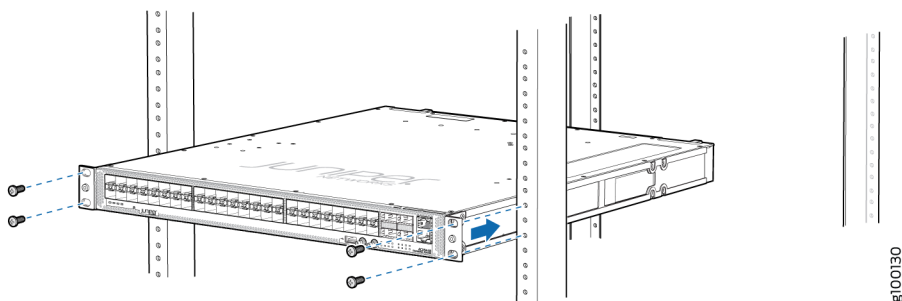


**Figure 49: Install the Mounting Rails on an ACX5448-M Router**

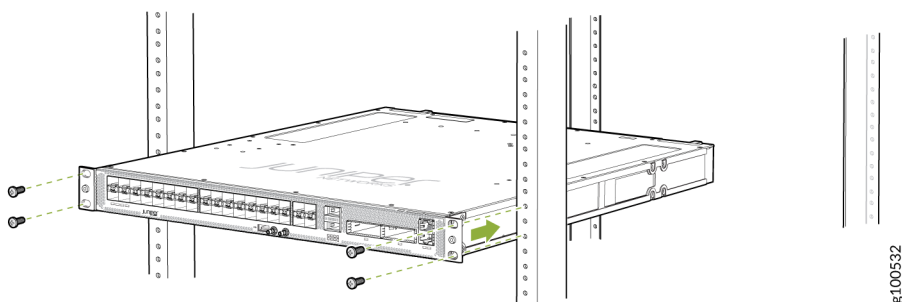


4. Using a Phillips (+) number 2 screwdriver, secure the mounting rails to the chassis using the mounting screws.
5. With one person on each side, hold on to the bottom of the chassis and carefully lift it so that the mounting rails contact the rack rails.
6. Carefully slide the chassis with the rails attached on to the rack rails (see [Figure 50 on page 79](#) for the ACX5448 router, [Figure 51 on page 79](#) for the ACX5448-D router, and [Figure 52 on page 80](#) for the ACX5448-M router).

**Figure 50: Install the ACX5448 Router in a Four-Post Rack**

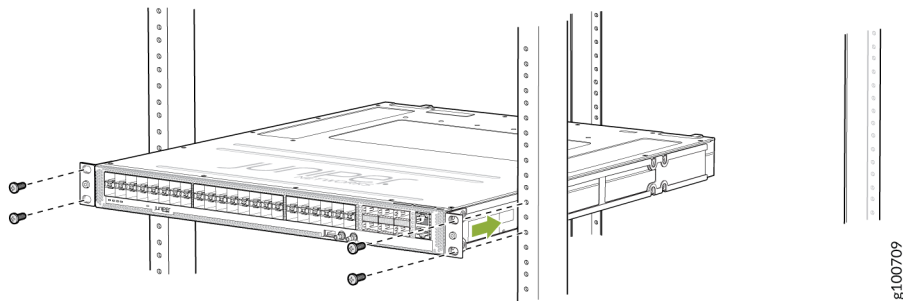


**Figure 51: Install the ACX5448-D Router in a Four-Post Rack**



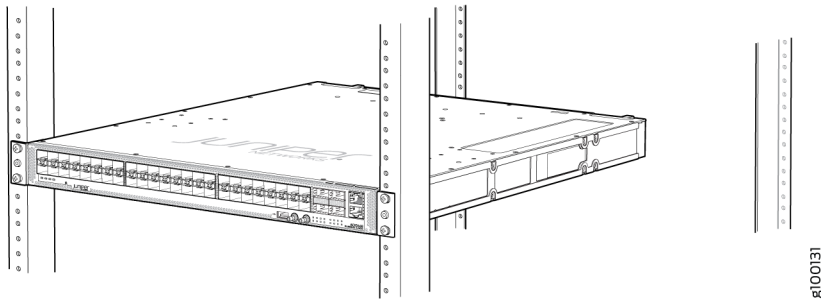


**Figure 52: Install the ACX5448-M Router in a Four-Post Rack**

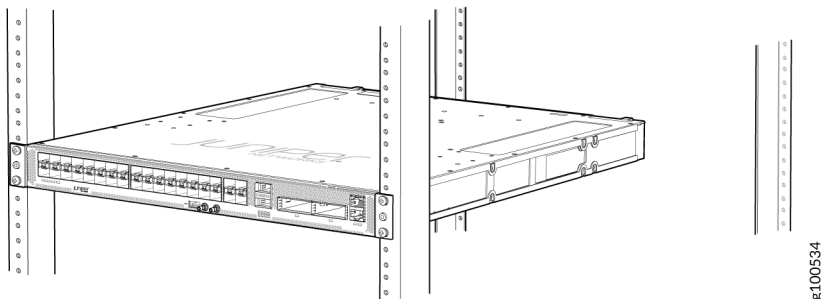


7. Install mounting screws into each of the front-mounting bracket holes aligned with the rack, starting from the bottom, and secure them tightly. [Figure 53 on page 80](#), [Figure 54 on page 80](#), and [Figure 55 on page 81](#) show the router fully secured to the front rails of the four-post rack.

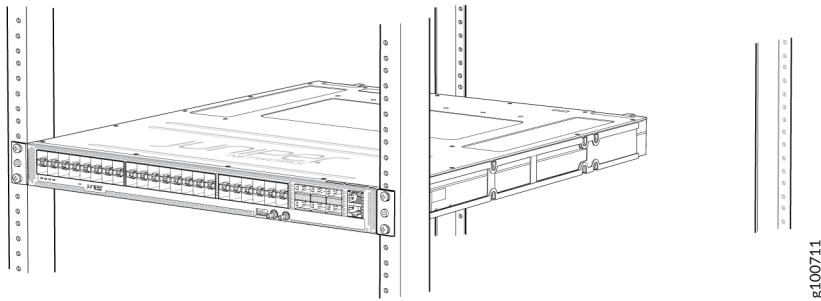
**Figure 53: ACX5448 Router Secured by Front-Mounting Brackets**



**Figure 54: ACX5448-D Router Secured by Front-Mounting Brackets**



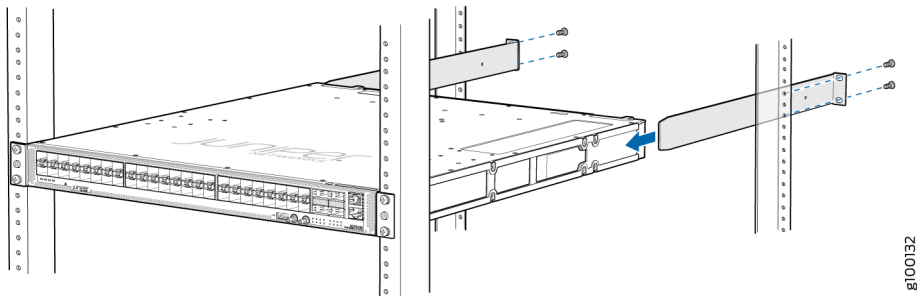
**Figure 55: ACX5448-M Router Secured by Front-Mounting Brackets**



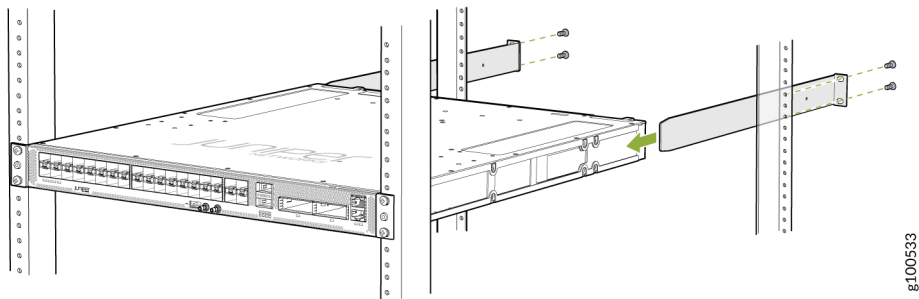
8. On the rear of the chassis, slide the rear-mounting blades on either side of the chassis until the rear-mounting brackets at the end of the blades contact the rack rails (see [Figure 56 on page 81](#) for the ACX5448 router, [Figure 57 on page 82](#) for the ACX5448-D router, and [Figure 58 on page 82](#) for the ACX5448-M router).

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

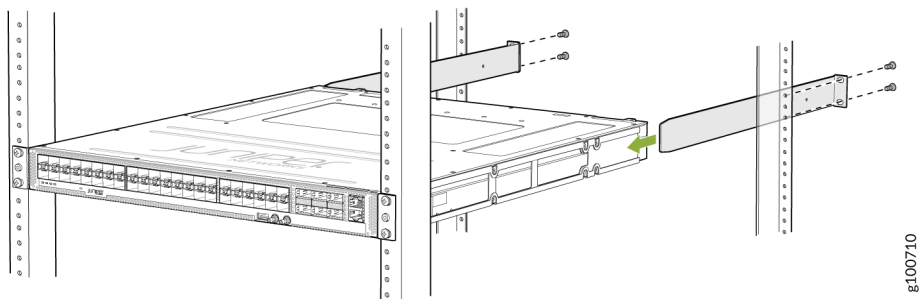
**Figure 56: Install the Rear-Mounting Blades on an ACX5448 Router**



**Figure 57: Install the Mounting Blades on an ACX5448-D Router**

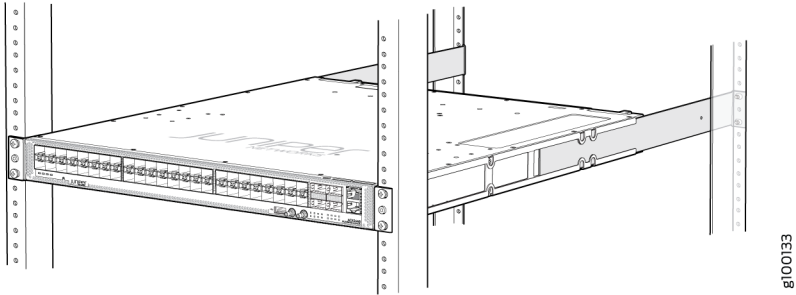


**Figure 58: Install the Rear-Mounting Blades on an ACX5448-M Router**

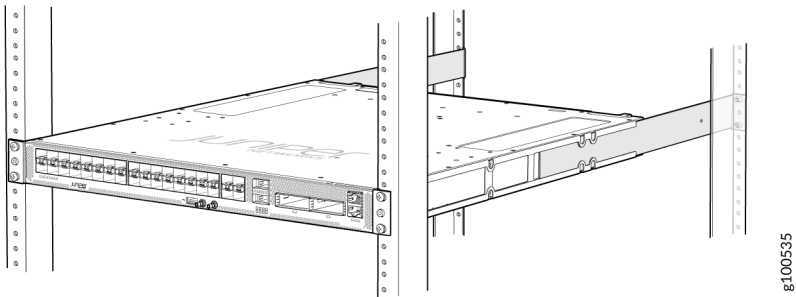


9. Install mounting screws into each of the rear-mounting bracket holes aligned with the rack, starting from the bottom, and secure them tightly.
10. Visually inspect the alignment of the chassis. If you've installed the chassis properly in the rack, all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side, and the router is level. [Figure 59 on page 83](#), [Figure 60 on page 83](#), and [Figure 61 on page 83](#) show the router fully secured and installed in a four-post rack.

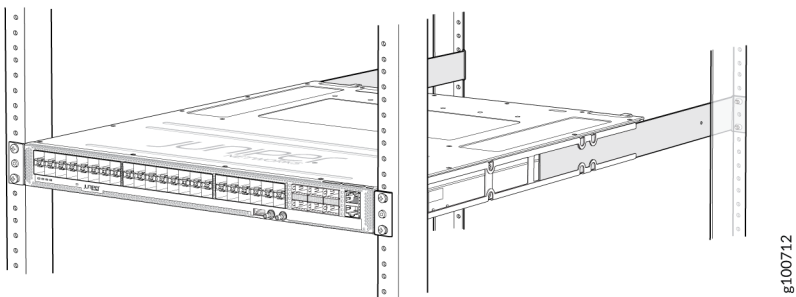
**Figure 59: ACX5448 Router Installed in the Rack**



**Figure 60: ACX5448-D Router Installed in the Rack**



**Figure 61: ACX5448-M Router Installed in the Rack**



# Connect ACX5448, ACX5448-D, and ACX5448-M to Power

## IN THIS SECTION

- [Connect Earth Ground to ACX5400 Routers | 84](#)
- [Connect AC Power to an ACX5400 Router | 89](#)
- [Connect DC Power to an ACX5400 Router | 93](#)

## Connect Earth Ground to ACX5400 Routers

### IN THIS SECTION

- [Connect Earth Ground to ACX5400 Chassis | 85](#)
- [Connect Earth Ground to DC PSM Protective Earthing Terminal | 87](#)

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must ground the router properly before connecting power. The ACX5400 routers have a separate protective earthing terminal provided on the chassis and on the DC power supply module (PSM) in addition to the grounding pin of the AC PSM cord.

To connect earth ground to ACX5400 routers, see ["Connect Earth Ground to ACX5400 Chassis" on page 85](#). To connect earth ground to the DC PSM protective earthing terminal, see ["Connect Earth Ground to DC PSM Protective Earthing Terminal" on page 87](#).

You must install a ACX5400 series router in a restricted-access location and ensure that the chassis is always properly grounded. An ACX5400 series router has a two-hole protective grounding terminal provided on the chassis. See [Figure 62 on page 85](#), [Figure 63 on page 85](#), and [Figure 64 on page 85](#). Under all circumstances, use this grounding connection to ground the chassis. For AC-powered systems, you must also use the grounding wire in the AC power cord along with the two-hole grounding lug connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

### Connect Earth Ground to ACX5400 Chassis

Before you connect earth ground to the protective earthing terminal of a ACX5400 router, ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable.

Figure 62 on page 85, Figure 63 on page 85, and Figure 64 on page 85 show the grounding points on ACX5400 routers.

Figure 62: Grounding Points on the ACX5448 Router

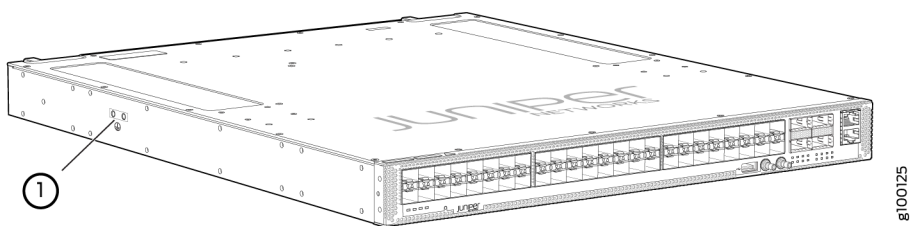


Figure 63: Grounding Points on the ACX5448-D Router

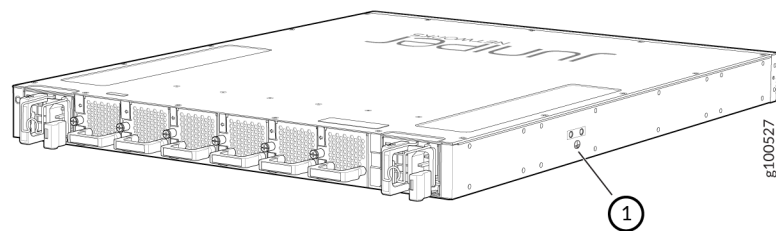
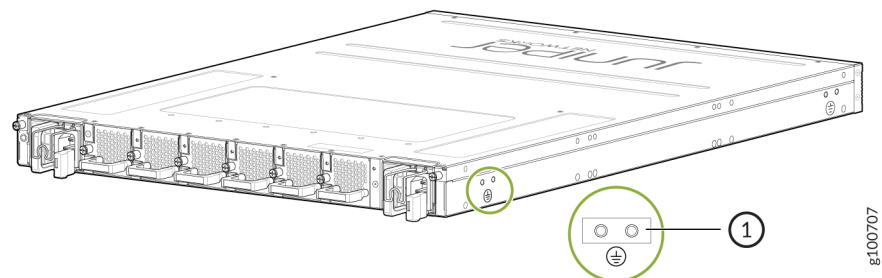


Figure 64: Grounding Points on the ACX5448-M Router



1– Grounding points

You need a protective earthing terminal bracket 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. (You need to provide these screws with integrated washers as we do not ship them in the accessory kit). The grounding points are spaced at 0.63-in. (16-mm) centers.

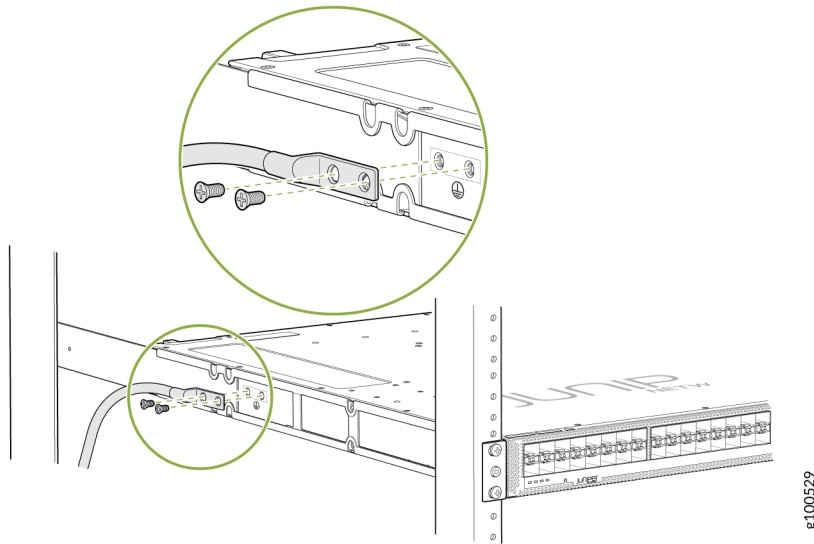
You ground the router by connecting one end of a grounding cable to earth ground and then attaching the other end to the chassis grounding points by using two #10–32 pan head screws. You must provide the grounding cables.

**NOTE:** The grounding lug required is a Panduit LCD10-10A-L or equivalent (not provided). The grounding lug accommodates 12 AWG (2.5 mm<sup>2</sup>) 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 mm<sup>2</sup>) stranded wire, 60° C wire for the ACX5448 router and 12 AWG (2.5 mm<sup>2</sup>), 90° C temperature-rated stranded wire for the ACX5448-D and ACX5448-M routers.

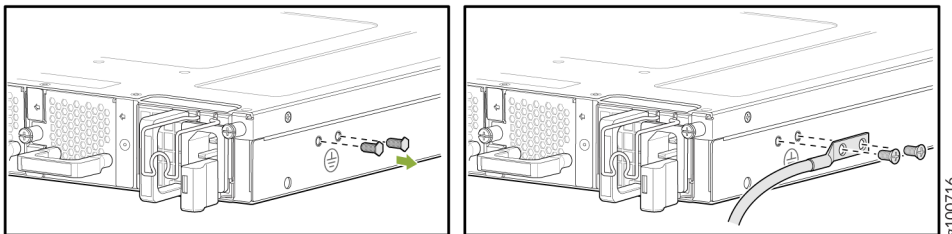
To ground the ACX5400 router:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
2. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.
3. Connect the grounding cable to a proper earth ground.
4. For ACX5448-M routers, remove the dummy screws from the grounding point (see [Figure 66 on page 87](#)).
5. Place the grounding cable lug over the grounding points on the side of the chassis (see [Figure 65 on page 87](#) for ACX5448 and ACX5448-D routers and [Figure 66 on page 87](#) for the ACX5448-M router).

**Figure 65: Connect the Grounding Cable to the ACX5448 or ACX5548-D Router**



**Figure 66: Connect the Grounding Cable to the ACX5448-M Router**



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

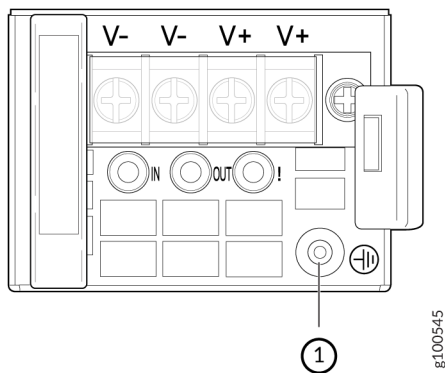
### Connect Earth Ground to DC PSM Protective Earthing Terminal

You attach the protective earthing terminal lug to the DC PSM protective earthing terminal to provide a protective earthing connection. The protective earthing terminal is in the form of a stud that can accommodate an M5 pan head screw of length 0.8 mm. (You need to provide these screws with integrated washers as we do not ship them in the accessory kit).

[Figure 67 on page 88](#) shows the protective earthing terminal on the DC PSM.



**Figure 67: Protective Earthing Terminal on the DC PSM**



1– Protective earthing terminal

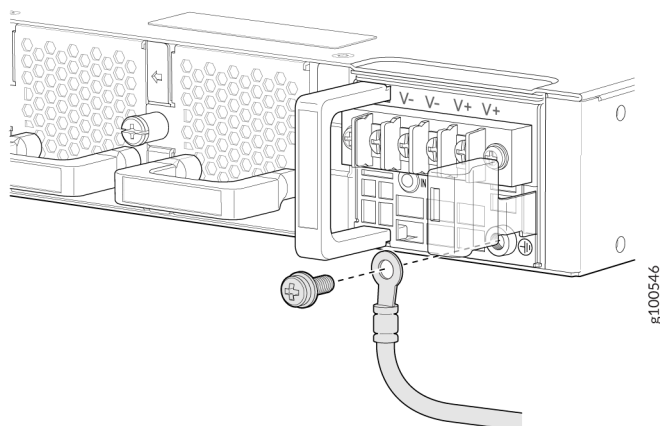
You ground the DC PSM protective earthing terminal by connecting one end of a grounding cable to earth ground and then attaching the other end to the protective earthing terminal on the DC PSM by using an M5 pan head screw. You must provide the grounding cables.

**NOTE:** The protective earthing terminal lug accommodates 12 AWG (2.5 mm<sup>2</sup>) standard wire. The grounding cable that you provide for the protective earthing terminal of the DC PSM must be of the same size or heavier than the input wire of each PSM. The minimum recommendations for the ACX5400 router are 12AWG (2.5 mm<sup>2</sup>) standard wire, 90° C wire.

To ground the chassis using the protective earthing terminal on the DC PSM:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
2. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.
3. Connect the grounding cable to a proper earth ground.
4. Place the grounding cable lug over the protective earthing terminal on the DC PSM.
5. Secure the grounding cable lug with the M5 pan head screw (see [Figure 68 on page 89](#)).

**Figure 68: Connect the Grounding Cable to the Protective Earthing Terminal on the DC PSM**



6. 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 over it.

## Connect AC Power to an ACX5400 Router

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*).
- 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. Under all circumstances, use the protective earthing terminal on the router chassis to connect to the earth ground. The router gains additional grounding when you plug the PSM in the router to a grounded AC power outlet by using the AC power cord appropriate for your geographical location.

- Install the PSM in the chassis.

The power supply module (PSM) in an ACX5400 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.

**NOTE:** You must connect each PSM to a dedicated power source outlet.

To connect AC power to an ACX5448 router:

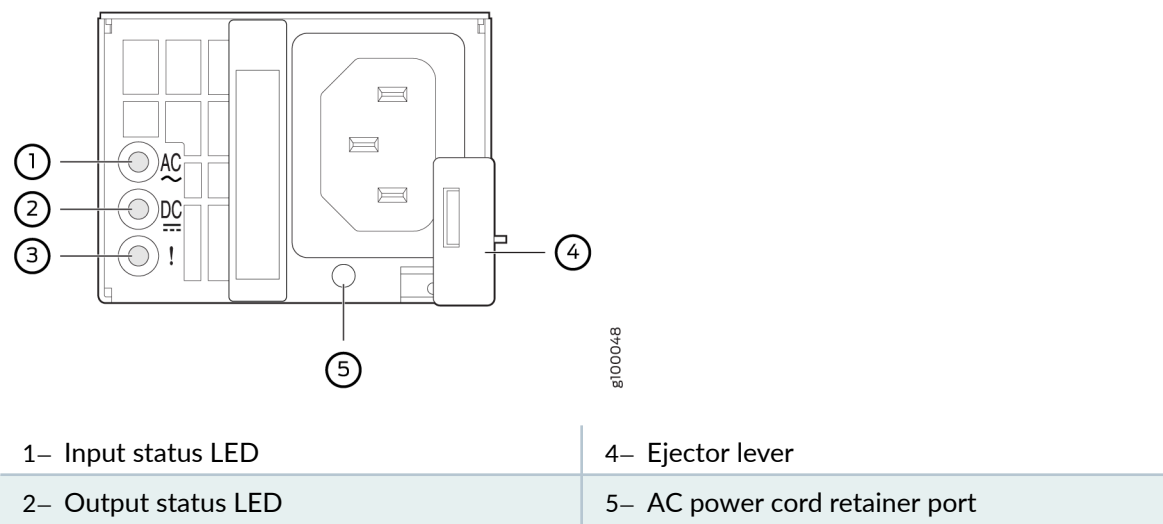
- 1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
- 2. Power off the AC input appliance inlet on the source power supply.
- 3. Connect the power cord to the power source outlet.

**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 faceplate on the router until it snaps into place. Ensure that the loop in the retainer strip faces toward the power cord.

Figure 69 on page 90 shows the port on the AC PSM for ACX5448 router where the power cord retainer is installed.

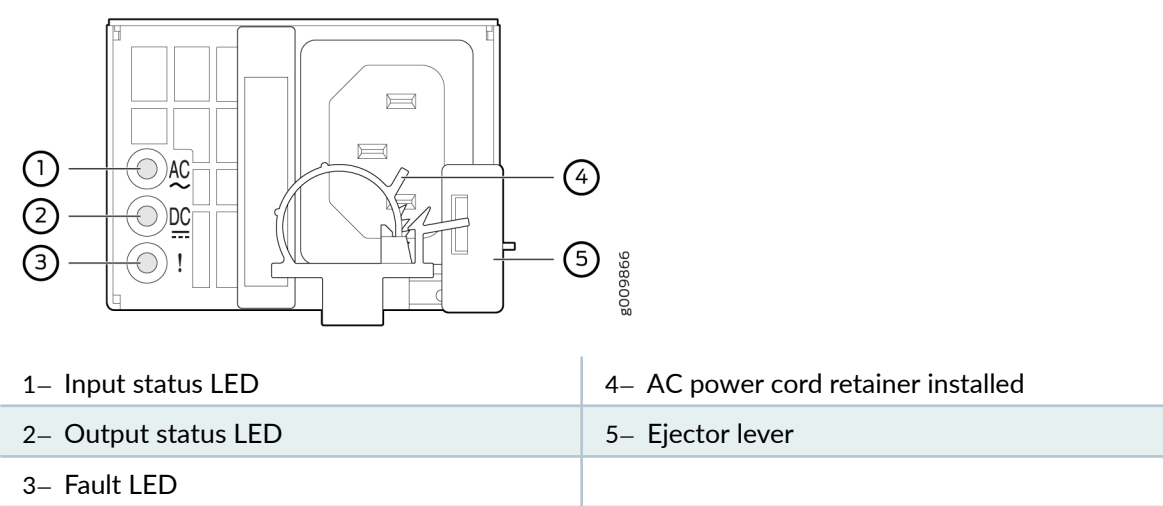
Figure 69: Power Cord Retainer Port on the AC PSM



3– Fault LED

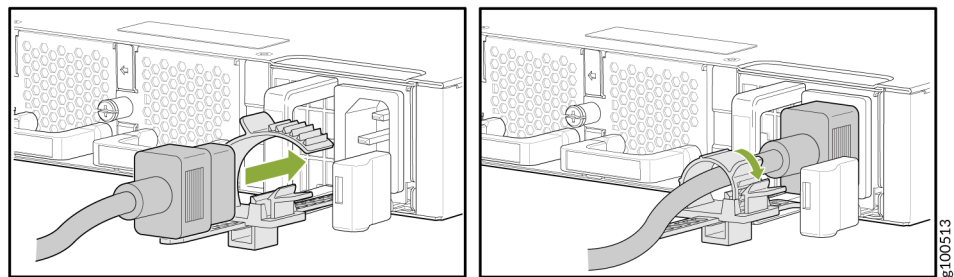
Figure 70 on page 91 shows the power cord retainer installed on the AC PSM for ACX5448 router.

Figure 70: Power Cord Retainer Installed on the AC PSM for ACX5448



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 PSM 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 71 on page 91](#)).
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 over it.
10. Power on the source power supply.
11. Repeat Step 3 through Step 9 for the installing the remaining PSM.

Figure 71: Connect an AC Power Cord to an ACX5448



To connect AC power to ACX5448-D and ACX5448-M routers:

- 1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
- 2. Power off the AC input appliance inlet on the source power supply.
- 3. Connect the power cord to the source power supply.

**NOTE:** Each PSM 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 power cord retainer onto the power cord.

Figure 72 on page 92 shows the power cord retainer installed on the AC PSM for the ACX5448-D and ACX5448-M router and Figure 73 on page 93 shows how to connect an AC power cord to an ACX5448-D or ACX5448-M router.

Figure 72: Power Cord Retainer Installed on the AC PSM for ACX5448-D and ACX5448-M

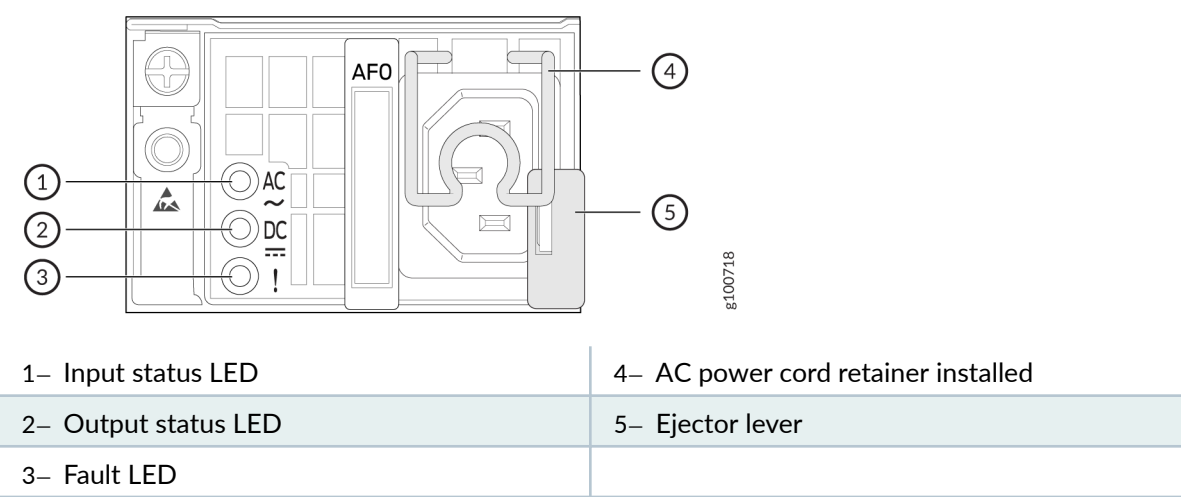
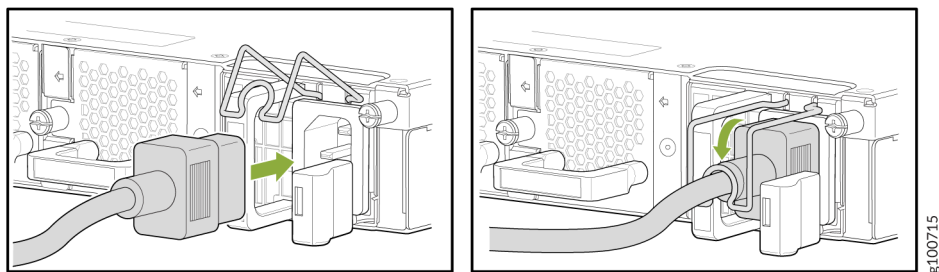


Figure 73: : Connect an AC Power Cord to an ACX5448-D or ACX5448-M router



5. Power on the power supply at source.

## Connect DC Power to an ACX5400 Router

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*).
- 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. .

- Install the PSM in the chassis.

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)

The power supply module (PSM) in an ACX5400 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 ACX5400 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).

To connect DC power to an ACX5400 router:

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
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 (+). You install this cable on the V+ (return) DC power input terminal.
  - The cable with very high resistance (indicating an open circuit) to chassis ground is negative (-). You install this cable 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 PSM.

3. Install heat-shrink tubing insulation around the power cables.

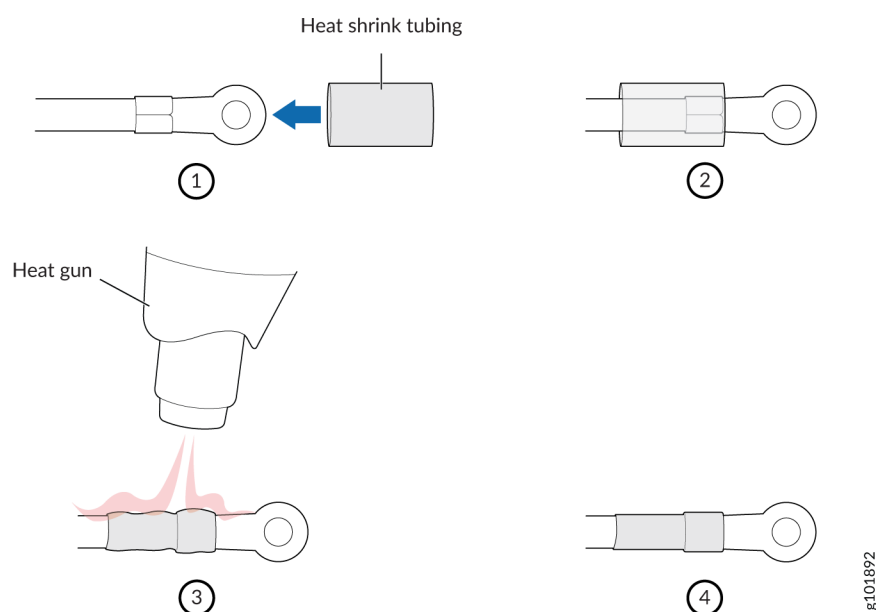
To install heat-shrink tubing:

  - a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.
  - b. Shrink the tubing with a heat gun. Ensure that you heat all sides of the tubing evenly so that it shrinks around the cable tightly.

Figure 74 on page 95 shows the steps to install heat-shrink tubing.

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

**Figure 74: How to Install Heat-Shrink Tubing**



4. 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*.

5. Ensure that the PSMs are fully inserted in the chassis.
6. Remove the terminal block cover. The terminal block cover is a piece of clear plastic that snaps into place over the terminal block (see [Figure 75 on page 97](#)).
7. Remove the screws on the terminals by 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 over them.



8. Connect each PSM to the power sources. Secure power source cables to the PSMs by screwing the ring lugs attached to the cables to the appropriate terminals by using the screw from the terminals (see [Figure 75 on page 97](#)).

The ACX5400 router is designed to operate with a DC PSM that has a single, non-redundant, feed input. For source redundancy, you must install two DC PSMs in the ACX5400; connect source (A) to one PSM and connect source (B) to the second PSM. This configuration provides the commonly deployed A/B feed redundancy for the system.

The terminal block of the PSM 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, as are the V– terminals.



**CAUTION:** The connection between each power source and PSM must include a 2-pole circuit breaker.

Do not connect two sources to a single PSM 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 PSM.
- b. Secure the ring lug of the negative (–) DC power source cable to the V– terminal on the DC PSM.
- c. Tighten the screws on the PSM 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, 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.

9. Replace the terminal block cover.
10. Close the input 2-pole circuit breaker.

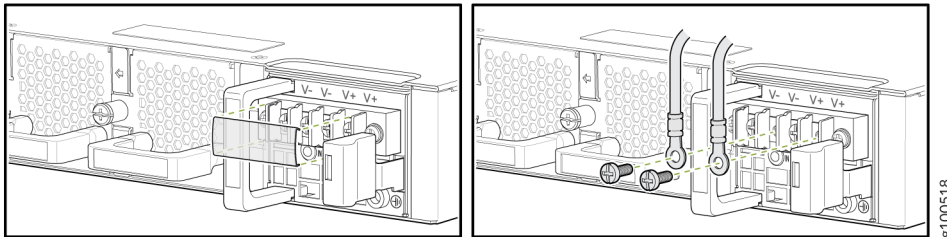
**NOTE:** The switch powers on as soon as power is provided to the PSM. There is no power switch on the device.

11. Verify that the **IN** and **OUT** LEDs on the PSM 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 75: Connect DC Power Cable to an ACX5400 Router**



## Connect ACX5448, ACX5448-D, and ACX5448-M to External Devices

### IN THIS SECTION

- [Connect an ACX5400 Router to a Management Console | 97](#)
- [Connect an ACX5400 Router to a Network for Out-of-Band Management | 99](#)
- [Connect an ACX5400 Router to External Clocking and Timing Devices | 100](#)

### Connect an ACX5400 Router to a Management Console

Ensure that you have an RJ-45 to DB-9 rollover cable available.

**NOTE:** If your laptop or PC does not have a DB-9 pin contact and you want to connect your laptop or PC directly to the ACX5400 routers, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter and a USB to DB-9 plug adapter. You must provide the USB to DB-9 plug adapter.

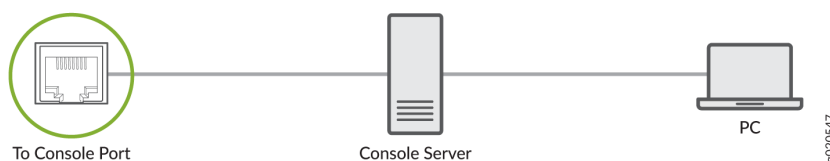
**NOTE:** We no longer include a DB-9 to RJ-45 cable or a DB-9 to RJ-45 adapter with a CAT5E copper cable as part of the device package. If you require a console cable, you can order it separately with the part number JNP-CBL-RJ45-DB9 (DB-9 to RJ-45 adapter with a CAT5E copper cable).

The ACX5400 routers have 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.

To connect the ACX5400 router to a management console (see [Figure 76 on page 98](#) and [Figure 77 on page 98](#)):

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 76 on page 98](#)) or management console (see [Figure 77 on page 98](#)).

**Figure 76: Connecting the ACX5400 Router to a Management Console Through a Console Server**



**Figure 77: Connecting the ACX5400 Router Directly to a Management Console**



## Connect an ACX5400 Router to a Network for Out-of-Band Management

Ensure that you have an appropriate cable available. See ["ACX5448, ACX5448-D, and ACX5448-M Network Cable and Transceiver Planning"](#) on page 62.

You can monitor and manage the ACX5400 router by using a dedicated management channel. ACX5400 routers have a minimum of two management ports: a 10/100/1000BASE-T RJ-45 port and a 1-Gbps SFP port. Some models have an additional 1-Gbps SFP port that can be used for either fiber or copper connections. Use the management ports to connect the ACX5400 router to a network for out-of-band management.



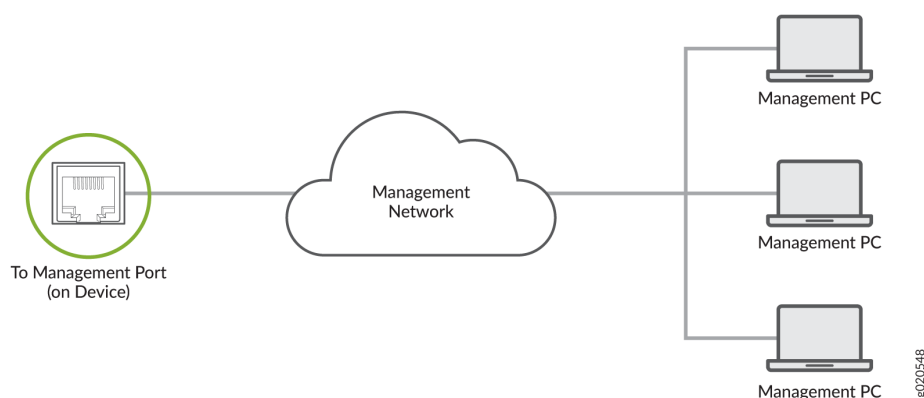
**CAUTION:** Do not configure the two management interfaces within the same subnet.

**NOTE:** You cannot use the management ports to perform the initial configuration of the ACX5400 router. You must configure the management ports before you can successfully connect to the ACX5400 router using these ports. See ["Perform Initial Software Configuration for the ACX5448, ACX5448-D, and ACX5448-M Routers"](#) on page 100.

To connect an ACX5400 router to a network for out-of-band management (see [Figure 78 on page 99](#)):

1. Connect one end of the cable to one of the management ports (labeled **MGMT** on the ACX5400 router).
2. Connect the other end of the cable to the management PC (see [Figure 78 on page 99](#)).

**Figure 78: Connect an ACX5400 Router to a Network for Out-of-Band Management**



## Connect an ACX5400 Router to External Clocking and Timing Devices

The ACX5400 router has two SMB connector ports that support 1-PPS and 10-MHz timing devices.

**NOTE:** Ensure that you use a cable of 3 m or less in length 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).

## Perform Initial Software Configuration for the ACX5448, ACX5448-D, and ACX5448-M Routers

Before you begin connecting and configuring an ACX5400 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

You must perform the initial configuration of the ACX5400 router through the console port using the command-line interface (CLI).

To connect and configure the router from the console:

1. Connect the console port to a laptop or PC using an 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**. You do not need a 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's management interface.

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



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

**NOTE:** The management port (**MGMT**) is located on the management panel of the ACX5400 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 the Telnet service.

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

**NOTE:** When Telnet is enabled, you cannot log in to a router through Telnet by using root credentials. Root login is allowed only for SSH access.

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

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

# 4

CHAPTER

## Maintaining Components

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Maintaining ACX5448, ACX5448-D, and ACX5448-M Components | 104

Uninstall the ACX5448, ACX5448-D, or ACX5448-M Router | 129

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# Maintaining ACX5448, ACX5448-D, and ACX5448-M Components

## IN THIS SECTION

- [Replace an ACX5400 Fan Module | 104](#)
- [Replace an ACX5400 AC Power Supply Module | 107](#)
- [Replace an ACX5400 DC Power Supply Module | 112](#)
- [Replace an SFP, SFP+, or QSFP+ Transceiver | 116](#)
- [Replace a QSFP28 Transceiver | 120](#)
- [Replacing a CFP2 Transceiver | 125](#)
- [How to Handle Fiber-Optic Cables | 128](#)

## Replace an ACX5400 Fan Module

### IN THIS SECTION

- [Remove a Fan Module from an ACX5400 Router | 104](#)
- [Install a Fan Module in an ACX5400 Router | 106](#)

### Remove a Fan Module from an ACX5400 Router

Before you remove a fan module from an ACX5400 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

Ensure that you have the following parts and tools available to remove a fan module from an ACX5400 router:

- ESD grounding strap
- Antistatic bag or an antistatic mat

- Phillips (+) screwdriver, number 2

The fan modules in ACX5400 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 that you have a replacement fan module at hand.

To remove a fan module from an ACX5400 router (see Figure 1):

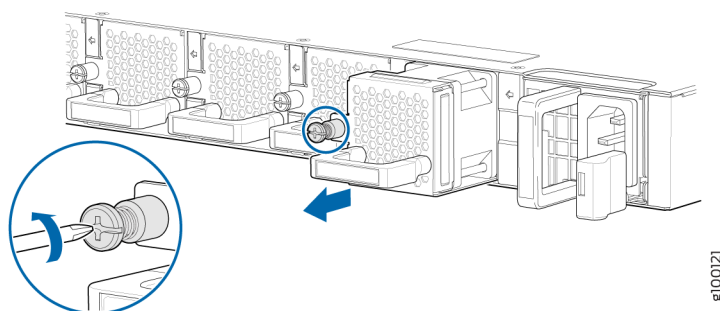
1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
3. Using a Phillips screwdriver, loosen the locking screw (3 or 4 turns).
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 stops 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 79: Remove a Fan Module from an ACX5400 Router**



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

## Install a Fan Module in an ACX5400 Router

Before you install a fan module in an ACX5400 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).

The fan modules in an ACX5400 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 that you have a replacement fan module at hand.

**NOTE:** The fan module provides port-to-FRU airflow (AFO) or FRU-to-port (AFI) airflow depending on the product model that you purchase.

Ensure that you have the following parts and tools available to install a fan module in an ACX5400 router:

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

To install a fan module in an ACX5400 router (see [Figure 80 on page 107](#)):

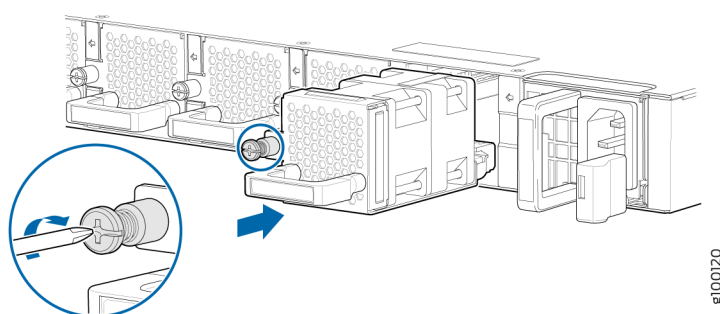
1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
2. Taking care not to touch the connectors, remove the fan module from its bag.
3. Align the module with the open slot on the rear panel of the chassis 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 model 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 ACX5400 product model that supports the same airflow type. See ["Cooling System and Airflow in ACX5448, ACX5448-D, and ACX5448-M Routers" on page 35](#) for more information.

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

**Figure 80: Install a Fan Module in an ACX5400 Router**



## Replace an ACX5400 AC Power Supply Module

### IN THIS SECTION

- Remove an AC Power Supply Module from an ACX5400 Router | 107
- Install an AC Power Supply Module in an ACX5400 Router | 109

### Remove an AC Power Supply Module from an ACX5400 Router

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

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

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

The power supply modules (PSMs) in an ACX5400 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 the PSM with a new PSM within 1 minute of removal to prevent chassis overheating.

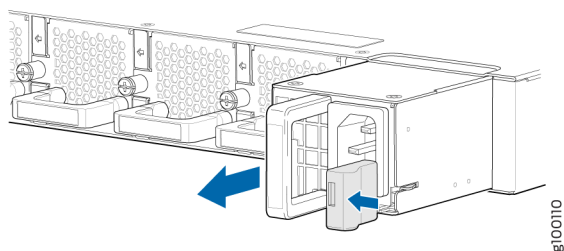
To remove an AC PSM from an ACX5400 router (see Figure 4):

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.

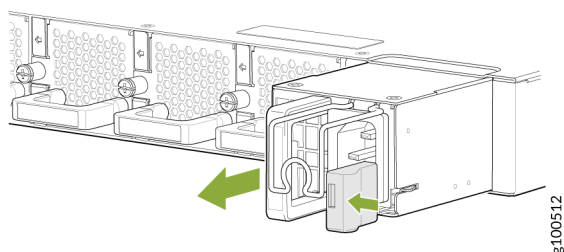
**NOTE:** If only one PSM is installed in your router, you must power off the router before removing the PSM. See ["Power Off an ACX5400 Router" on page 129](#).

3. Disconnect power to the router. 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 power cord plug connected to the power source outlet.
4. Remove the power source cable from the power supply faceplate. Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the socket end of the power cord connected to the power supply faceplate.
5. Slide the ejector lever toward the handle until you can no longer slide it.
6. Grasp the PSM handle and pull firmly to slide the PSM halfway out of the chassis.
7. Place one hand under the PSM 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 PSM in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

**Figure 81: Remove PSM from an ACX5448 Router**



**Figure 82: Remove PSM from an ACX5448-D or ACX5448-M Router**



### Install an AC Power Supply Module in an ACX5400 Router

- Before you install a PSM in a router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see *Prevention of Electrostatic Discharge Damage*).
- Ensure that the airflow direction of the PSM is the same as that indicated on the chassis. Labels on the PSM handle indicate the direction of airflow. See "[Cooling System and Airflow in ACX5448, ACX5448-D, and ACX5448-M Routers](#)" on page 35 for more information.

The power supply modules (PSMs) in an ACX5400 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.

To install an AC PSM in an ACX5400 router (see [Figure 83 on page 110](#)):

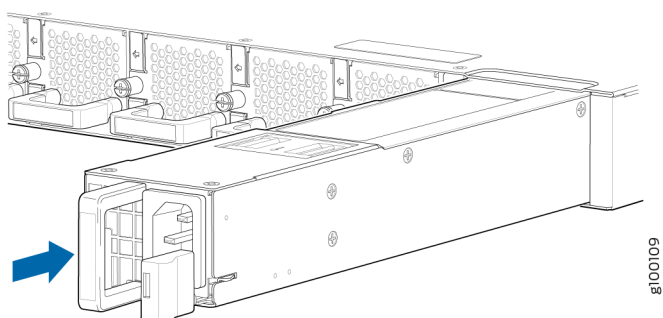
1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
2. Taking care not to touch power supply components, pins, leads, or solder connections, remove the PSM from its bag.



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

3. Using both hands, place the PSM in the power supply slot on the rear panel of the router and slide it in until it is fully seated and the ejector lever slides into place.
4. Press the latch located on the side of the PSM to slide it into the chassis.
5. Attach the power cord to the PSM.
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 PSM is correctly installed and functioning normally, the status LED lights green steadily.

**Figure 83: Install an AC PSM in an ACX5448 Router**



**Figure 84: Install an AC Power Cord in an ACX5448 router**

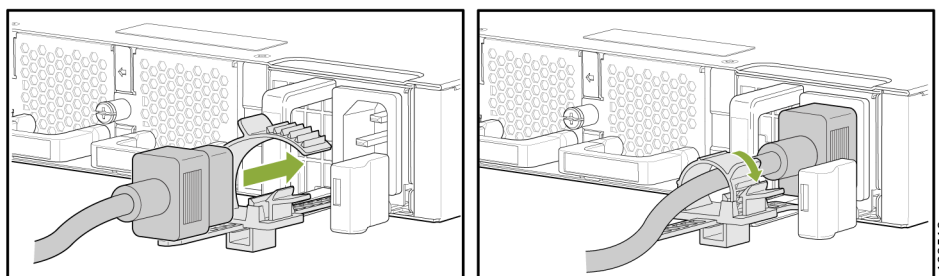


Figure 85: Install an AC PSM in an ACX5448-D or ACX5448-M Router

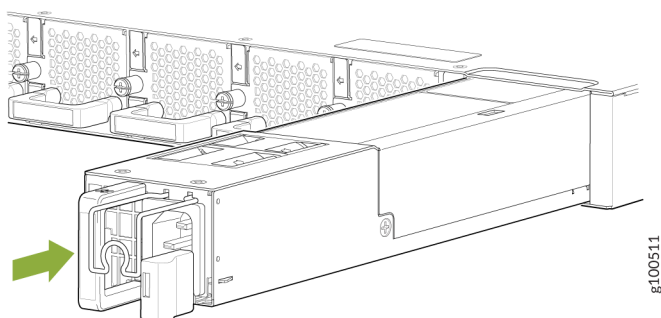
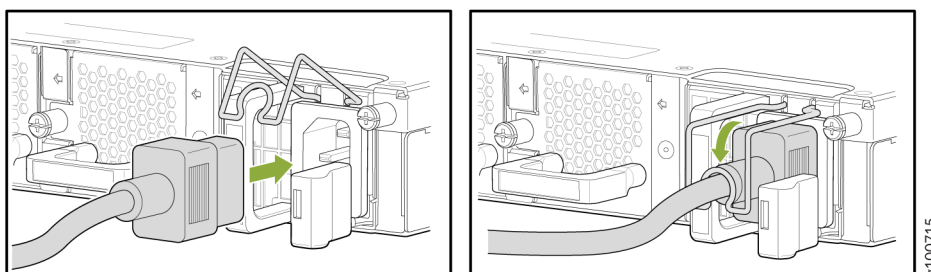


Figure 86: Install an AC Power Cord in an ACX5448-D or ACX5448-M router



**NOTE:** Each PSM 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.



## Replace an ACX5400 DC Power Supply Module

### IN THIS SECTION

- [Remove an ACX5400 DC Power Supply Module | 112](#)
- [Install an ACX5400 DC Power Supply Module | 113](#)

### Remove an ACX5400 DC Power Supply Module

Before you remove a power supply module (PSM), be aware of the following:

**NOTE:** The minimum required number of PSMs 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 a PSM. If you remove a PSM, you must install a replacement PSM shortly after the removal.

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



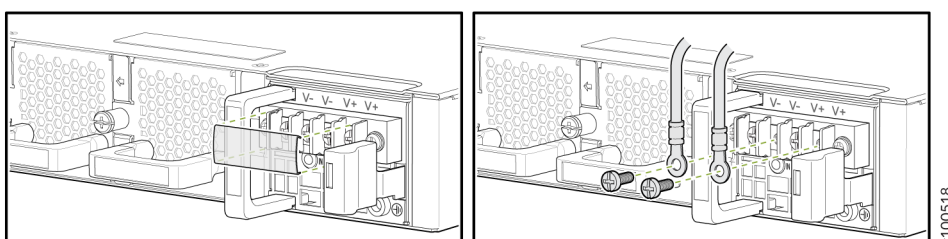
**CAUTION:** Do not mix AC and DC PSMs in the same chassis.

To remove a DC PSM:

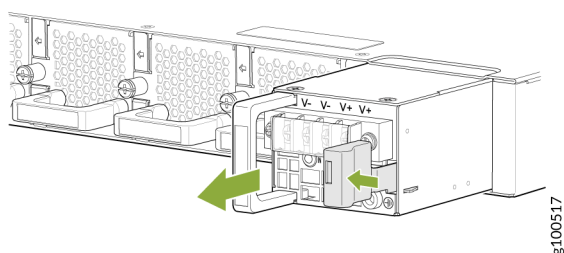
1. Switch off the dedicated customer-site 2-pole circuit breaker for the PSM being removed. Follow your site's procedures for preventing ESD damage.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.

3. Verify that the status LED on the PSM is not lit.
4. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point 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 9).
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 PSM, to release it from the chassis.
10. Pull the PSM straight out of the chassis (see Figure 10).

**Figure 87: Disconnect the DC Power Cables**



**Figure 88: Remove a DC PSM**



## Install an ACX5400 DC Power Supply Module



**WARNING:** Before you perform DC power procedures, ensure there is no power to 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 PSM (see [Figure 89 on page 115](#)):

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. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
3. Using both hands, slide the DC PSM straight into the slot on the rear panel of the chassis until the PSM is fully seated in the slot. The PSM faceplate must align with any adjacent PSM faceplate installed in the power supply slot.
4. Remove the clear plastic cover protecting the terminals on the faceplate.
5. Remove the screws from the terminals.
6. Secure each power cable lug to the terminal with the screw (see [Figure 91 on page 115](#)). 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:**

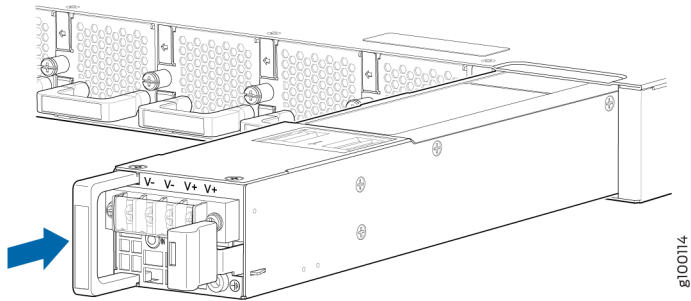
- You must ensure that power connections maintain the proper polarity. The power source cables might be labeled **(+)** and **(-)** to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on each PSM.
- 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 over 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.

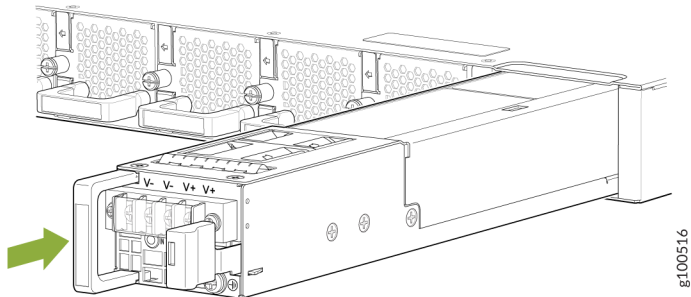
**NOTE:** If more than one PSM is being installed, turn on all PSMs at the same time.

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

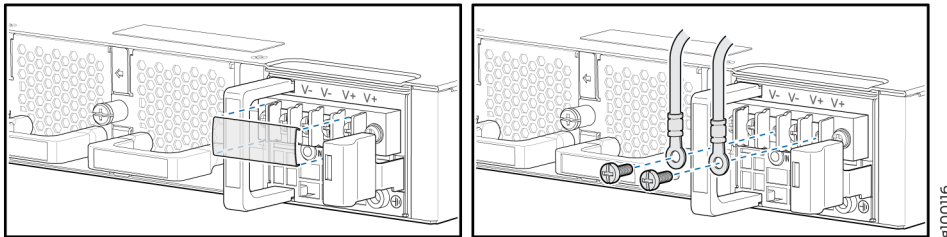
**Figure 89: Install a DC PSM in an ACX5448 Router**



**Figure 90: Install a DC PSM in an ACX5448-D or ACX5448-M Router**



**Figure 91: Connect the DC Power Cables**



## Replace an SFP, SFP+, or QSFP+ Transceiver

### IN THIS SECTION

- [Remove a Transceiver | 116](#)
- [Install a Transceiver | 118](#)

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

### Remove a Transceiver

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

Ensure that you have the following parts and tools available:

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

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

To remove a transceiver:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.
3. Label the cables connected to the transceiver so that you can reconnect them correctly later.
4. Remove the cable connected to the transceiver (see *Disconnect a Fiber-Optic Cable*). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.



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



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

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



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

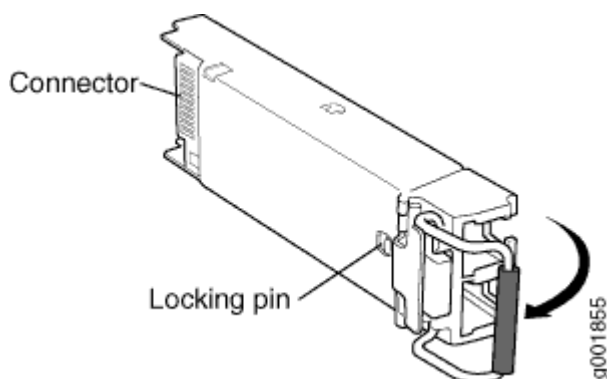
6. By using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.



**CAUTION:** Ensure that you open the ejector handle completely until you hear it click. Doing this prevents damage to the transceiver.

Figure 14 shows how to remove an SFP transceiver. The procedure is the same for SFP+ and QSFP + transceivers.

Figure 92: Small Form-Factor Pluggable (SFP) Transceiver



7. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the interface port.
8. Using your fingers, grasp the body of the transceiver, and pull it the rest of the way out of the interface port.
9. Place a rubber safety cap over the transceiver.
10. Place the removed transceiver on an antistatic mat or in an electrostatic bag.
11. Place the dust cover over the empty port or install the replacement transceiver.



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

## Install a Transceiver

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

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

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

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



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

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

To install a transceiver:

1. Attach an ESD grounding strap to your bare wrist, and connect the other end of the strap to an ESD grounding point.
2. Remove the transceiver from its bag.
3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.



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

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

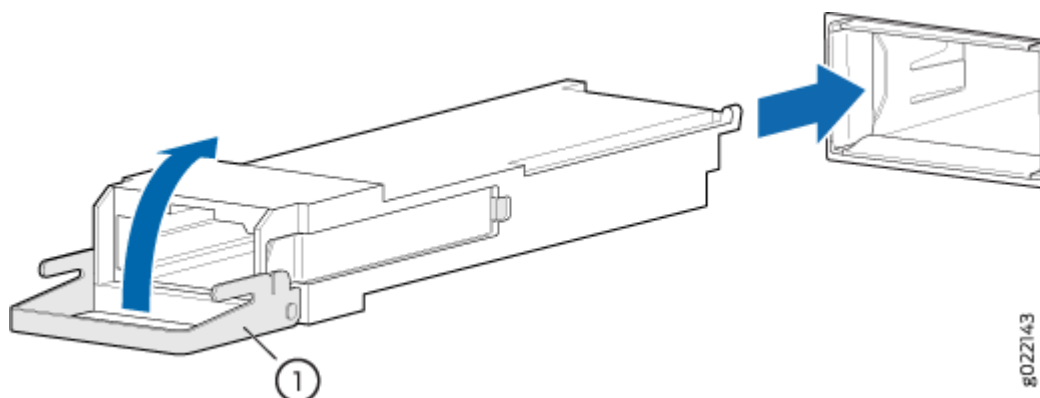


**CAUTION:** Before you slide the transceiver into the port, ensure that the transceiver is aligned correctly. Misalignment might cause the pins to bend, making the transceiver unusable.

5. Slide in the transceiver until it is fully seated. If you are unable to fully insert the transceiver, ensure that the connector is facing the right way.



Figure 93: Install a Transceiver



1– Ejector lever

6. Close the ejector handle of the transceiver.
7. Remove the rubber safety cap from the transceiver and from the end of the cable. Insert the cable into the transceiver.



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

## Replace a QSFP28 Transceiver

### IN THIS SECTION

- [Remove a QSFP28 Transceiver | 121](#)
- [Install a QSFP28 Transceiver | 122](#)

28-Gbps quad small form-factor pluggable (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.

## Remove a QSFP28 Transceiver

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

Ensure that you have the following parts and tools available:

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

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

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

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

To remove a QSFP28 transceiver (see Figure 16):

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. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.
3. Label the cable connected to the QSFP28 transceiver so that you can later reconnect the cable 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.



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



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

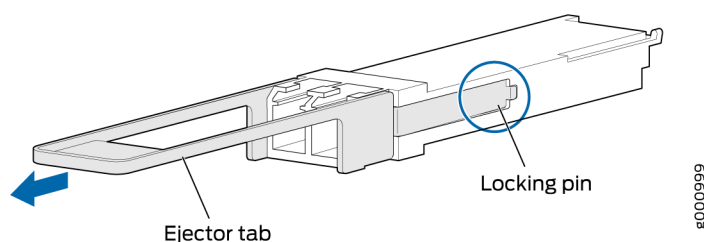
5. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the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



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

6. Pull the transceiver's rubber handle straight back.  
The locking pins on the transceiver automatically releases the transceiver.

**Figure 94: 28-Gbps Quad Small Form-Factor Pluggable (QSFP28) Transceiver**



7. Place the transceiver on the antistatic mat or in the electrostatic bag.
8. Place the dust cover over the empty port or install the replacement transceiver.

## Install a QSFP28 Transceiver

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

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

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

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

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



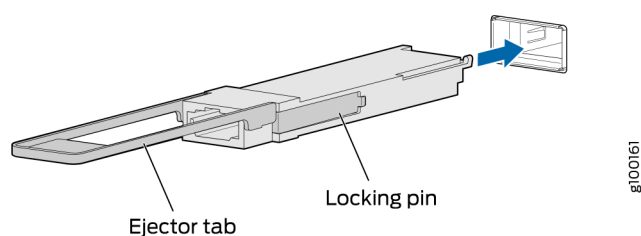
**CAUTION:** The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem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

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

To install a replacement QSFP28 transceiver (see [Figure 95 on page 124](#)):

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.
2. Verify that a rubber safety cap covers the QSFP28 transceiver. If it is not, cover the transceiver with a safety cap.
3. Orient the transceiver in front of the port so that the QSFP28 connector faces the appropriate direction.

Figure 95: Install a QSFP28 Transceiver



4. Slide the transceiver into the slot until the locking pins lock in place. If there is resistance, remove the transceiver and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and from the end of the cable, and insert the cable into the transceiver.



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



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

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



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



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

7. Verify that the status LEDs on the router indicate that the QSFP28 transceiver is functioning correctly. You can also verify that the interface port is functioning by running the `show chassis fpc pic-status` command.

## Replacing a CFP2 Transceiver

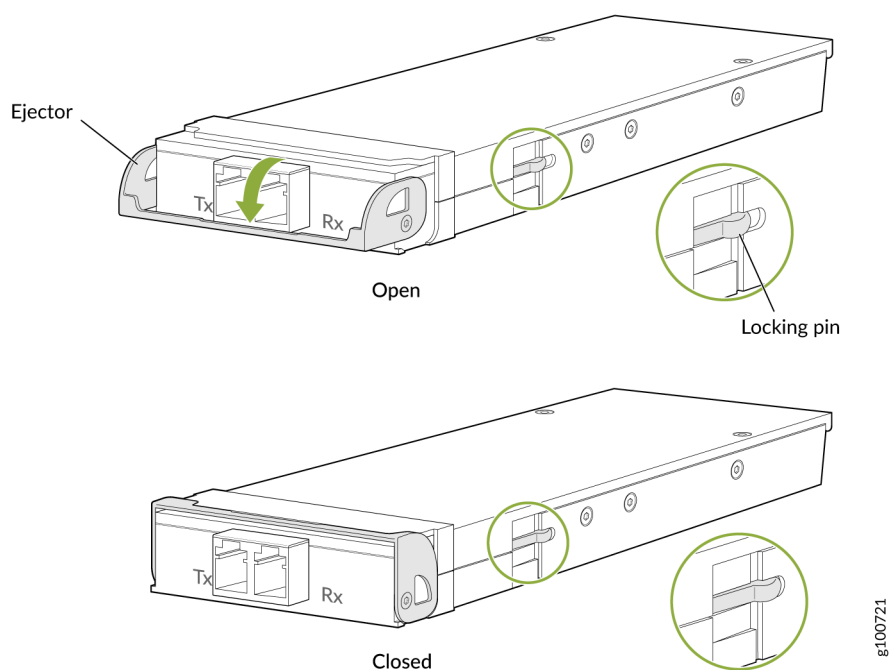
### IN THIS SECTION

- [Removing a CFP2 Transceiver | 125](#)
- [Installing a CFP2 Transceiver | 127](#)

### Removing a CFP2 Transceiver

CFP2 transceivers are hot-insertable and hot-removable. Removing a CFP2 transceiver does not interrupt the device functions, but the removed CFP2 transceiver no longer receives or transmits data.

**Figure 96: Form-Factor Pluggable (CFP2)**



To remove a CFP2 transceiver (see Figure 18):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the CFP2 transceiver. Have ready a rubber safety cap for the CFP2 transceiver and the cable.
2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
3. Label the cable connected to the CFP2 transceiver so that you can later reconnect it to the correct CFP2 transceiver.
4. Disconnect the cable from the CFP2 transceiver. Immediately cover the transceiver and the end of the cable with a rubber safety cap.



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



**CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and 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 is not supporting 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 ejector latch to the extreme end away from the CFP2 transceiver faceplate to unseat the CFP2 transceiver from the device. Pull the CFP2 transceiver out of the device and place it on the antistatic mat or in the electrostatic bag.

**NOTE:** You cannot remove the transceiver until you move the ejector latch to the extreme end.

## Installing a CFP2 Transceiver

To install a replacement CFP2:

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
2. Verify that a rubber safety cap covers the CFP2 transceiver, installing one if necessary.
3. Orient the CFP2 over the port in the device so that the connector end will enter the slot first and the CFP2 connector faces the appropriate direction.
4. Slide the CFP2 into the slot. If there is resistance, remove the CFP2 and flip it so that the connector faces the other direction.

**NOTE:** When inserting the C form-factor pluggable 2 (CFP2) transceiver, ensure that the transceiver sits tightly in the port. You hear a distinct click sound when the latch locks into the corresponding port. The latch must be fully engaged in the corresponding port for the CFP2 transceiver to function properly. Failing to do so can result in loss of connection. To verify that the CFP2 transceiver module is inserted properly, give a gentle pull by grasping the sides of the module. The module should sit tightly.

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



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



**CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and 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 is not supporting 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 device indicate that the CFP2 is functioning correctly.

## How to Handle Fiber-Optic Cables

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

Follow these guidelines when handling fiber-optic cables:

- When you unplug a fiber-optic cable from a transceiver, place rubber safety caps over the transceiver and on the end of the cable.
- Anchor fiber-optic cables to prevent stress on the connectors. When attaching a fiber-optic cable to a transceiver, be sure to secure the fiber-optic cable so that it does not support its own weight as it hangs to the floor. Never let a fiber-optic cable hang free from the connector.
- Avoid bending fiber-optic cables beyond their minimum bend radius. Bending fiber-optic cables into arcs smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cables in and out of optical instruments can damage the instruments, which are expensive to repair. To prevent damage from overuse, attach a short fiber extension to the optical equipment. The short fiber extension absorbs wear and tear due to frequent plugging and unplugging, which is easier and less expensive to replace than the instruments.
- Keep fiber-optic cable connections clean. Microdeposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reduction in signal power, and possibly intermittent problems with the optical connection.
  - To clean the transceiver canal, use an appropriate fiber-cleaning device such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the instructions in the cleaning kit you use.

- After cleaning the transceiver, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit such as the Opptex Cletop-S® Fiber Cleaner. Follow the instructions in the cleaning kit you use.

## Uninstall the ACX5448, ACX5448-D, or ACX5448-M Router

### IN THIS SECTION

- [Power Off an ACX5400 Router | 129](#)
- [Remove an ACX5400 Router from a Rack or Cabinet | 131](#)

### Power Off an ACX5400 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*.
- 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
- A Phillips number 2 screwdriver

To power off your ACX5400 router:

1. Connect to the router using one of the following methods:
  - Connect a management device to the console (**CON**) port on the router. For instructions about connecting a management device to the console (**CON**) port, see ["Connect an ACX5400 Router to a Management Console" on page 97](#).

- You can shut down the router from a management device on your out-of-band management network. For instructions about connecting a management device to the management (MGMT) port, see ["Connect an ACX5400 Router to a Network for Out-of-Band Management" on page 99](#).

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. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to the ESD point on the chassis.
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 switch, set it to the off (O) position. If the AC power source outlet does not have a power switch, gently pull out the power cord plug 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.
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 socket end of the power cord connected to the power supply faceplate.

- DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply module (PSM) using the screwdriver, and remove the power source cables from the PSM. Replace the screws on the terminals and tighten them.
7. Uncable the router before removing it from the rack or cabinet.

## Remove an ACX5400 Router from a Rack or Cabinet

Before removing your ACX5400 router from its rack:

Ensure that you have the following parts and tools available:

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

If you need to relocate an installed ACX5400 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.

- 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*.
- Use the appropriate power-off sequence to safely power off the device. See ["Power Off an ACX5400 Router" on page 129](#).
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the router ports.

To remove an ACX5400 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 rails to the rack or cabinet.
2. Slowly slide the router out of the rack, with the mounting rails attached to its sides.
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 new location.

# 5

CHAPTER

## Troubleshooting Hardware

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Troubleshooting the ACX5448, ACX5448-D, and ACX5448-M Router | 134

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# Troubleshooting the ACX5448, ACX5448-D, and ACX5448-M Router

IN THIS SECTION

- [Alarm Types and Severity Classes on ACX Series Routers | 134](#)

## Alarm Types and Severity Classes on ACX Series Routers

IN THIS SECTION

- [Alarm Types | 135](#)
- [Alarm Severity Classes | 135](#)

Before monitoring the alarms on the router, become familiar with the terms defined in [Table 38 on page 134](#).

**Table 38: Alarm Terms**

Term	Definition
Alarm	Signal that alerts you to conditions that might prevent normal operation. On a router, the alarm signal is the ALM LED that is 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 (steady amber).

**Table 38: Alarm Terms (Continued)**

Term	Definition
Chassis alarm	Predefined alarm that is triggered by a physical condition on the router, such as a power failure, excessive component temperature, or media failure.
System alarm	Predefined alarm that is 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 major alarm condition requires immediate action.
  - One or more hardware components have failed.
  - One or more hardware components have exceeded temperature thresholds.
  - An alarm condition that is configured on an interface has triggered a critical warning.
- Minor (steady amber)—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.



# 6

CHAPTER

## Contacting Customer Support and Returning the Chassis or Components

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Contacting Customer Support and Returning the Chassis or Components | 137

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# Contacting Customer Support and Returning the Chassis or Components

## IN THIS SECTION

- [How to Return a Hardware Component to Juniper Networks, Inc. | 137](#)
- [How to Locate the Serial Number on an ACX5400 Router or Component | 138](#)
- [Contact Customer Support to Obtain a Return Material Authorization | 145](#)
- [Guidelines for Packing Hardware Components for Shipment | 146](#)

## How to Return a Hardware Component to Juniper Networks, Inc.

If a hardware component fails, 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 webpage at <https://support.juniper.net/support/>.

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Service Request Manager link at <https://support.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.

## How to Locate the Serial Number on an ACX5400 Router or Component

### IN THIS SECTION

- [List the Chassis and Component Details Using the CLI | 138](#)
- [Locate the Chassis Serial Number ID Label on an ACX5400 Router | 142](#)
- [Locate the Serial Number ID Labels on ACX5400 Power Supply Modules | 143](#)
- [Locate the Serial Number ID Label on an ACX5400 Fan Module | 145](#)

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 *Contact 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.

### List the Chassis and Component Details Using the CLI

To list the components and serial numbers of ACX5448, ACX5448-D, and ACX5448-M routers, use the `show chassis hardware` CLI operational mode command.

The show chassis hardware output for ACX5448:

```

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-AI
PEM 1         REV 04   740-038949  1GA36460006   JPSU-650W-DC-AI
Routing Engine          BUILTIN     BUILTIN       Routing Engine
DFEB
FPC 0              BUILTIN     BUILTIN       FPC BUILTIN
  MIC 0
    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
    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
Airflow - AFI
Fan Tray 1
Airflow - AFI
Fan Tray 2
Airflow - AFI
Fan Tray 3
Airflow - AFI
Fan Tray 4
Airflow - AFI
Fan Tray 5
Airflow - AFI

```

The show chassis hardware output for ACX5448-D:

```

user@device> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis                               XW3617360011  ACX5448-D
Midplane      REV 02   650-077913  XW3617360011  ACX5448-D
PEM 0         REV 02   740-070749  1F187290059   AC AFO 850W PSU

```

PEM 1	REV 02	740-070749	1F187290027	AC AFO 850W PSU
Routing Engine		BUILTIN	BUILTIN	Routing Engine
DFEB				
FPC 0		BUILTIN	BUILTIN	FPC BUILTIN
MIC 0				36x1GE/36x10GE
PIC 0		BUILTIN	BUILTIN	36x1GE/36x10GE
Xcvr 6	REV 01	740-031980	2013057700056	SFP+-10G-SR
MIC 1				8x10/25GE 2x40/100GE
PIC 1		BUILTIN	BUILTIN	8x10/25GE 2x40/100GE
MIC 2				2x200GE CFP2-DCO
PIC 2		BUILTIN	BUILTIN	2x200GE CFP2-DCO
Fan Tray 0				Fan Tray ACX5448-D 0, Front to Back
Airflow - AFO				
Fan Tray 1				Fan Tray ACX5448-D 1, Front to Back
Airflow - AFO				
Fan Tray 2				Fan Tray ACX5448-D 2, Front to Back
Airflow - AFO				
Fan Tray 3				Fan Tray ACX5448-D 3, Front to Back
Airflow - AFO				
Fan Tray 4				Fan Tray ACX5448-D 4, Front to Back
Airflow - AFO				
Fan Tray 5				Fan Tray ACX5448-D 5, Front to Back
Airflow - AFO				

The show chassis hardware output for ACX5448-M:

```

user@device> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis                               XW3617360011  ACX5448-M
Midplane      REV 02   650-077913  XW3617360011  ACX5448-M
PEM 0         REV 02   740-070749  1F187290059   AC AFO 850W PSU
PEM 1         REV 02   740-070749  1F187290027   AC AFO 850W PSU
Routing Engine          BUILTIN      BUILTIN      Routing Engine
DFEB
FPC 0              BUILTIN      BUILTIN      FPC BUILTIN
MIC 0              44x1GE/44x10GE MACSEC
PIC 0              BUILTIN      BUILTIN      44x1GE/44x10GE MACSEC
Xcvr 6          REV 01   740-031980  2013057700056  SFP+-10G-SR
MIC 1              24x10/25GE 6x40/100GE

```

PIC 1	BUILTIN	BUILTIN	24x10/25GE 6x40/100GE
Fan Tray 0			Fan Tray ACX5448-M 0, Front to Back
Airflow - AFO			
Fan Tray 1			Fan Tray ACX5448-M 1, Front to Back
Airflow - AFO			
Fan Tray 2			Fan Tray ACX5448-M 2, Front to Back
Airflow - AFO			
Fan Tray 3			Fan Tray ACX5448-M 3, Front to Back
Airflow - AFO			
Fan Tray 4			Fan Tray ACX5448-M 4, Front to Back
Airflow - AFO			
Fan Tray 5			Fan Tray ACX5448-M 5, Front to Back
Airflow - AFO			

The show chassis hardware output for ACX5448-M-LT:

```

user@device> show chassis hardware
Hardware inventory:

Item Version Part number Serial number Description
-----
Chassis XM0219200013 ACX5448-M-L

Midplane REV 06 650-092523 XM0219200013 ACX5448-M-L

PEM 0 REV 05 740-053352 1GD18190445 JPSU-850W-AC-AFO

PEM 1 REV 05 740-053352 1GD18190001 JPSU-850W-AC-AFO

Routing Engine 0 BUILTIN BUILTIN RE-ACX-5448

DFEB

FPC 0 BUILTIN BUILTIN FPC BUILTIN

MIC 0 44x1GE/44x10GE MACSEC

PIC 0 BUILTIN BUILTIN 44x1GE/44x10GE MACSEC

MIC 1 24x10/25GE 6x40/100GE

PIC 1 BUILTIN BUILTIN 24x10/25GE 6x40/100GE

```

Fan Tray 0 Fan Tray ACX5448-M 0, Front to Back Airflow - AFO

Fan Tray 1 Fan Tray ACX5448-M 1, Front to Back Airflow - AFO

Fan Tray 2 Fan Tray ACX5448-M 2, Front to Back Airflow - AFO

Fan Tray 3 Fan Tray ACX5448-M 3, Front to Back Airflow - AFO

Fan Tray 4 Fan Tray ACX5448-M 4, Front to Back Airflow - AFO

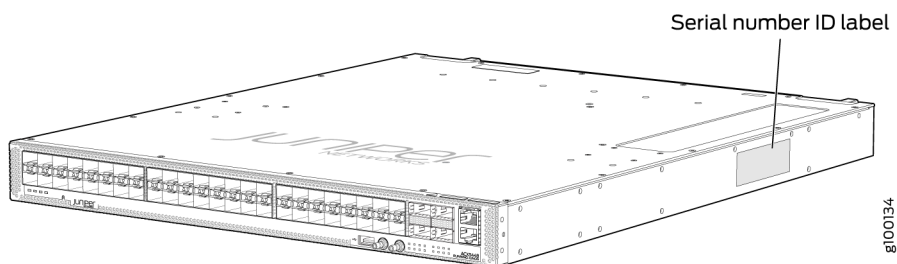
Fan Tray 5 Fan Tray ACX5448-M 5, Front to Back Airflow - AFO

**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.

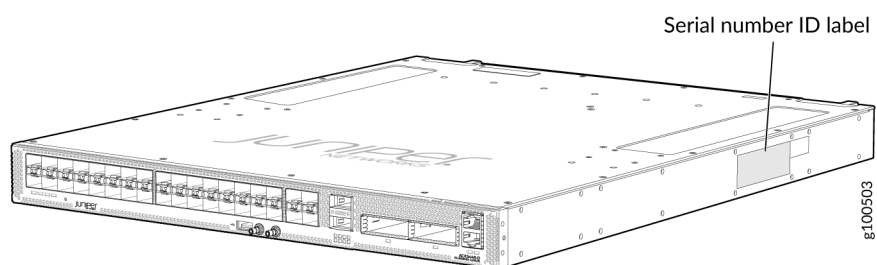
## Locate the Chassis Serial Number ID Label on an ACX5400 Router

On the ACX5400 router product models, the serial number ID label is located on the right side of the port panel. See [Figure 97 on page 142](#), [Figure 98 on page 143](#), and [Figure 99 on page 143](#) for examples of where to find the serial number ID.

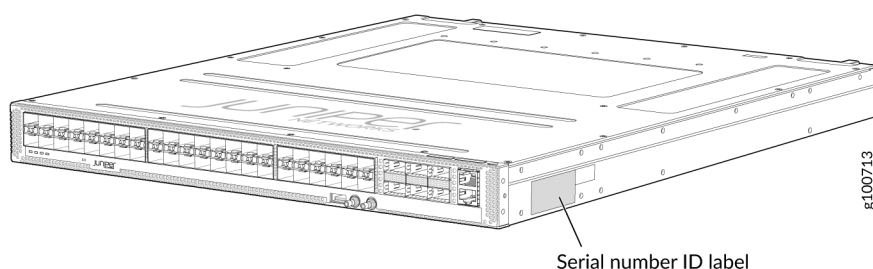
**Figure 97: Location of the Serial Number ID Label on an ACX5448 router**



**Figure 98: Location of the Serial Number ID Label on an ACX5448-D router**



**Figure 99: Location of the Serial Number ID Label on an ACX5448-M router**

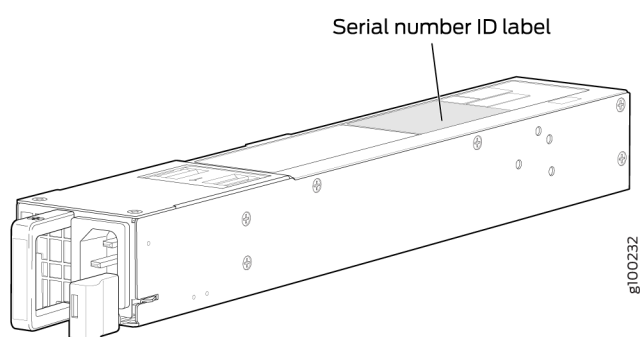


## Locate the Serial Number ID Labels on ACX5400 Power Supply Modules

The power supply modules (PSMs) installed in an ACX5400 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.

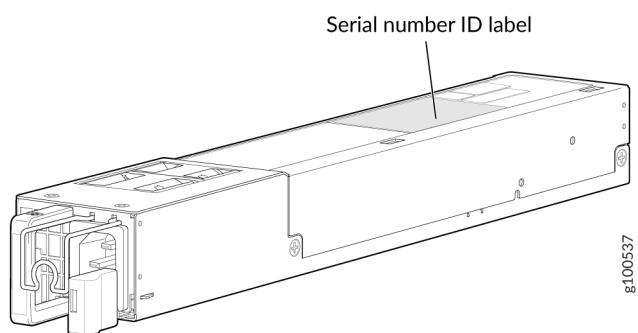
- AC PSM—The serial number ID label is on the top of the AC PSM. See [Figure 100 on page 143](#) and [Figure 101 on page 144](#).

**Figure 100: ACX5448 AC PSM Serial Number Location**



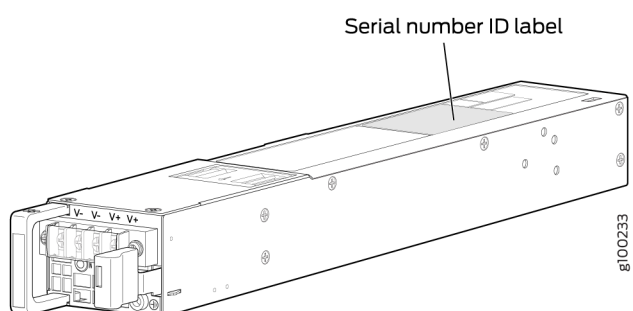


**Figure 101: ACX5448-D and ACX5448-M AC PSM Serial Number Location**

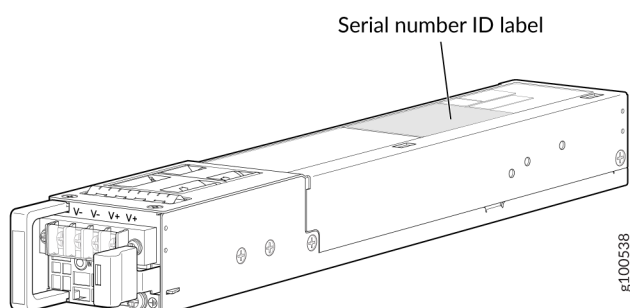


- DC PSM—The serial number ID label is on the top of the DC PSM. See [Figure 102 on page 144](#) and [Figure 103 on page 144](#).

**Figure 102: ACX5448 DC PSM Serial Number Location**



**Figure 103: DC PSM Serial Number Location for ACX5448-D and ACX5448-M Routers**

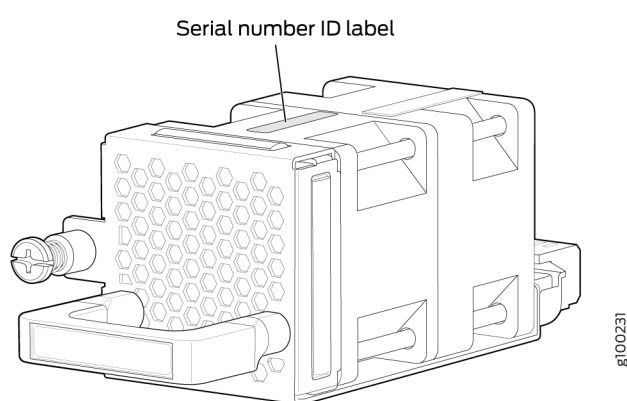


## Locate the Serial Number ID Label on an ACX5400 Fan Module

The fan modules installed in an ACX5400 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 104 on page 145](#).

**Figure 104: ACX5400 Fan Module Serial Number Location**



## Contact Customer Support to Obtain a Return Material Authorization

If you need to return a device or hardware component to Juniper Networks for repair or replacement, obtain a Return Material Authorization (RMA) number from Juniper Networks Technical Assistance Center (JTAC). You must obtain an RMA number before you attempt to return the component.

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

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

- Your existing service request number, if you have one
- Serial number of the component
- Your name, organization name, telephone number, fax number, and shipping address

- Details of the failure or problem
- Type of activity being performed on the device when the problem occurred
- Configuration data displayed by one or more `show` commands

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

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

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

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

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

## Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure that 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.

# 7

CHAPTER

## Safety and Compliance Information

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# General Safety Guidelines and Warnings

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

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

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



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

## Definitions of Safety Warning Levels

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

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



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

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



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

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



**WARNING:** This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry, and familiarize yourself with standard practices for preventing accidents.

**Waarschuwing** Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

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

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

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

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

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

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

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

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



## Qualified Personnel Warning



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

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

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

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

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

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

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

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

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

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

## Warning Statement for Norway and Sweden



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

**Advarsel** Apparatet skal kobles til en jordet stikkontakt.

**Varning!** Apparaten skall anslutas till jordat nätuttag.

# Fire Safety Requirements

## IN THIS SECTION

- [Fire Suppression | 153](#)
- [Fire Suppression Equipment | 153](#)

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

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

## Fire Suppression

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

## Fire Suppression Equipment

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

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

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

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

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

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

## Installation Instructions Warning



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

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

**Varoitus** Lue asennusohjeet ennen järjestelmän yhdistämistä virtälähteeseen.

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

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

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

**Advarsel** Les installasjonsinstruksjonene før systemet kobles til strømkilden.

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

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

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

## Restricted Access Warning



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

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

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

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

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

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

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

**Aviso** Esta unidade foi concebida para instalação em áreas de acesso restrito. Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal de serviço autorizado,

que possua uma ferramenta, chave e fechadura especial, ou qualquer outra forma de segurança. Esta área é controlada pela autoridade responsável pelo local.

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

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

## Ramp Warning



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

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

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

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

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

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

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

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

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

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

# Rack-Mounting and Cabinet-Mounting Warnings

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



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

- Install the device in a rack that is secured to the building structure.
- Mount the device at the bottom of the rack if it is the only unit in the rack.
- When mounting the device on a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

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

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

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

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

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

- Le rack sur lequel est monté le Juniper Networks switch doit être fixé à la structure du bâtiment.
- Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.
- Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l'élément le plus lourd dans le bas.
- Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l'unité en casier.

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

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.

- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

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

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

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

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

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

- O Juniper Networks switch deverá ser instalado numa prateleira fixa à estrutura do edifício.



- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

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

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

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

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

## Grounded Equipment Warning



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

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

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

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

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

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

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

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

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

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

## Radiation from Open Port Apertures Warning



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

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

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

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

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

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

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

**Aviso** Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar an EXposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

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

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

## Laser and LED Safety Guidelines and Warnings

### IN THIS SECTION

● General Laser Safety Guidelines | 163

- [Class 1 Laser Product Warning | 164](#)
- [Class 1 LED Product Warning | 164](#)
- [Laser Beam Warning | 165](#)

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

Observe the following guidelines and warnings:

## General Laser Safety Guidelines

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

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



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

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

## Class 1 Laser Product Warning



**LASER WARNING:** Class 1 laser product.

**Waarschuwing** Klasse-1 laser produkt.

**Varoitus** Luokan 1 lasertuote.

**Avertissement** Produit laser de classe I.

**Warnung** Laserprodukt der Klasse 1.

**Avvertenza** Prodotto laser di Classe 1.

**Advarsel** Laserprodukt av klasse 1.

**Aviso** Produto laser de classe 1.

**¡Atención!** Producto láser Clase I.

**Varning!** Laserprodukt av klass 1.

## Class 1 LED Product Warning



**LASER WARNING:** Class 1 LED product.

**Waarschuwing** Klasse 1 LED-product.

**Varoitus** Luokan 1 valodiodituote.

**Avertissement** Alarme de produit LED Class I.

**Warnung** Class 1 LED-Produktwarnung.

**Avvertenza** Avvertenza prodotto LED di Classe 1.

**Advarsel** LED-produkt i klasse 1.

**Aviso** Produto de classe 1 com LED.

**¡Atención!** Aviso sobre producto LED de Clase 1.

**Varning!** Lysdiodprodukt av klass 1.

## Laser Beam Warning



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

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

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

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

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

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

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

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

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

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

## Maintenance and Operational Safety Guidelines and Warnings

### IN THIS SECTION

- [Battery Handling Warning | 166](#)
- [Jewelry Removal Warning | 167](#)
- [Lightning Activity Warning | 168](#)

- Operating Temperature Warning | 169
- Product Disposal Warning | 170

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

## Battery Handling Warning



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

**Waarschuwing** Er is ontplofingsgevaar 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 suositttelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.

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

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

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

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

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

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

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

## Jewelry Removal Warning



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

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

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

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

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



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

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

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

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

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

## Lightning Activity Warning



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

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

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

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

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

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

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

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

**¡Atención!** No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

**Varning!** Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

## Operating Temperature Warning



**WARNING:** To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

**Waarschuwing** Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

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

**Avertissement** Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

**Warnung** Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene

Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

**Avvertenza** Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

**Advarsel** Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

**Aviso** Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

**¡Atención!** Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

**Varning!** Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

## Product Disposal Warning



**WARNING:** Disposal of this device must be handled according to all national laws and regulations.

**Waarschuwing** Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

**Varoitus** Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

**Avertissement** La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

**Warnung** Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

**Avvertenza** L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

**Advarsel** Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

**Aviso** A descarte final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

**¡Atención!** El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

**Varning!** Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

## General Electrical Safety Guidelines and Warnings



**WARNING:** Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS (Network Equipment-Building System) requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be metalically 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 metalically to OSP wiring.

**Avertissement** Certains ports de l'appareil sont destinés à un usage en intérieur uniquement (ports Type 2 ou Type 4 tels que décrits dans le document *GR-1089-CORE*) et doivent être isolés du câblage de l'installation extérieure exposée. Pour respecter les exigences NEBS et assurer une protection contre la foudre et les perturbations de tension secteur, les ports pour intérieur *ne doivent pas* être raccordés physiquement aux interfaces prévues pour la connexion à l'installation extérieure ou à son câblage. Les

ports pour intérieur de l'appareil sont réservés au raccordement de câbles pour intérieur ou non exposés uniquement. L'ajout de protections ne constitue pas une précaution suffisante pour raccorder physiquement ces interfaces au câblage de l'installation extérieure.



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

**Attention** Avant de retirer ou d'installer des composants d'un appareil, raccordez un bracelet antistatique à un point de décharge électrostatique et fixez le bracelet à votre poignet nu. L'absence de port d'un bracelet antistatique pourrait provoquer des dégâts sur l'appareil.

- Install the device in compliance with the following local, national, and international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
  - Evaluated to the TN power system.
  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
  - Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.

Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.
- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Make sure that you clean grounding surface and give them a bright finish before making grounding connections.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.

- Operate the device within marked electrical ratings and product usage instructions.
- To ensure that the device and peripheral equipment function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

You can remove and replace many device components without powering off or disconnecting power to the device, as detailed elsewhere in the hardware documentation for this device. Never install equipment that appears to be damaged.

## 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 105 on page 174](#)) in one hand and touch the exposed, bare metal of the device with the other hand immediately before inserting the component into the device.



**WARNING:** For safety, periodically check the resistance value of the ESD grounding strap. The measurement must be in the range 1 through 10 Mohms.

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

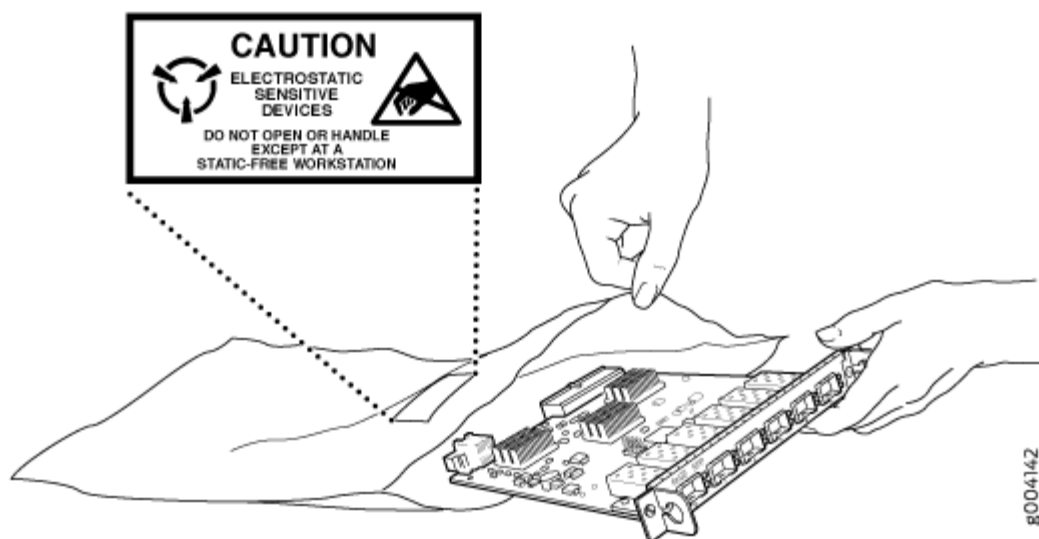
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

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

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

- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an antistatic bag (see [Figure 105 on page 174](#)). If you are returning a component, place it in an antistatic bag before packing it.

Figure 105: Placing a Component into an Antistatic Bag



**CAUTION:** ANSI/TIA/EIA-568 cables such as Category 5e and Category 6 can get electrostatically charged. To dissipate this charge, always ground the cables to a suitable and safe earth ground before connecting them to the system.

**Attention** Les câbles ANSI/TIA/EIA-568, par exemple Cat 5e et Cat 6, peuvent emmagasiner des charges électrostatiques. Pour évacuer ces charges, reliez toujours les câbles à une prise de terre adaptée avant de les raccorder au système.

## Site Electrical Wiring Guidelines

[Table 39 on page 175](#) describes the factors you must consider while planning the electrical wiring at your site.



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

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

**Table 39: Site Electrical Wiring Guidelines**

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



# AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to AC-powered devices:

- Note the following warnings printed on the device:

**“CAUTION: THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK.”**

**“ATTENTION: CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE.”**

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.
- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

## Power Cable Warning (Japanese)

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

**注意**

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

0617203

## AC Power Disconnection Warning



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

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

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

**Avertissement** Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

**Warnung** Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

**Avvertenza** Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

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

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

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

**Warning!** 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.

**Avertissement** Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

**Warnung** Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

**Avvertenza** Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

**Advarsel** Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

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

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

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

## DC Power Grounding Requirements and Warning

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



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

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

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

**Avertissement** Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

**Warnung** Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

**Avvertenza** In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

**Advarsel** Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

**Aviso** Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

**¡Atención!** Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

**Warning!** Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

## DC Power Wiring Sequence Warning



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

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

**Varoitus** Oikea yhdistettävä kytkentäjäjestys on maajohto maajohtoon, +RTN varten +RTN, –48 V varten –48 V. Oikea irrotettava kytkentäjäjestys on –48 V varten –48 V, +RTN varten +RTN, maajohto maajohtoon.

**Avertissement** Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis –48 V à –48 V. En débranchant la puissance, l'ordre approprié de câblage est –48 V à –48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

**Warnung** Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

**Avvertenza** Mostra la morsettiera dell'alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

**Advarsel** Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, -48 V til -48 V. Riktig frakoples tilkoplingssekvens er -48 V til -48 V, +RTN til +RTN, jord til jord.

**Aviso** Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces -48 V a -48 V. Al desconectar potencia, la secuencia apropiada del cableado es -48 V a -48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

**¡Atención!** Wire a fonte de alimentação de DC Usando os talões apropriados nan Extremidade da fiação. Ao conectar a potência, a seqüência apropriada da fiação é moída para moer, +RTN a +RTN, então -48 V a -48 V. Ao desconectar a potência, a seqüência apropriada da fiação é -48 V a -48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

**Warning!** Korrekt kopplingssekvens ar jord till jord, +RTN till +RTN, -48 V till -48 V. Korrekt kopplas kopplingssekvens ar -48 V till -48 V, +RTN till +RTN, jord till jord.

## DC Power Wiring Terminations Warning



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

**Waarschuwing** Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingspunten, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten

dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

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

**Avertissement** Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

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

**Avvertenza** Quando occorre usare trecce, usare connettori omologati, come quelli a occhio o a forcina 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 nødvendigt med flertrådede ledninger, bruges godkendte ledningsafslutninger, som for eksempel lukket sløye eller spadetype med oppoverbøjede kabelsko. Disse afslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og ledaren.

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

**¡Atención!** Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

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

## Multiple Power Supplies Disconnection Warning



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

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

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

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

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

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

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

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

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

**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** Kojе on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

**Avertissement** Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

**Warnung** Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

**Avvertenza** Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

**Advarsel** Utstyret er utfomet til bruk med TN-strømsystemer.

**Aviso** O dispositivo foi criado para operar com sistemas de corrente TN.

**¡Atención!** El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

**Varning!** Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

## Action to Take After an Electrical Accident

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

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

# Agency Approvals for ACX5448, ACX5448-D, and ACX5448-M Routers

## IN THIS SECTION

- [Compliance Statement for Argentina | 186](#)

The ACX5400 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 Statement for Argentina

EQUIPO DE USO IDÓNEO.

## Compliance Statements for Data Center

- 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

## IN THIS SECTION

- [Canada | 187](#)
- [European Community | 187](#)
- [Israel | 187](#)
- [Japan | 188](#)
- [United States | 188](#)

## 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

### אזהרה

מוצר זה הוא מוצר Class A. בסביבה ביתית, מוצר זה עלול לגרום הפרעות בתדר רדיו, ובמקרה זה, המשתמש עשוי להידרש לנקוט אמצעים מתאימים.

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

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用する  
と電波妨害を引き起こすことがあります。この場合には使用者が適切な対策  
を講ずるよう要求されることがあります。 VCCI-A

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.