ACX5048 and ACX5096 Universal Metro Router Hardware Guide



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

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ACX5048 and ACX5096 Universal Metro Router Hardware Guide
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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at https://www.juniper.net/documentation/.

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Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

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Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   system {
     scripts {
       commit {
         file ex-script.xsl;
       }
     }
   }
   interfaces {
     fxp0 {
       disable;
       unit 0 {
         family inet {
           address 10.0.0.1/24;
         }
       }
     }
   }
   ```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

   ```
   [edit]
   user@host# load merge /var/tmp/ex-script.conf
   load complete
   ```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   commit {
     file ex-script-snippet.xsl; }
   ```


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2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see CLI Explorer.

Documentation Conventions

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

Table 1: Notice Icons

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

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

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Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric** *metric***>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(***string1* **|** *string2* **|** *string3***)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [** *community-ids* **]**

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

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

GUI Conventions

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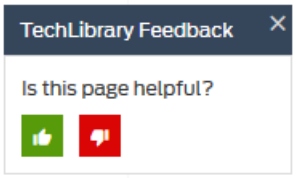
Table 2: Text and Syntax Conventions (continued)

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

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We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

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Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active Juniper Care or Partner Support Services support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

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

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Self-Help Online Tools and Resources

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

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- Find product documentation: https://www.juniper.net/documentation/
- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: https://www.juniper.net/company/communities/
- Create a service request online: https://myjuniper.juniper.net

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

Creating a Service Request with JTAC

You can create a service request with JTAC on the Web or by telephone.

- Visit https://myjuniper.juniper.net.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

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

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CHAPTER 1

Overview

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ACX5048 and ACX5096 System Overview

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ACX5000 Universal Metro Router Overview

The ACX5000 Universal Metro Routers are Juniper Networks' top-of-rack router solutions for data centers and campus distribution or aggregation environments. The ACX5000 router portfolio consists of high-performance fixed-configuration routers that add higher port densities, additional scalability, and improved latency to the ACX Series. The ACX5000 routers are available in two models—ACX5048 and ACX5096. See "ACX5000 Router Models" on page 19.

ACX5000 routers offer a compact 1 U model and a 2 U model that provide wire-speed packet performance, very low latency, and a rich set of Layer 2 and Layer 3 features. These routers have a high-throughput Packet Forwarding Engine, and the performance of the control plane running on ACX5000 routers is enhanced by the 1.5 Ghz dual-core Intel CPU with 8 GB of memory and 32 GB of solid-state drive (SSD) storage.

The ACX5000 routers include both 10-Gigabit Ethernet and 40-Gigabit Ethernet fixed configurations.

For more information about which features are supported on an ACX5000 routers, see "Protocols and Applications Supported by ACX Series Routers" on page 24.

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ACX5000 routers use the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. Junos OS is installed on an ACX5000 router's 32-gigabyte (GB) internal solid state flash drive. The same Junos OS code base that runs on an ACX5000 routers also runs on all Juniper Networks QFX and EX Series switches, and J Series, M Series, MX Series, ACX Series and T Series routers.

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.

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- ACX5048 Router on page 18
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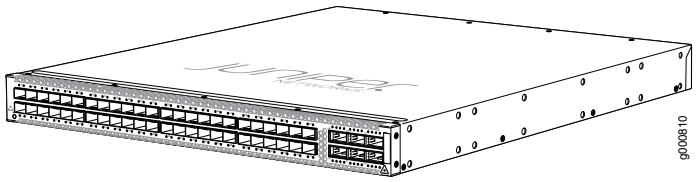
Benefits of the ACX5048 and ACX5096 Routers

- **Performance—**ACX5000 routers provide wire-speed packet performance, very low latency, and a rich set of Layer 2 and Layer 3 features.
- **Service virtualization—**ACX5000 routers offer service virtualization on a dedicated and customizable KVM-compliant virtual machine that enables you to execute operational scripts and programs for network performance monitoring and analysis.

ACX5048 Router

As shown in Figure 1 on page 18, the ACX5048 is a 10-Gigabit Ethernet enhanced small form-factor pluggable (SFP+) top-of-rack router with 48 SFP+ ports and 6 quad SFP+ (QSFP+) ports. Each SFP+ port can operate as a native 10-Gigabit Ethernet port or as a 1-Gigabit Ethernet port when 1-gigabit optics are inserted. Each QSFP+ port (**48** through **53**) can operate as a 40-Gigabit Ethernet port or be channelized to operate as four independent 10-Gigabit Ethernet ports (a total of 24 10-Gigabit Ethernet ports). The 6 QSFP+ ports can be used as either access ports or uplink ports. The ACX5048 provides full duplex throughput of 1.44 Tbps. The ACX5048 has a 1 U form factor and is shipped with redundant fans and redundant power supplies. The router can be ordered with front-to-back airflow (air out or AFO) and with AC or DC power supplies.

Figure 1: ACX5048 Port Panel



ACX5048 can be used only as a standalone router.

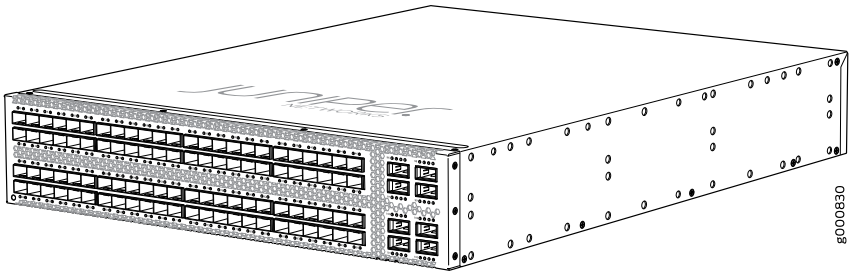
ACX5096 Router

As shown in Figure 2 on page 19, the ACX5096 is a is a 10-Gigabit Ethernet enhanced small form-factor pluggable (SFP+) top-of-rack router with 96 SFP+ ports and 8 quad SFP+ (QSFP+) ports. Each SFP+ port can operate as a native 10-Gbps port or as a 1-Gbps port. The QSFP+ ports **96** and **100** can operate at native 40 Gbps speed or can be channelized to 4 independent 10 Gbps port speeds. The 8 QSFP+ ports can be used as

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either access ports or as uplinks. The ACX5096 has a 2 U form factor and is shipped with redundant fans and redundant power supplies. The router can be ordered with front-to-back airflow (air out or AFO) and with AC or DC power supplies.

Figure 2: ACX5096 Port Panel



ACX5096 can be used only as a standalone router.

See Also
- Chassis Physical Specifications for an ACX5000 Router on page 68

ACX5000 Router Models

Table 3 on page 19 lists the ACX5000 router models. The ACX5000 routers are available in 48 port or 96 port configurations. The routers are available with either AC or DC power supply and with airflow-out (AFO) cooling.

Table 3: ACX5000 Router Model Numbers and Description

Model Number	Ports	Power Supply	Number of Management Ports	Airflow
ACX5048-AC	48 SFP+ and 6 QSFP+ transceivers	AC	3	Air Out (front-to-back)
ACX5048-DC	48 SFP+ and 6 QSFP+ transceivers	DC	3	Air Out (front-to-back)
ACX5096-AC	96 SFP+ and 8 QSFP+ transceivers	AC	2	Air Out (front-to-back)
ACX5096-DC	96 SFP+ and 8 QSFP+ transceivers	DC	2	Air Out (front-to-back)

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

See Also
- Determining Transceiver Support for the ACX5000 on page 73

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Field-Replaceable Units in an ACX5000 Router

Field-replaceable units (FRUs) are components that you can replace at your site. The ACX5000 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 ACX5000 FRUs:

- Power supplies
- Fan modules

Table 4 on page 20 lists the FRUs for the ACX5000 and actions to take before removing them.

Table 4: FRUs in ACX5000 Routers and Action Required Before Removing Them

FRUs	Required Action
Power supplies	None
Fan modules	None



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



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



NOTE: Before removing the optical transceivers, we recommend that you disable the interface using the **set interfaces *interface-name* disable** command. See "Disconnecting a Fiber-Optic Cable from an ACX5000 Router" on page 109.

See Also

- Installing a Power Supply in an ACX5000 Router on page 116
- Removing a Power Supply from an ACX5000 Router on page 114

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- Installing a Fan Module in an ACX5000 Router on page 113
- Removing a Fan Module from an ACX5000 Router on page 111

Understanding Hardware Redundancy of an ACX5000 Router Components and Functionality

The following hardware components provide redundancy on an ACX5000 router:

- Power supplies—The ACX5000 router has one or two power supplies. Each power supply provides power to all components in the router. If two power supplies are installed, the two power supplies provide full power redundancy to the device. If one power supply fails or is removed, the second power supply balances the electrical load without interruption.

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

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

- Cooling system—The 1 U ACX5048 router has five fan modules; the 2 U ACX5096 router has three fan modules. If a fan module fails and is unable to keep the ACX5000 router within the desired temperature thresholds, chassis alarms occur and the ACX5000 router can shut down.

See Also

- AC Power Supply for an ACX5000 Router on page 55
- DC Power Supply for an ACX5000 Router on page 58
- Cooling System and Airflow in an ACX5000 Router on page 51

ACX5000 Routers Hardware and CLI Terminology Mapping

- ACX5048 Router Hardware and CLI Terminology Mapping on page 21
- ACX5096 Router Hardware and CLI Terminology Mapping on page 23

ACX5048 Router Hardware and CLI Terminology Mapping

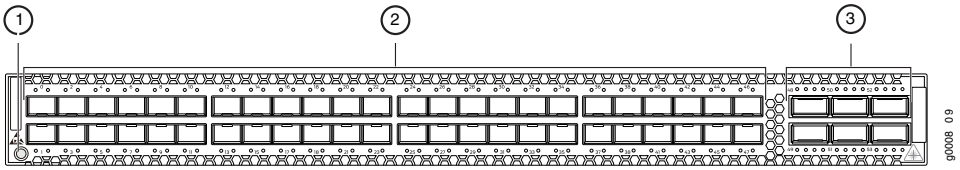
Table 5 on page 22 describes the hardware terms used in an ACX5048 router documentation and the corresponding terms used in the Junos OS command line interface (CLI). Figure 3 on page 22 shows the port locations of the interfaces.

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Table 5: CLI Equivalents of Terms Used in Documentation for an ACX5048 Router

Hardware Item (as displayed in the CLI)	Description (as displayed in the CLI)	Value (as displayed in the CLI)	Item in Documentation	Additional Information
Chassis	ACX5048	–	Router chassis	"Chassis Physical Specifications for an ACX5000 Router" on page 68
FPC (*n*)	Abbreviated name of the Flexible PIC Concentrator (FPC)	Value of *n* is always 0.	The router does not have actual FPCs. In this case, FPC refers to the router itself.	*Interface Naming Conventions Used in the Junos OS Operational Commands*
PIC (*n*)	Abbreviated name of the Physical Interface Card (PIC)	Value of *n* is always 0.	The router does not have actual PIC devices; see entries for PIC 0 for the equivalent item on the router.	*Interface Naming Conventions Used in the Junos OS Operational Commands*
	48x10G–6x40G	PIC 0	Built-in network ports on the front panel of the router	"ACX5000 Universal Metro Router Overview" on page 17
Xcvr (*n*)	Abbreviated name of the transceiver	*n* is a value equivalent to the number of the port in which the transceiver is installed.	Optical transceivers	*Port and Interface Specifications*
Power supply (*n*)	Power supply	*n* is a value in the range of 0-1.	AC power supply DC power supply	"AC Power Supply for an ACX5000 Router" on page 55 "DC Power Supply for an ACX5000 Router" on page 58
Fan	Fan	*n* is a value in the range of 0-4.	Fan	"Cooling System and Airflow in an ACX5000 Router" on page 51

Figure 3: ACX5048 Interface Port Mapping



1—Electrostatic Discharge (ESD) terminal	3—40 Gigabit Ethernet ports (6)
2—10 Gigabit Ethernet ports (48)	

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ACX5096 Router Hardware and CLI Terminology Mapping

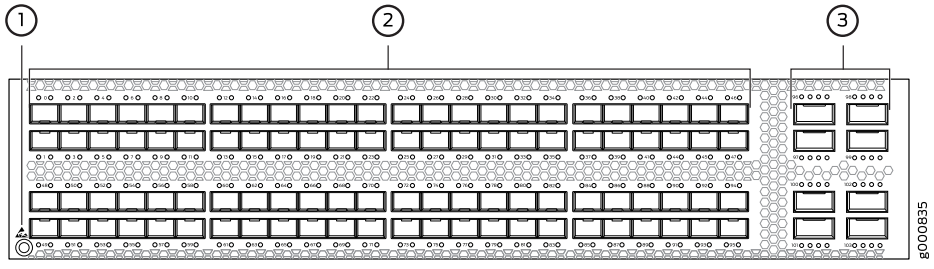
Table 6 on page 23 describes the hardware terms used in an ACX5096 router documentation and the corresponding terms used in the Junos OS command line interface (CLI). Figure 4 on page 24 shows the port locations of the interfaces.

Table 6: CLI Equivalents of Terms Used in Documentation for an ACX5096 Router

Hardware Item (as displayed in the CLI)	Description (as displayed in the CLI)	Value (as displayed in the CLI)	Item in Documentation	Additional Information
Chassis	ACX5096	–	Router chassis	"Chassis Physical Specifications for an ACX5000 Router" on page 68
FPC (*n*)	Abbreviated name of the Flexible PIC Concentrator (FPC)	Value of *n* is always 0.	The router does not have actual FPCs. In this case, FPC refers to the router itself.	*Interface Naming Conventions Used in the Junos OS Operational Commands*
PIC (*n*)	Abbreviated name of the Physical Interface Card (PIC)	Value of *n* is always 0.	The router does not have actual PIC devices; see entries for PIC 0 for the equivalent item on the router.	*Interface Naming Conventions Used in the Junos OS Operational Commands*
	96x10G–8x40G	PIC 0	Built-in network ports on the front panel of the router	"ACX5000 Universal Metro Router Overview" on page 17
Xcvr (*n*)	Abbreviated name of the transceiver	*n* is a value equivalent to the number of the port in which the transceiver is installed.	Optical transceivers	*Port and Interface Specifications*
Power supply (*n*)	Built-in power supply	*n* is a value in the range of 0-1.	AC power supply DC power supply	"AC Power Supply for an ACX5000 Router" on page 55 "DC Power Supply for an ACX5000 Router" on page 58
Fan	Fan	*n* is a value in the range of 0-2 for ACX5096	Fan	"Cooling System and Airflow in an ACX5000 Router" on page 51

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Figure 4: ACX5096 Interface Port Mapping



1—Electrostatic Discharge (ESD) terminal	3—40 Gigabit Ethernet ports (8)
2—10 Gigabit Ethernet ports (96)	

Protocols and Applications Supported by ACX Series Routers

Table 7 on page 24 contains the first Junos OS Release support for protocols and applications on ACX Series routers. A dash indicates that the protocol or application is not supported.

NOTE:

- The [edit logical-systems *logical-system-name*] hierarchy level is not supported on ACX Series routers.
- The ACX Series routers does not support per-family maximum transmission unit (MTU) configuration. The MTU applied to family inet gets applied to other families as well, even though it can be configured though CLI and visible in show interface extensive output. The only way to use higher MTU for a family is to manipulate the MTU, apply at interface or family inet levels, and let it calculate for each family automatically. MTU values are not limited to 1500 but can range between 256 to 9216.

  For more information, see the Knowledge Base (KB) article KB28179 at: https://kb.juniper.net/InfoCenter/index?page=content&id=KB28179.

Table 7: Protocols and Applications Supported by ACX Series Routers

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Interface and Encapsulation Types										
Ethernet interfaces—1G, 10G	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Ethernet interfaces—40G	–	–	–	–	–	–	15.1X54 –D20	15.1X54 –D20	–	18.2R1
ATM interfaces (IMA only)	12.2	–	12.2	12.2R2	–	–	–	–	–	–

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
E1 interfaces	12.2	–	12.2	12.2R2	–	–	–	–	–	–
T1 interfaces	12.2	–	12.2	12.2R2	–	–	–	–	–	–
Circuit emulation interfaces (SAToP, CESoP)	12.2	–	12.2	12.2R2	-	12.3x51 -D10	–	–	–	–
SONET/SDH interfaces	–	–	–	–	–	12.3x51 -D10 (requires a MIC)	–	–	–	–
Layer 3										
Static routes	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
OSPF	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
IS-IS	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
BGP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Internet Control Message Protocol (ICMP)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Address Resolution Protocol (ARP)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Bidirectional Forwarding Detection (BFD) protocol	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Dynamic Host Configuration Protocol (DHCP)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
IP fast reroute (FRR) (OSPF, IS-IS)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Maximum transmission unit (MTU) range (256 to 9192)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Layer 3 VPNs	12.3R1	12.3R1	12.3R1	12.3R1	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
RSVP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
LDP (targeted and direct)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
MPLS, VPLS, VPNs										
Static label-switched path (LSP)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
FRR	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Traffic engineering	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
E-LINE	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Pseudowire Emulation Edge to Edge (PWE3 [signaled])	12.2	–	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	–	18.2R1
Static Ethernet PWs	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Layer 2 circuits	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
IEE802.1ag CC monitoring on active and standby pseudowires	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
VPLS	–	–	–	–	–	–	15.1X54–D20	15.1X54–D20	–	18.2R1
Ethernet Layer 2										
Ethernet in the first mile (EFM 802.3ah)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
802.1ag connectivity fault management (CFM)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
IEE802.1ag interface-status type, length, and value (TLV)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
QoS										
Firewall filters (access control lists—ACLs)—family inet	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Standard firewall filter match conditions for MPLS traffic	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Firewall filters—family ccc/any	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Firewall - Port Mirroring	12.2R1	12.2R2	12.2R1	12.2R2	12.3X54 –D15	12.3x51 -D10	17.1R1	17.1R1	-	18.2R1
Policing—per logical interface	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Policing—per physical interface	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Policing—per family	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
TrTCM (color aware, color blind)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 12.3X54 –D15 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
SrTCM (color aware, color blind)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Host protection	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Eight queues per port	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Priority queuing	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Rate control	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Scheduling with two different priorities	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Low-latency queue (LLQ)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Weighted random early detection (WRED) drop profile (DP)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Classification—DSCP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Classification—MPLS EXP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Classification—IEEE 802.1p	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Rewrite—DSCP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Rewrite MPLS EXP	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Rewrite 802.1p	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Rewrite MPLS and DSCP to different values	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Timing										
Timing-1588-v2, 1588-2008–backup clock	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Synchronous Ethernet	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Building-integrated timing supply (BITS)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
Clock synchronization	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
Redundant clock (multiple 1588 masters)	–	–	–	–	–	–	–	–	–	-
Transparent clock	–	–	–	–	–	–	15.1X54–D20	15.1X54–D20	–	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Grand Master Clock	–	–	–	–	–	–	–	–	12.3X54–D20 and 17.3R1 (Indoor) 12.3X54–D25 (Outdoor)	-
OAM, Troubleshooting, Manageability, Lawful Intercept										
Network Time Protocol (NTP)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
SNMP	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
802.1ag CFM	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
802.3ah LFM	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Y.1731 Fault and Performance Management	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
MPLS OAM	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
RMON	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Layer 2 traceroute	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
DNS	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
TFTP for software downloads	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Port mirroring (local port mirroring)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1
Interface loopback	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	15.1X54–D20	15.1X54–D20	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	18.2R1

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Ethernet loopback	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
Interface byte and packet stats	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Interface queue stats	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Drop packet stats	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Distinguish each 802.1ag connection by VLAN-ID	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Interface passive-monitor-mode	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Multipacket mirror	–	–	–	–	–	–	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Security										
TACACS AAA	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
RADIUS authentication	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Control plane DOS prevention	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
High Availability										
MPLS FRR	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
BFD	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
ATM Transport										
ATM over PWE3	12.2	–	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	–	-
RFC4717 ATM encapsulation: S6.1 ATM N to one cell mode (required as per standard)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
RFC4717: S6.3—ATM AAL5 SDU encapsulation (optional)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
ATM PWE3 control word	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
ATM PWE3 by means of dynamic labels	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
ATM VPI/VCI swapping	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
ATM idle/unassigned cell suppression	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
ATM support for N to 1 PW promiscuous mode: 1 PW per port and 1 PW per VPI	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
Cell concatenation (1 to 30 cells per packet)	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
Packet/byte counters per VP and VC	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
Inverse multiplexing over ATM (IMA)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
ATM Encapsulation										
AAL5 SDU (n-to-1 cell relay)	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
ATM Queuing										
ATM service categories (CBR, nrt-VBR, UBR) to the UNI	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
MAP ATM service categories to PW EXP bits	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-
Input policing per VC	12.2	12.2R2	12.2	12.2R2	12.3X54–D15	12.3x51-D10	–	–	12.3X54–D20 (Indoor) 12.3X54–D25 (Outdoor)	-

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Table 7: Protocols and Applications Supported by ACX Series Routers (continued)

Protocol or Application	ACX1000	ACX1100	ACX2000	ACX2100	ACX2200	ACX4000	ACX5048	ACX5096	ACX500	ACX5448
VC output shaping	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
Early packet discard	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	–	–	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	-
MIBs										
Standard SNMP MIBs	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1
Juniper Networks enterprise-specific MIBs	12.2	12.2R2	12.2	12.2R2	12.3X54 –D15	12.3x51 -D10	15.1X54 –D20	15.1X54 –D20	12.3X54 –D20 (Indoor) 12.3X54 –D25 (Outdoor)	18.2R1

See Also
- ACX Series Universal Metro Routers

ACX5048 and ACX5096 Chassis

- Management Panel of an ACX5000 Router on page 40
- Port Panel of an ACX5048 Router on page 42
- Port Panel of an ACX5096 Router on page 43
- Chassis Status LEDs on an ACX5000 Router on page 44
- Management Port LEDs on an ACX5000 Router on page 46
- Access Port and Uplink Port LEDs on an ACX5000 Router on page 48

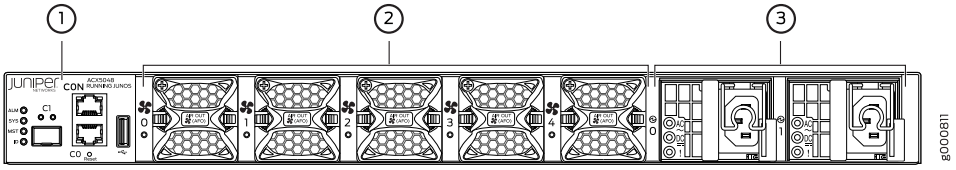
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Management Panel of an ACX5000 Router

The management panel of the ACX5000 router is found on the Field Replaceable Unit (FRU) end of the router as shown in Figure 5 on page 40 for 1 U ACX5048 router and Figure 6 on page 40 for the 2 U ACX5096 router.

See Figure 7 on page 40 and Figure 8 on page 41 for FRUs and management panel detail.

Figure 5: ACX5048, FRU End 1 U Product SKU



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

Figure 6: ACX5096, FRU End 2 U Product SKU

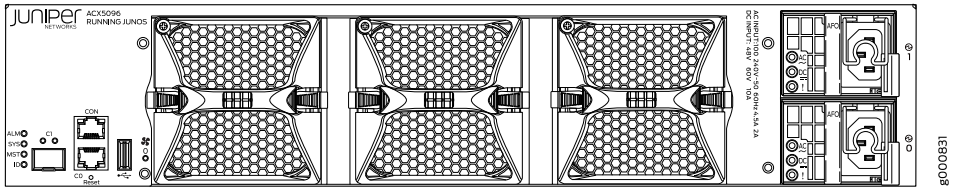
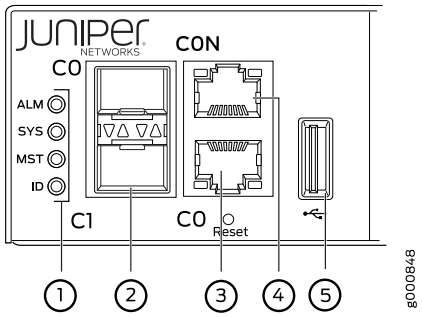


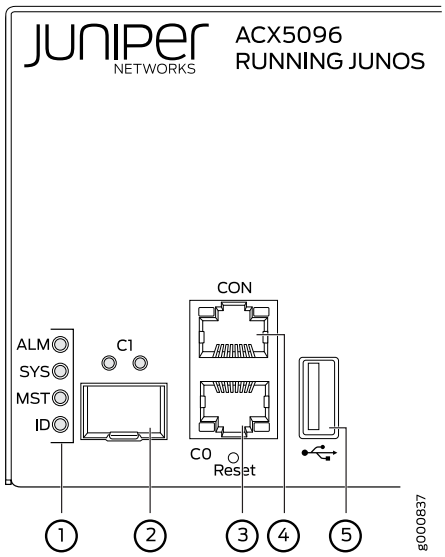
Figure 7: Management Panel Components on ACX5048



1—Status LEDs	4—RJ-45 console port (**CON**))
2—em1–SFP management Ethernet port (**C1**) Cage (socket for either 1 GbE copper SFP or fiber SFP)	5—USB port
3—em0–RJ-45 (1000 Base-T) management Ethernet port (**C0**) Some SKUs have an additional SFP management Ethernet port (second **C0**)	

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Figure 8: Management Panel Components on ACX5096



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

The management panel consists of the following components:

- Status LEDs
  - ALM–Alarm
    - Unlit indicates the router is halted or that there is no alarm.
    - Red indicates a hardware fault, such as a power failure or a system shutdown due to system over-heating.
    - Amber indicates a major or minor alarm.
  - SYS–System
    - Unlit indicates the router is powered off or halted.
    - Solid green indicates that Junos OS for ACX Series is loaded on the router.
  - ID–Identification or beacon
    - Unlit indicates the beacon feature is not enabled.
    - Blinking blue indicates the beacon feature is enabled. This feature is enabled using the **request chassis beacon** command.
- Router product number
- Management Ports **C0** and **C1**

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  - C0–Use the RJ-45 connectors for 10/100/1000 BaseT. See "Connecting an ACX5000 Router to a Network for Out-of-Band Management" on page 101.
  - C1–Use the SFP connector for 1000 BaseX.
- USB port for image updates.
- Console port (RJ-45) to support RS-232 serial ports.

See Also

- USB Port Specifications for an ACX5000 Router on page 81
- Connecting an ACX5000 Router to a Management Console on page 100
- Connecting an ACX5000 Router to a Network for Out-of-Band Management on page 101

Port Panel of an ACX5048 Router

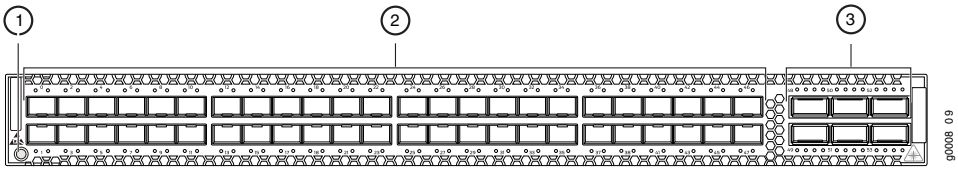
The port panel of the ACX5048 supports up to a maximum of 72 logical 10 GbE ports when operating as a standalone router. Forty-eight physical ports(**0** through **47**) support 10 Gbps small form-factor pluggable plus (SFP+) transceivers. These ports can be configured as access ports. All 48 of these ports can be used for SFP+ transceivers or SFP+ direct attach copper (DAC) cables. You can use 1-Gigabit Ethernet SFP, 10-Gigabit Ethernet SFP+ transceivers and SFP+ direct attach copper cables in any access port.

The remaining 24 logical ports are available for six 40 GbE ports (**48** through **53**) that support up to six quad small-form factor pluggable plus (QSFP+) transceivers or QSFP+. Each QSFP+ socket can operate either as a single 40 Gbps port or as a set of 4 independent 10 Ggps ports using QSFP+ breakout cables. The 40 GbE ports can be configured as either access ports or as uplinks.

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

Figure 9 on page 42 shows the port panel of a ACX5048 router.

Figure 9: ACX5048 Router Port Panel



1—Electrostatic Discharge (ESD) terminal	3—40 Gigabit Ethernet ports (6)
2—10 Gigabit Ethernet ports (48)	

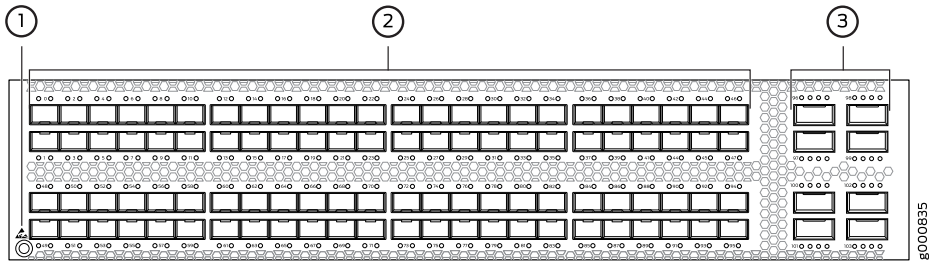
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Port Panel of an ACX5096 Router

The port panel of the ACX5096 router consists of 96 small form-factor pluggable plus (SFP+) and 8 quad small-form factor pluggable plus (QSFP+) ports. Physical ports(**0** through **95**) support 10 Gbps SFP+ transceivers and normally are configured as access ports. The eight 40-Gigabit ports (**96** through **103**) support QSFP+ transceivers and are normally configured as uplinks or Virtual Chassis ports (VCPs). Although the 104 physical ports of the ACX5096 would map to 128 logical ports using channelization, only 104 logical ports are supported.

Figure 10 on page 43 shows the port panel of a ACX5096 router.

Figure 10: ACX5096 Router Port Panel



1—Electrostatic Discharge (ESD) terminal	3—40 Gigabit Ethernet ports (8)
2—10 Gigabit Ethernet ports (96)	

This topic describes:

- Router Ports on page 43
- Channelizing Interfaces on page 44

Router Ports

The ACX5096 ports, (**0** through **95**) support:

- 1 Gbps SFP transceivers
- 10 Gbps SFP+ transceivers
- 10 Gbps direct attach copper (DAC) cables

Ports **96** through **104** support:

- 40 Gbps QSFP+ transceivers

Additionally ports **96** and **100** support:

- QSFP+ direct attach copper (DAC) cables
- QSFP+ to SFP+ direct attach copper break out (DACBO) cables
- QSFP+ to SFP+ fiber break out cables

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All 96 of these ports can be used for SFP+ transceivers or SFP+ direct attach copper (DAC) cables. You can use 1-Gigabit Ethernet SFP+, 10-Gigabit Ethernet SFP+ transceivers and SFP+ direct attach copper cables in any access port.



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

Channelizing Interfaces

The port panel of an ACX5096 supports up to a maximum of 104 logical 10 GbE ports that can be distributed over 96 small form-factor pluggable plus (SFP+) and 8 quad small-form factor pluggable plus (QSFP+) transceivers . Because of an 104 port restriction, only two of the eight QSFP+ can be channelized. Depending on how you set the system mode for channelization, the behavior of channelization for the QSFP+ changes. The following system modes are available for the ACX5096 router:

- Non-oversubscribed

  All 96 SFP+ ports on the router (PIC 0) are supported. In this mode, the eight QSFP+ ports are not supported and cannot be channelized. There is no packet loss for packets of any size in this mode.

- Default mode

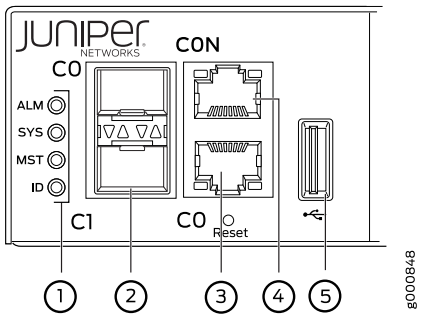
  All 96 SFP+ ports on the router (PIC 0) are supported. QSFP+ ports **96** and **100** can be channelized. If ports **96** and **100** are channelized, the interfaces on ports **97**, **98**, **99**, **101**, **102**, and **103** are disabled.

Chassis Status LEDs on an ACX5000 Router

The ACX5000 routers has four status LEDs on the FRU side of the chassis, next to the management ports (see Figure 11 on page 45).

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Figure 11: Chassis Status LEDs on an ACX5000 Routers



1—Status LEDs	4—RJ-45 console port (**CON**))
2—em1–SFP management Ethernet port (**C1**) Cage (socket for either 10/100/1000 Base-T RJ45 SFP or 1GbE fiber SFP)	5—USB port
3—em0–RJ-45 (10/100/1000 Base-T) management Ethernet port (**C0**)	

Table 8 on page 45 describes the chassis status LEDs on an ACX5000 router, their colors and states, and the status they indicate. You can view the colors of the three LEDs remotely through the CLI by issuing the operational mode command **show chassis lcd**.

Table 8: Chassis Status LEDs on an ACX5000 Router

Name	Color	State	Description
ALM–Alarm or beacon	Unlit	Off	The router is halted or there is no alarm.
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the router has halted. Power off the ACX5000 router by setting the AC power source outlet to the OFF (**O**) position, or unplugging the AC power cords. Correct any voltage or site temperature issues, and allow the router to cool down. Power on the ACX5000 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 ACX5000 router by setting the AC power source outlet to the OFF (**O**) position, or unplugging the AC power cords. Power on the ACX5000 router and monitor the status LEDs to ensure that Junos OS boots properly.
SYS–System	Unlit	Off	The router is powered off or halted.
	Green	On steadily	Junos OS for ACX Series is loaded on the router.

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Table 8: Chassis Status LEDs on an ACX5000 Router (continued)

Name	Color	State	Description
MST–Master	Unlit	Off	The router is a linecard member.
	Green	On steadily	The router is a standalone router.
ID–Identification	Unlit	Off	The beacon feature is not enabled on the router. This feature is enabled using the **request chassis beacon** command.
	Blue	Blinking	The beacon feature is enabled on the router. This feature is enabled using the **request chassis beacon** command.

See Also

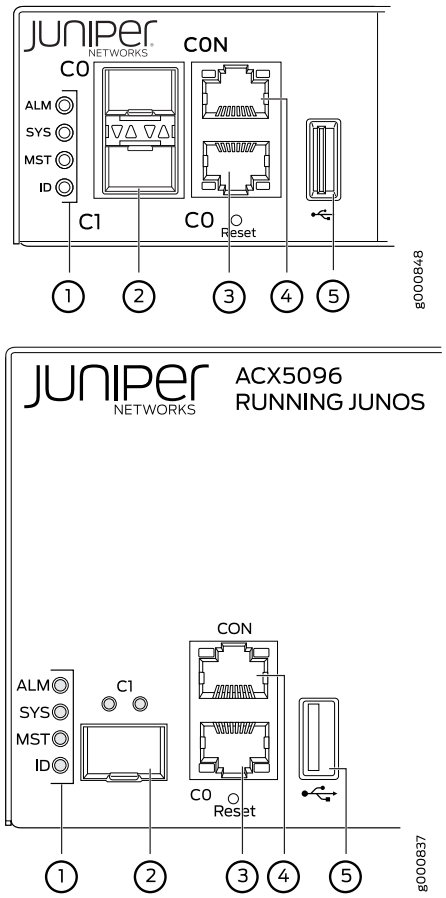
- *show chassis alarms*
- *request chassis beacon*

Management Port LEDs on an ACX5000 Router

The management ports (labeled **C0** for 10/100/1000 Base-T and **C1** for 10/100/1000 Base-T and SFP 1000 Base-X connections) on an ACX5000 router have two LEDs that indicate link status and link activity (see Figure 12 on page 47). The left LED indicates status; the right LED indicates link/activity.

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Figure 12: Management Port LEDs on an ACX5000 Router



1— Status LEDs	4—RJ-45 console port (**CON**))
2—em1–SFP management Ethernet port (**C1**) Cage (socket for either 10/100/1000 Base-T RJ45 SFP or 1GbE fiber SFP)	5—USB port
3—em0–RJ-45 (10/100/1000 Base-T) management Ethernet port (**C0**)	

Table 9 on page 47 describes the management port LEDs.

Table 9: Management Port LEDs on an ACX5000 Router

LED	Color	State	Description
Link/Activity	Unlit	Off	No link is established, there is a fault, or the link is down.
	Green	On steadily	A link is established, but there is no link activity.
		Blinking or flickering	A link is established, and there is link activity.

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Table 9: Management Port LEDs on an ACX5000 Router (continued)

LED	Color	State	Description
Status	Unlit	Off	Either the port speed is 10 M or the link is down.
	Green	On steadily	The port speed is 1000 M.
	Amber	On steadily	The port speed is 100 M.

See Also
- Connecting an ACX5000 Router to a Network for Out-of-Band Management on page 101

Access Port and Uplink Port LEDs on an ACX5000 Router

The Link/Activity and Status LED configuration for ACX5000 routers use bi-colored LEDs. The link LED indicates link activity or a fault. The status LED indicates transceiver presence. See Table 10 on page 49 to locate the position and type of LED for your ACX5000 model.

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Table 10: ACX5000 Access Port and Uplink LED Locations

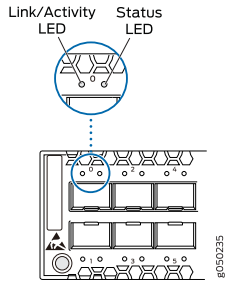
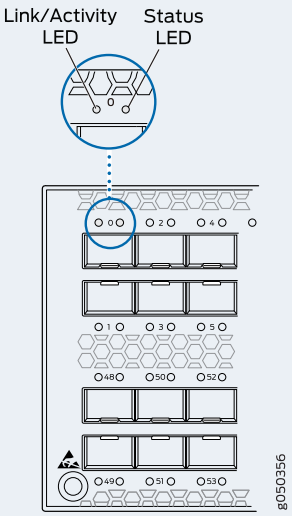
Model	Port Type	Indicators	Location
ACX5048	SFP+	Link Status	
ACX5096	SFP+	Link Status	

Table 11 on page 49 describes how to interpret the SFP+ port LEDs.

Table 11: Network Port LEDs on SFP+ Ports on an ACX5000 Router

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

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Table 11: Network Port LEDs on SFP+ Ports on an ACX5000 Router (continued)

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

As shown in Table 10 on page 49, there are four bi-color LEDs for each QSFP+ port. The first LED is used and the remaining LEDs are not used when the interface is configured for 40-Gigabit Ethernet and connected to a QSFP+ transceiver. All four LEDs are used when the interface is configured for 10-Gigabit Ethernet and the port is connected using an optical split cable or a copper DACBO cable. Table 12 on page 50 describes how to interpret the QSFP+ LEDs.

Table 12: Network Port LEDs on QSFP+ Ports on an ACX5000 Router

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

See Also

- Installing a Transceiver in an ACX5000 Router on page 107
- Connecting a Fiber-Optic Cable to an ACX5000 Router on page 109

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ACX5048 and ACX5096 Cooling System

- Cooling System and Airflow in an ACX5000 Router on page 51
- Fan Module LED on an ACX5000 Router on page 54

Cooling System and Airflow in an ACX5000 Router

The cooling system in ACX5000 routers consists of fan modules and a single fan in each power supply. The number of fan modules vary depending whether the size of the router is 1 U or 2 U high. All routers can be set up to work in the following airflow direction:

- Airflow Out (AFO)—Air comes into the router through the vents in the front panel.

This topic describes:

- Fan Modules on page 51
- Fan Module Status on page 53

Fan Modules

The fan modules in ACX5000 routers are hot-insertable and hot-removable field-replaceable units (FRUs). These fan modules are designed for air to enter from the ports to the FRU–Airflow Out. The fan modules are installed in the fan module slots on the management panel of the router next to the power supplies.

Both the 1 U and 2 U versions of ACX5000 fan modules have a similar design with different dimensions. The 1 U ACX5000 routers have 5 fan modules numbered 0 through 4 from left to right, where the 2 U, ACX5096 has 3 fan modules numbered 0 through 2. On all ACX5000 routers, each fan module slot has a fan icon next to it.

Figure 13 on page 51 shows the 1 U fan module and Figure 14 on page 52 shows the 2 U fan module.

Figure 13: 1 U Fan Module Used in ACX5048

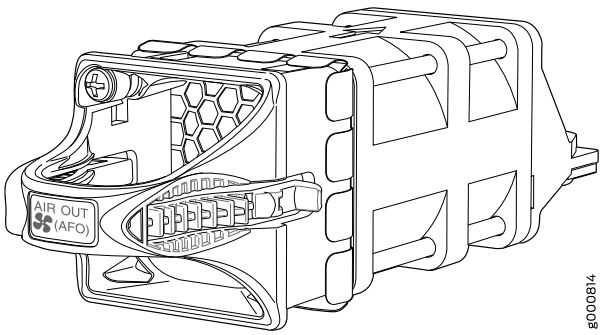
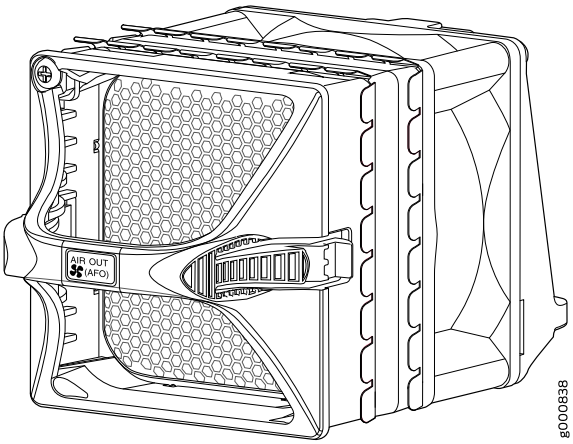


Figure 14: 2 U Fan Module Used in ACX5096



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.**

The fan module airflow direction (port-to-FRU, AFO) is indicated by either a gold color or the label **AIR OUT** . Table 13 on page 52 lists the fan module product SKUs and the direction of airflow in them:

Table 13: Fan Module in ACX5000 Routers

Fan Module	ACX5000 Router Supported	Airflow Diagram	Label on the Fan Module	Color of Fan Module	Direction of Airflow in the Fan Module	Power Supplies
QFX5100-FAN-AFO	ACX5048	Figure 15 on page 53	**AIR OUT**	Juniper Gold	Port-to-FRU, that is, air comes in through vents on the end with ports; air exhausts out the end with the fans (also known as front-to-back airflow).	You must install only power supplies that have **AIR OUT** labels in routers in which the fan modules have **AIR OUT** labels.
QFX5100-96S-FANAFO	ACX5096	Figure 16 on page 53				

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

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Figure 15: Air Out Airflow Through 1 U ACX5048 Chassis

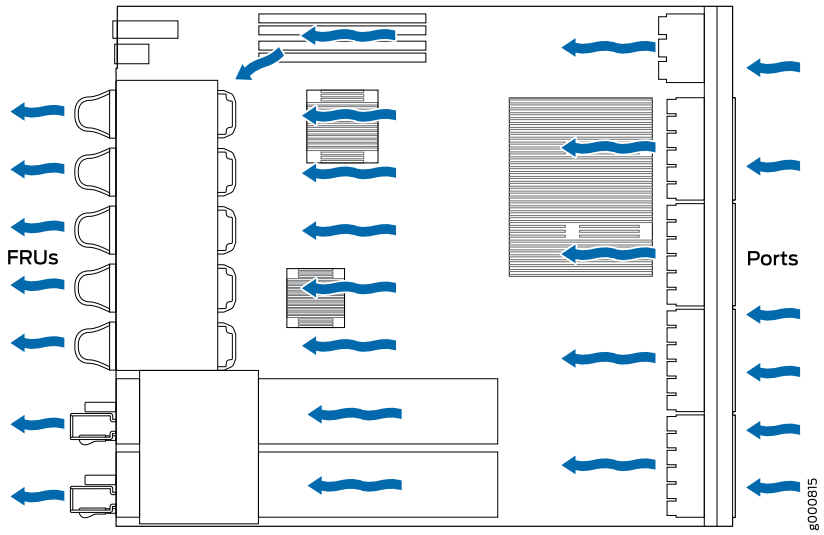
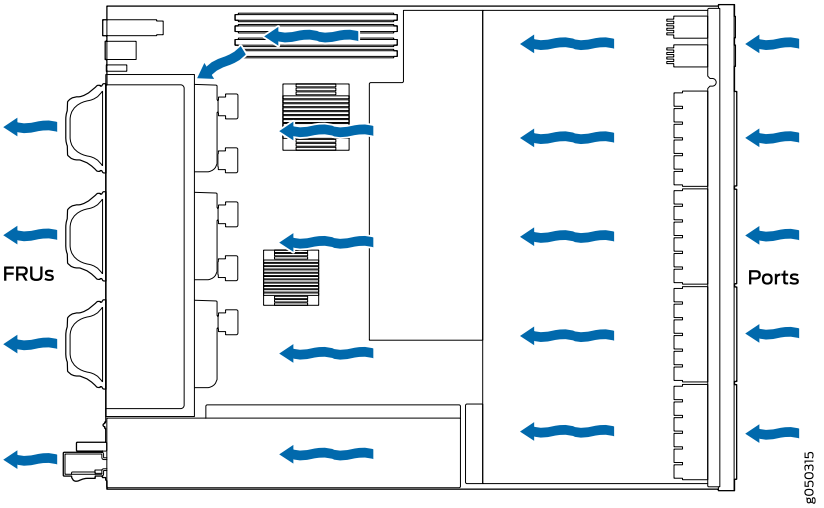


Figure 16: Air Out Airflow Through 2 U ACX5096 Chassis



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.

Each router has a Status LED (labeled **ST**) for each fan module on the left side of the corresponding fan module slot. It indicates the status of all the fan modules. Table 14 on page 54 describes the Status LED on the fan module in an ACX5000 router.

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Table 14: Fan Module LED

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

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

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

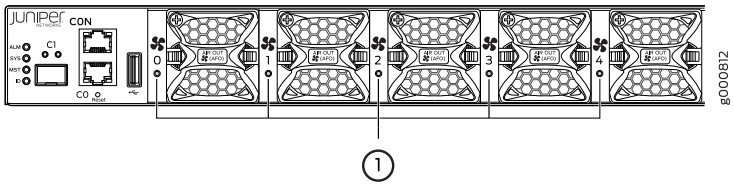
See Also

- Prevention of Electrostatic Discharge Damage on page 155
- Installing a Fan Module in an ACX5000 Router on page 113
- Removing a Fan Module from an ACX5000 Router on page 111

Fan Module LED on an ACX5000 Router

Figure 17 on page 54 shows the location of the LED next to the fan module.

Figure 17: Fan Module LED in an ACX5000 Router



1—Fan LED	

Table 15 on page 55 describes the function of the fan tray LED.

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Table 15: Fan Tray LED in an ACX5000 Router

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

See Also
- Installing a Fan Module in an ACX5000 Router on page 113
- Removing a Fan Module from an ACX5000 Router on page 111

ACX5048 and ACX5096 Power System

- AC Power Supply for an ACX5000 Router on page 55
- AC Power Supply LEDs on an ACX5000 Router on page 57
- DC Power Supply for an ACX5000 Router on page 58
- DC Power Supply LEDs on an ACX5000 Router on page 60
- AC Power Specifications for an ACX5000 Router on page 61
- AC Power Cord Specifications for an ACX5000 Router on page 62
- DC Power Specifications for an ACX5000 Router on page 63

AC Power Supply for an ACX5000 Router

The two power supplies in ACX5000 routers are hot-removable and hot-insertable field-replaceable units (FRUs). The power supplies are installed in the router at the factory. You can install replacement power supplies from the management panel without powering off the router or disrupting the router function.

The AC power supply in 1 U ACX5048 is 650 W; the AC power supply in the 2 U ACX5096, is 850 W. Both power supplies look identical. Be sure to use the correct power supply for your chassis product SKU (see Table 16 on page 57).

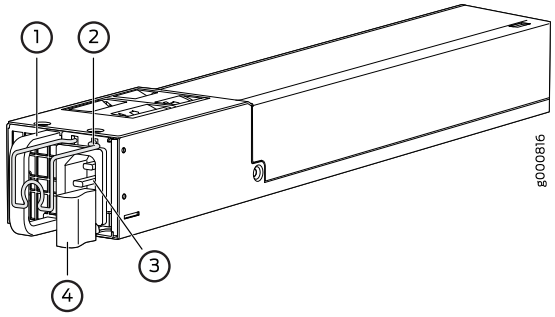


CAUTION: Do not mix power supplies with different wattage. The system raises an alarm when a power supply having a different wattage is inserted into the chassis.

See Figure 18 on page 56 for an example of the 1 U design and Figure 19 on page 56 for an example of the 2 U power supply.

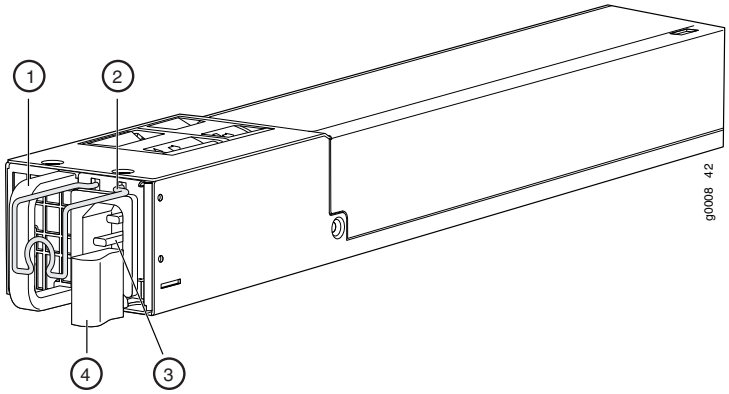
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Figure 18: 1 U AC Power Supply in an ACX5048



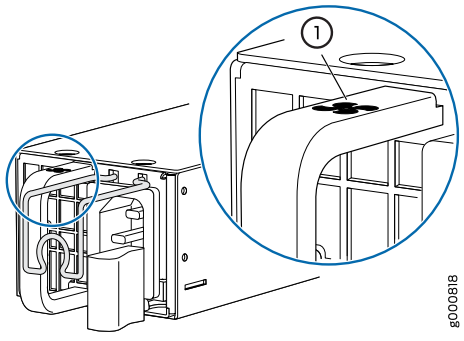
1—Handle	3—AC appliance inlet
2—Security latch	4—Ejector lever

Figure 19: 2 U AC Power Supply in an ACX5096



The power supply provides port-to-FRU airflow depending on the product SKU you purchase. The power supplies either have labels on the handles that indicate the direction of airflow or they have color-coded handles with a fan icon. See Figure 20 on page 56 for an example of the power supply. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Figure 20: Power Supply Handle Detail



1—Fan icon on handle	

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CAUTION: Verify that the airflow direction on the power supply handle matches the direction of airflow in the chassis. Ensure that each power supply you install in the chassis has the same airflow direction.

To avoid electrical injury, carefully follow instructions in "Connecting AC Power to an ACX5000 Router" on page 93.

Table 16 on page 57 shows the different power supplies and their direction of airflow.

Table 16: Airflow Direction in an ACX5000 AC Power Supplies

ACX5000 Product SKUs	Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
ACX5048	650 W	JPSU-650W-AC-AFO	Port-to-FRU	Juniper Gold
ACX5096	850 W	JPSU-850W-AC-AFO		

See Also
- Connecting AC Power to an ACX5000 Router on page 93

AC Power Supply LEDs on an ACX5000 Router

Figure 21 on page 57 shows the location of the LEDs on the power supply.

Figure 21: AC Power Supply LEDs on an ACX5000 Router

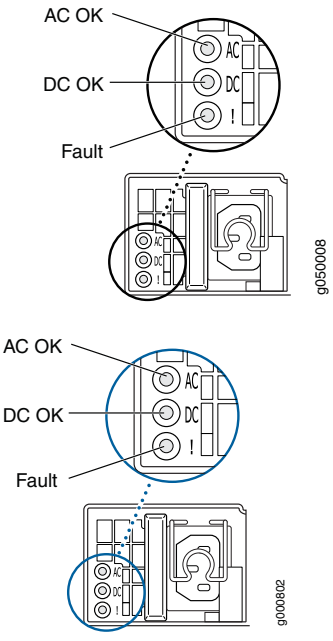


Table 17 on page 58 describes the LEDs on the AC power supplies.

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Table 17: AC Power Supply LEDs on an ACX5000 Router

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

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

See Also
- Connecting AC Power to an ACX5000 Router on page 93

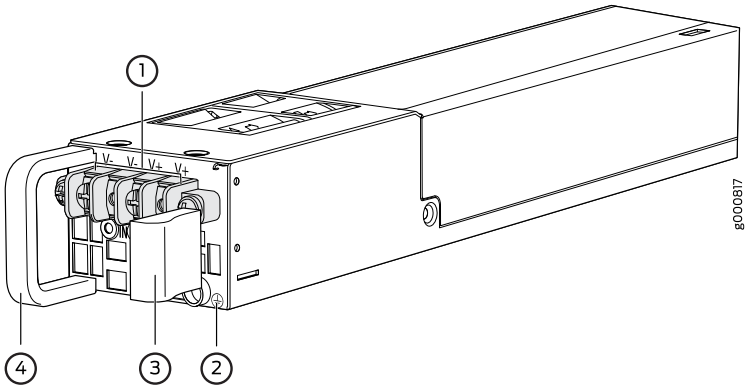
DC Power Supply for an ACX5000 Router

The power supplies in ACX5000 routers (see Figure 22 on page 59) are hot-removable and hot-insertable field-replaceable units (FRUs) that you can install in 1 U DC ACX5048 SKUs of ACX5000 routers without powering off the router or disrupting the routing function.

The DC power supply in 1 U ACX5048 is 650 W with dual feeds for power resiliency. The DC power supply in the 2 U ACX5096 is 850 W with dual feeds for power resiliency. Both power supplies have a similar design and look identical. Be sure to use the correct power supply for your chassis product SKU (see Table 18 on page 60). See Figure 22 on page 59 for an example of the 1 U design and Figure 23 on page 59 for an example of the 2 U power supply.

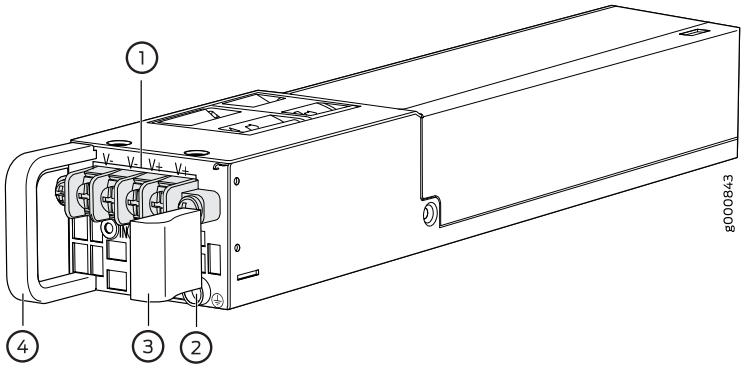
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Figure 22: DC Power Supply in ACX5048 Routers



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

Figure 23: DC Power Supply for an ACX5096

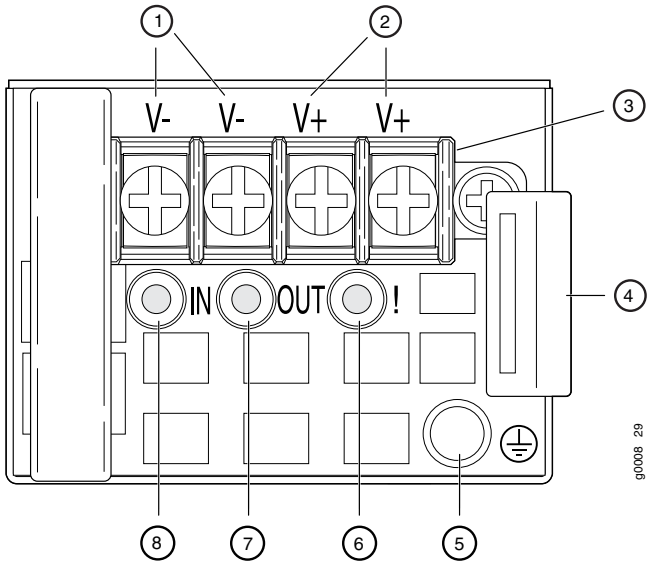


1— Terminal block	3—Ejector lever
2—ESD grounding point	4—Handle

NOTE: The DC power supply in the router has four terminals labeled V–, V–, V+, and V+ (see Figure 24 on page 60) for connecting DC power source cables labeled positive (+) and negative (–). The V+ terminals are shunted internally together, as are the V- terminals.

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Figure 24: DC Power Supply Faceplate in ACX5000 Routers



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

To avoid electrical injury, carefully follow instructions in "Installing a Power Supply in an ACX5000 Router" on page 116 and "Removing a Power Supply from an ACX5000 Router" on page 114.

Table 18 on page 60 shows the different power supplies and their direction of airflow.

Table 18: Airflow Direction in ACX5000 DC Power Supplies

Router Model	Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
ACX5048	650 W	JPSU-650W-DC-AFO	Port-to-FRU	Juniper Gold
ACX5096	850 W	JPSU-850W-DC-AFO		

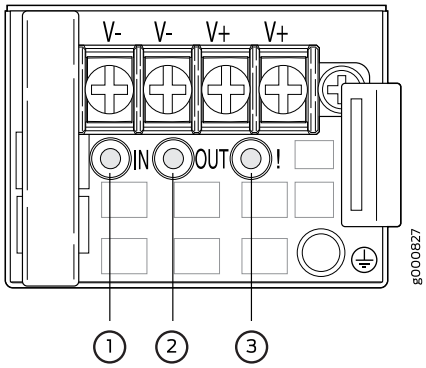
See Also • Connecting DC Power to an ACX5000 Router on page 96

DC Power Supply LEDs on an ACX5000 Router

Figure 25 on page 61 shows the location of the LEDs on the DC power supply.

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Figure 25: DC Power Supply Faceplate on an ACX5000 Router



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

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

Table 19 on page 61 describes the LEDs on the DC power supplies.

Table 19: DC Power Supply LEDs on an ACX5000 Router

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

AC Power Specifications for an ACX5000 Router

Table 20 on page 62 describes the AC power specifications for an ACX5000 router.

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Table 20: AC Power Specifications for an ACX5000 Router

Item	Specification
AC input voltage	Operating range: • 100 / 240 VAC
AC input line frequency	50–60 Hz (all product SKUs)
AC input current rating	• 4.5 A at 100–120 VAC • 2.0 A at 200–240 VAC
Typical power consumption	
ACX5048	230 W
ACX5096	315 W
Maximum power consumption	
ACX5048	365 W
ACX5096	470 W

See Also
- General Safety Guidelines and Warnings on page 132
- General Electrical Safety Guidelines and Warnings on page 154

AC Power Cord Specifications for an ACX5000 Router

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

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

Table 21 on page 63 lists AC power cord specifications provided for each country or region.

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Table 21: AC Power Cord Specifications

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

See Also

- General Safety Guidelines and Warnings on page 132
- General Electrical Safety Guidelines and Warnings on page 154
- Prevention of Electrostatic Discharge Damage on page 155

DC Power Specifications for an ACX5000 Router

Table 22 on page 63 describes the DC power specifications for DC variant of an ACX5000 router.

Table 22: DC Power Specifications for an ACX5000 Router

Item	Router Model	Specifications
DC input voltage	ACX5048	• Rated operating voltage: –48 VDC to -60 VDC • Operating voltage range: –40 VDC through –72 VDC
	ACX5096	• Rated operating voltage: VDC –48 VDC to –60 VDC • Operating voltage range: –40 VDC through –72 VDC

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Table 22: DC Power Specifications for an ACX5000 Router (continued)

Item	Router Model	Specifications
DC input current rating	ACX5048	10 A maximum
	ACX5096	
Typical power consumption	ACX5048	300 W
	ACX5096	315 W
Maximum power consumption	ACX5048	385 W
	ACX5096	470 W

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CHAPTER 2

Site Planning, Preparation, and Specifications

- Site Preparation Checklist for an ACX5000 Router on page 65
- ACX5048 and ACX5096 Site Guidelines and Requirements on page 66
- ACX5048 and ACX5096 Network Cable and Transceiver Planning on page 72
- ACX5048 and ACX5096 Management Cable Specifications and Pinouts on page 79

Site Preparation Checklist for an ACX5000 Router

The checklist in Table 23 on page 65 summarizes the tasks you need to perform when preparing a site for an ACX5000 router installation.

Table 23: Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"ACX5000 Router Environmental Specifications" on page 69		
Power			
Measure the distance between external power sources and router installation site.			
Calculate the power consumption and requirements.	"AC Power Specifications for an ACX5000 Router" on page 61		
Rack or Cabinet			
Verify that your rack or cabinet meets the minimum requirements for the installation of the router.	"Rack Requirements for an ACX5000 Router" on page 71 "Cabinet Requirements for an ACX5000 Router" on page 71		
Plan rack or cabinet location, including required space clearances.	"Clearance Requirements for Airflow and Hardware Maintenance for an ACX5000 Router" on page 67		

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Table 23: Site Preparation Checklist (continued)

Item or Task	For More Information	Performed By	Date
Secure the rack or cabinet to the floor and building structure.			
Cables			
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	"Determining Transceiver Support for the ACX5000" on page 73 "Cable Specifications for QSFP+ and QSFP28 Transceivers" on page 74		
Plan the cable routing and management.			

Related Documentation

- General Safety Guidelines and Warnings on page 132

ACX5048 and ACX5096 Site Guidelines and Requirements

- General Site Guidelines on page 66
- QFX5120 Site Electrical Wiring Guidelines on page 67
- Clearance Requirements for Airflow and Hardware Maintenance for an ACX5000 Router on page 67
- Chassis Physical Specifications for an ACX5000 Router on page 68
- ACX5000 Router Environmental Specifications on page 69
- ACX5000 Chassis Grounding Cable and Lug Specifications on page 70
- Cabinet Requirements for an ACX5000 Router on page 71
- Rack Requirements for an ACX5000 Router on page 71

General Site Guidelines

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

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

- Keep the area around the chassis free from dust and conductive material, such as metal flakes.
- Follow prescribed airflow guidelines to ensure that the cooling system functions properly and that exhaust from other equipment does not blow into the intake vents of the device.

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- 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.

QFX5120 Site Electrical Wiring Guidelines

Table 24 on page 67 describes the factors you must consider while planning the electrical wiring at your site.



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

Table 24: Site Electrical Wiring Guidelines

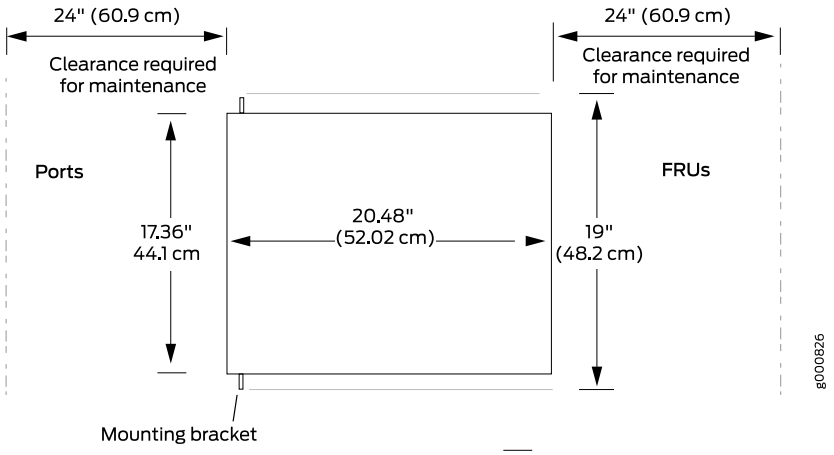
Site Wiring Factor	Guidelines
Signaling limitations	If your site experiences any of the following problems, consult experts in electrical surge suppression and shielding: • Improperly installed wires cause radio frequency interference (RFI). • Damage from lightning strikes occurs when wires exceed recommended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

Clearance Requirements for Airflow and Hardware Maintenance for an ACX5000 Router

When planning the site for installing an ACX5000 router, you must allow sufficient clearance around the installed chassis (see Figure 26 on page 68).

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Figure 26: Clearance Requirements for Airflow and Hardware Maintenance for an ACX5000 Router



- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "Cooling System and Airflow in an ACX5000 Router" on page 51 for more information about the airflow through the chassis.
- If you are mounting an ACX5000 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.
- Leave at least 24 in. (61 cm) both in front of and behind the ACX5000 router. For service personnel to remove and install hardware components, you must leave adequate space at the front and back of the router. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack or cabinet and 24 in. (61 cm) behind the rack or cabinet.

See Also
- Rack-Mounting and Cabinet-Mounting Warnings on page 139

Chassis Physical Specifications for an ACX5000 Router

The ACX5000 router chassis is a rigid sheet-metal structure that houses the hardware components. Table 25 on page 68 summarizes the physical specifications of an ACX5000 router.

Table 25: Physical Specifications for an ACX5000 Router Chassis

Router Model	Height	Width	Depth	Weight
ACX5048	1.72 in. (4.3 cm)	17.36 in. (44.1 cm)	20.48 in. (52 cm)	With FRUs installed: 21.8 lbs (9.8 kg)
ACX5096	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	22.44 in. (57 cm) (not including handles for Fans and PSUs)	With FRUs installed: 32 lbs (14.5 kg)

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See Also

- Mounting an ACX5000 Router in a Rack or Cabinet on page 85
- ACX5048 and ACX5096 Installation Overview on page 83
- Removing an ACX5000 Router from a Rack or Cabinet on page 120

ACX5000 Router Environmental 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 26 on page 69 provides the required environmental conditions for normal router operation.

Table 26: ACX5000 Router Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation to 6,562 feet (2000 meters)
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing • Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing NOTE: As defined in NEBS GR-63-CORE, Issue 3, short-term events can be up to 96 hours in duration but not more than 15 days per year.
Temperature	• Normal operation ensured in temperature range of 32° F through 104° F (0° C through 40° C) • Non-operating storage temperature in shipping container: –40° F through 158° F (–40° C through 70° C)
Seismic	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 3.



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

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See Also
- ACX5048 and ACX5096 Installation Overview on page 83

ACX5000 Chassis Grounding Cable and Lug Specifications

For installations that require a separate grounding conductor to the chassis, the router must be adequately grounded before power is connected to ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements. To ground a ACX5000 router, connect a grounding cable to earth ground and then attach it to the chassis grounding points.



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



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



CAUTION: Before router installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. See "Connecting the ACX5000 Router to Earth Ground" on page 92. A cable with an incorrectly attached lug can damage the router.

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

- A protective earthing terminal bracket is provided in the accessory kit for connecting the router to earth ground. This L-shaped bracket attaches to a post on the ACX5000 router left front mounting bracket, providing a protective earthing terminal for the router. The grounding points are studs sized for M4 hex nuts. The grounding points are spaced at 0.625 in. (15.86 mm). M4 hex nuts with integrated washers are provided in the accessory kit.
- The grounding lug required is a Panduit LCD10-10A-L or equivalent. This grounding lug is provided in the accessory kit. The grounding lug provided accommodates 14–10 AWG (2–5.3 mm^2) stranded wire.
- The grounding cable that you provide for a ACX5000 router must be 14 AWG (2 mm^2), minimum 60° C wire, or as permitted by the local code.

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Cabinet Requirements for an ACX5000 Router

You can mount an ACX5000 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 27 on page 71 provides the cabinet requirements and specifications for an ACX5000 router.

Table 27: Cabinet Requirements for an ACX5000 Router

Cabinet Requirement	Guidelines
Cabinet size and clearance	The minimum cabinet size for accommodating a ACX5000 router is 36 in. (91.4 cm) deep. Large cabinets improve airflow and reduce the chance of overheating.
Cabinet airflow requirements	When you mount the router in a cabinet, ensure that ventilation through the cabinet is sufficient to prevent overheating. • Ensure that the cool air supply you provide through the cabinet adequately dissipates the thermal output of the router (or routers). • Ensure that the cabinet allows the chassis hot exhaust air to exit the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. • The ACX5000 router fans exhaust hot air either through the vents on the port panel or through the fans and power supplies. Install the router in the cabinet in a way that maximizes the open space on the FRU side of the chassis. This maximizes the clearance for critical airflow. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent cabinets allows for the proper clearance around the router and cabinet.

See Also • Mounting an ACX5000 Router in a Rack or Cabinet on page 85

Rack Requirements for an ACX5000 Router

All ACX5000 routers are designed to be installed on four-post racks. The ACX5096 can also be installed on two-post racks.

Rack requirements consist of:

- Rack type
- Mounting bracket hole spacing

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- Rack size and strength

Table 28 on page 72 provides the rack requirements and specifications for an ACX5000 router.

Table 28: Rack Requirements for an ACX5000 Router

Rack Requirement	Guidelines
Rack type (all router models)	Use a four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association.
Rack type (ACX5096 only)	Use a two-post or four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight.
Mounting bracket hole spacing (all router models)	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.
Rack size and strength (all router models)	• Ensure that the rack complies with the standards for a 19-in. or 23-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association. • A 600-mm rack as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (http://www.etsi.org). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the device's mounting brackets, which measure 19 in. (48.26 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required. • Ensure that the rack rails are spaced widely enough to accommodate the router chassis' external dimensions. The outer edges of the front-mounting brackets extend the width to 19 in. (48.26 cm). • For four-post installations, the front and rear rack rails must be spaced between 23.6 in. (60 cm) and 36 in. (91.4 cm) front-to-back. • The rack must be strong enough to support the weight of the router. • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the router and rack.
Rack connection to building structure	• Secure the rack to the building structure. • If earthquakes are a possibility in your geographical area, secure the rack to the floor. • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

See Also • Mounting an ACX5000 Router in a Rack or Cabinet on page 85

ACX5048 and ACX5096 Network Cable and Transceiver Planning

- Determining Transceiver Support for the ACX5000 on page 73
- Cable Specifications for QSFP+ and QSFP28 Transceivers on page 74

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- Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 76
- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 78

Determining Transceiver Support for the ACX5000

All the router models of the ACX5000 router supply quad small form-factor pluggable plus (QSFP+) ports for use as uplinks or as access ports. These 40 GbE ports support QSFP+ transceivers, QSFP+ direct-attach copper (DAC) cables, and DAC breakout cables (DACBO). The ACX5048 has 6 QSFP+ ports; the ACX5096 has 8 QSFP+ ports that can all be used as uplinks.

On all ACX5000 routers, the ports are enabled by default.

Downlink ports are product SKU-specific:

- *ACX5096*—has 96 SFP+ ports that support SFP and SFP+ transceivers, as well as DAC cables.
- *ACX5048*—has 48 SFP+ ports that support SFP and SFP+ transceivers, as well as DAC cables.

You can find information about the pluggable transceivers supported on your Juniper Networks device by using the Hardware Compatibility Tool. In addition to transceiver and connector type, the optical and cable characteristics—where applicable—are documented for each transceiver. The Hardware Compatibility Tool enables you to search by product, displaying all the transceivers supported on that device, or category, by interface speed or type. The list of supported transceivers for the ACX5000 is located at https://pathfinder.juniper.net/hct/product/#prd=ACX5000.

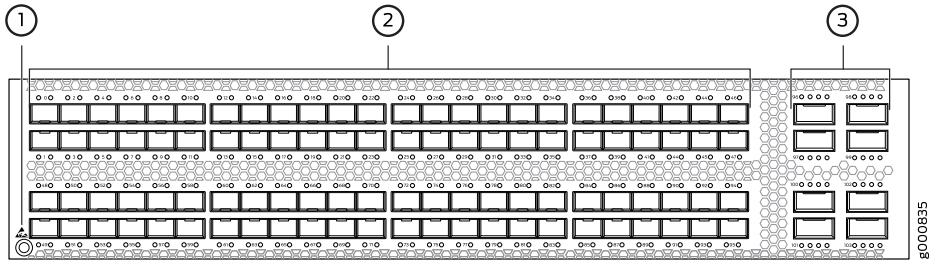


CAUTION: If you face a problem running a Juniper Networks device that uses a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially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

Figure 27 on page 74 shows the location of SFP+ and QSFP+ ports for the ACX5096, Figure 28 on page 74 shows these ports for the ACX5048.

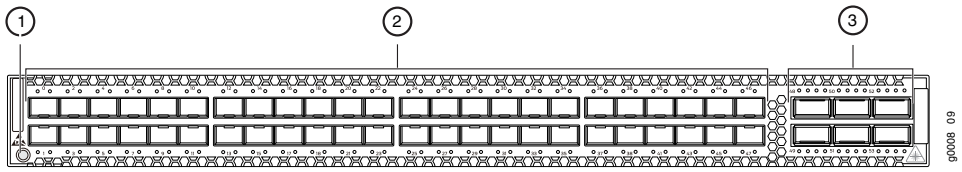
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Figure 27: Port Panel ACX5096



1—Electrostatic discharge (ESD) terminal	3—QSFP+ uplink ports (8)
2—SFP+ access ports (96)	

Figure 28: Port Panel ACX5048



1—Electrostatic discharge (ESD) terminal	3—QSFP+ uplink ports (6)
2—SFP+ access ports (48)	

Cable Specifications for QSFP+ and QSFP28 Transceivers

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

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

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

Table 29 on page 74 describes the signals on each fiber. Table 30 on page 75 shows the pin to pin connections for proper polarity.

Table 29: QSFP+ MPO Cable Signals

Fiber	Signal
1	Tx0 (Transmit)

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Table 29: QSFP+ MPO Cable Signals (continued)

Fiber	Signal
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 30: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts

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

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Table 30: QSFP+ MPO Fiber-Optic Crossover Cable Pinouts (continued)

Pin	Pin
12	1

Calculating Power Budget and Power Margin for Fiber-Optic Cables

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



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

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

1. Calculating Power Budget for Fiber-Optic Cable on page 76
2. Calculating Power Margin for Fiber-Optic Cable on page 76

Calculating Power Budget for Fiber-Optic Cable

To ensure that fiber-optic connections have sufficient power for correct operation, you need to calculate the link's power budget, which is the maximum amount of power it can transmit. When you calculate the power budget, you use a worst-case analysis to provide a margin of error, even though all the parts of an actual system do not operate at the worst-case levels. To calculate the worst-case estimate of power budget (P_B), you assume minimum transmitter power (P_T) and minimum receiver sensitivity (P_R):

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

Calculating Power Margin for Fiber-Optic Cable

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

$$P_M = P_B - LL$$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 31 on page 77 lists an

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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 31: Estimated Values for Factors Causing Link Loss

Link-Loss Factor	Estimated Link-Loss Value
Higher-order mode losses	Single-mode—None Multimode—0.5 dB
Modal and chromatic dispersion	Single-mode—None Multimode—None, if product of bandwidth and distance is less than 500 MHz-km
Connector	0.5 dB
Splice	0.5 dB
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 31 on page 77 to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 7\ dB$

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 31 on page 77 to calculate link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B - LL$

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

$P_M = 13\ dB - 4\ dB - 3.5\ dB$

$P_M = 5.5\ dB$

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

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

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

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 78
- Attenuation and Dispersion in Fiber-Optic Cable on page 78

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

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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.

ACX5048 and ACX5096 Management Cable Specifications and Pinouts

- Cable Specifications for Console and Management Connections for an ACX5000 Router on page 79
- Management Port Connector Pinouts for an ACX5000 Router on page 80
- Console Port Connector Pinouts for an ACX5000 Router on page 80
- USB Port Specifications for an ACX5000 Router on page 81

Cable Specifications for Console and Management Connections for an ACX5000 Router

Table 32 on page 79 lists the specifications for the cables that connect the ACX5000 routers to a management device.



NOTE: The ACX5000 router management port can be configured with a small form-factor pluggable (SFP) transceivers. See the Hardware Compatibility Tool for more information:

https://pathfinder.juniper.net/hct/product/#prd=ACX5000

Table 32: Cable Specifications for Console and Management Connections for the ACX5000 Router

Port on ACX5000 Routers	Cable Specification	Cable Supplied	Maximum Length	Device Receptacle
Console port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter) long RJ-45 patch cable and RJ-45 to DB-9 adapter	7 feet (2.13 meters)	RJ-45
Management port	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter) long RJ-45 patch cable	328 feet (100 meters)	RJ-45

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Management Port Connector Pinouts for an ACX5000 Router

The 1000BASE-T RJ-45 management ports use an RJ-45 connector to connect to a management device for out-of-band management.

Table 33 on page 80 provides the pinout information of the RJ-45 management port connector. An RJ-45 cable is supplied with an ACX5000 router.

Table 33: RJ-45 Management Port Connector Pinouts for an ACX5000 Router

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

See Also

- Management Port LEDs on an ACX5000 Router on page 46

Console Port Connector Pinouts for an ACX5000 Router

The console port (labeled **CON**, **C1**, or **CONSOLE**) is an RS-232 serial interface that uses an RJ-45 connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 34 on page 81 provides the pinout information for the RJ-45 console connector. An RJ-45 cable and RJ-45 to DB-9 adapter are supplied with the ACX5000 router.



NOTE: If your laptop or PC does not have a DB-9 male connector pin and you want to connect your laptop or PC directly to an ACX5000 router, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter supplied with the router and a USB to DB-9 male adapter. You must provide the USB to DB-9 male adapter.

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Table 34: Console Port Connector Pinouts for an ACX5000 Router

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

See Also

- Connecting an ACX5000 Router to a Management Console on page 100

USB Port Specifications for an ACX5000 Router

The following Juniper Networks USB flash drives have been tested and are officially supported for the USB port in the ACX5000 routers:

- RE-USB-1G-S—1-gigabyte (GB) USB flash drive
- RE-USB-2G-S—2-GB USB flash drive
- RE-USB-4G-S—4-GB USB flash drive



CAUTION: Any USB memory product not listed as supported for the ACX5000 routers has not been tested by Juniper Networks. The use of any unsupported USB memory product could expose your device to unpredictable behavior. Juniper Networks Technical Assistance Center (JTAC) can provide only limited support for issues related to unsupported hardware. We strongly recommend that you use only supported USB flash drives.



CAUTION: Remove the USB flash drive before upgrading Junos OS or rebooting a ACX5000 routers. Failure to do so could expose your device to unpredictable behavior.



NOTE: USB flash drives used with the ACX5000 router must support USB 2.0 or later.

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CHAPTER 3

Initial Installation and Configuration

- ACX5048 and ACX5096 Installation Overview on page 83
- Unpacking and Mounting the ACX5048 and ACX5096 Routers on page 84
- Connecting the ACX5048 and ACX5096 to Power on page 91
- Connecting the ACX5048 and ACX5096 to External Devices on page 100
- Initially Configuring the ACX5000 Router on page 102

ACX5048 and ACX5096 Installation Overview

You can mount an ACX5000 router:

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

To install and connect an ACX5000 router:

1. Follow the instructions in "Unpacking an ACX5000 Router" on page 84.

2. Determine how the device is to be mounted.

   Flush or recessed mounted in a rack or cabinet, see "Mounting an ACX5000 Router in a Rack or Cabinet" on page 85.

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3. Follow the instructions in:

   a. Connecting the ACX5000 Router to Earth Ground on page 92

   b. "Connecting AC Power to an ACX5000 Router" on page 93 or "Connecting DC Power to an ACX5000 Router" on page 96 as required

   c. *Registering Products—Mandatory for Validating SLAs*

4. Configure the ACX5000 router. See "Initially Configuring the ACX5000 Router" on page 102.

Related Documentation

- Clearance Requirements for Airflow and Hardware Maintenance for an ACX5000 Router on page 67

Unpacking and Mounting the ACX5048 and ACX5096 Routers

- Unpacking an ACX5000 Router on page 84
- Mounting an ACX5000 Router in a Rack or Cabinet on page 85

Unpacking an ACX5000 Router

The ACX5000 router chassis is a rigid sheet-metal structure that houses the hardware components. An ACX5000 router is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory box and quick start instructions.



CAUTION: **ACX5000 routers are maximally protected inside the shipping carton. Do not unpack the router until you are ready to begin installation.**

To unpack an ACX5000 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 35 on page 85 lists the inventory of components supplied with an ACX5000 router.

5. Pull out the packing material holding the router in place.

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6. Verify the chassis components received:
   - Two power supplies
   - Fan modules:
     - Five fan modules for ACX5048
     - Three fan modules for ACX5096
7. Save the shipping carton and packing materials in case you need to move or ship the router later.

Table 35: Inventory of Components Supplied with an ACX5000 Router

Component	Quantity
Chassis with five fan modules and two power supplies. The ACX5096 has three fan modules.	1
AC power cord (AC-powered ACX5000 routers)	2
Rear mounting blades	2
Front mounting brackets	2
Extension brackets	2
RJ-45 cable and RJ-45 to DB-9 adapter	1
Quick Start installation instructions	1

Mounting an ACX5000 Router in a Rack or Cabinet

You can mount all ACX5000 routers on a four post 19-in. rack or cabinet using the mounting kit provided with the device. The ACX5096 router can also be installed on a two-post rack or cabinet. The mounting kit for the two-post installation is not provided with the router.

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

The mounting kit for the ACX5096 has mounting rails, blades, and brackets for the four-post configuration.

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The front and rear rack rails must be spaced between 28 in. (71.1 cm) and 36 in. (91.4 cm) front to back.

This topic describes:

- Before You Begin Rack Installation on page 86
- Four Post Procedure on page 88
- Two Post Procedure on page 90

Before You Begin Rack Installation

Before you begin mounting a ACX5000 router in the rack or cabinet:

1. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 155.

2. Verify that the site meets the requirements described in "Site Preparation Checklist for an ACX5000 Router" on page 65.

3. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.

4. Read "General Site Guidelines" on page 66, with particular attention to "Chassis and Component Lifting Guidelines" on page 137.

5. Remove the router from the shipping carton. See "Unpacking an ACX5000 Router" on page 84.

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

   NOTE: The ACX5000 routers can be installed on a four-post rack or cabinet. The mounting blades, rails, and the respective screws for the four-post installation comes with the ACX5000 routers.

   The ACX5096 router can also be installed on a two-post rack or cabinet. The mounting brackets and the respective screws for the two-post installation does not come with the ACX5096 router. You need to purchase it separately.

   - ESD grounding strap (not provided).
   - Blades, rails, or brackets (provided).
     - For four-post installations:

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    - 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).
    - Screws to secure the mounting rails to the chassis (provided).
        - Twelve screws for ACX5048
        - Twenty-four screws for ACX5096
    - Eight screws to secure the chassis and rear installation blades to the rack (not provided).
  - For two-post installations (ACX5096 only):
    - One pair of mounting brackets (not provided).
    - Sixteen screens for attaching the brackets to the chassis (not provided).
    - Four screws to secure the mounting brackets and chassis to the post (not provided).
- Appropriate screwdriver for the mounting screws (not provided).
- Two power cords with plugs appropriate to your geographical location (provided).
- RJ-45 cable and RJ-45 to DB-9 serial port adapter (provided).
- Management host, such as a PC laptop, with a serial port (not provided).

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



WARNING: The 1 U ACX5048 must be supported at all four corners. Mounting the chassis using only the front brackets will damage the chassis and can result in serious bodily injury.



CAUTION: All ACX5000 routers require two people for installation, one person to lift the router into place, and another person to attach the router to the rack. If you are installing the ACX5000 routers above 60 in. (152.4 cm) from the floor, you can remove the power supplies and fan modules to minimize the weight before attempting to install the router.



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

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Four Post Procedure

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

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

2. Decide whether the Field Replaceable Unit (FRU) end of the router or the port end is to be placed at the front of the rack. Position the router in such a manner that the **AIR OUT** labels on components are next to the hot aisle.

3. Align the holes in the mounting rail with the holes on the side of the chassis. See Figure 29 on page 88 for the alignment for the ACX5048, and Figure 30 on page 88 for the ACX5096 router.

Figure 29: Attaching Mounting Rails to the ACX5048 Router

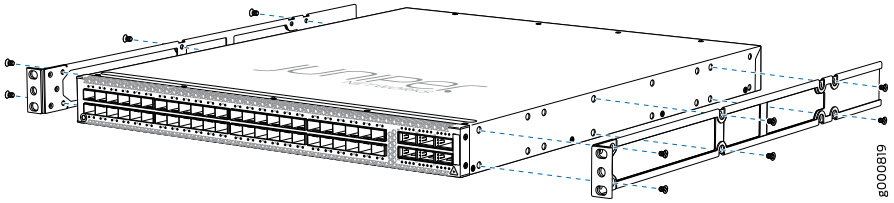
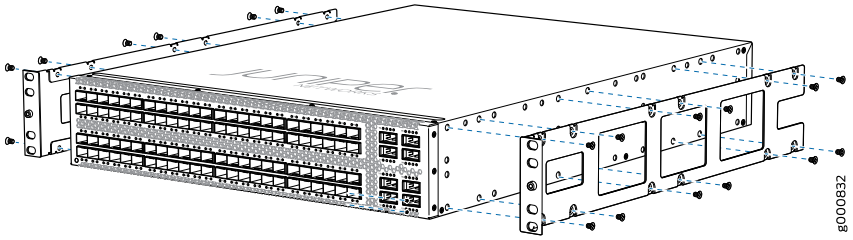


Figure 30: Attaching Mounting Rails to the ACX5096 Router



4. Attach the mounting rail to the router using the mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.

5. Repeats steps 4 and 5 on the opposite side of the router.

6. Have one person grasp both sides of the router, lift it, and position it in the rack so that the front bracket is aligned with the rack holes.

7. Have a second person secure the front of the router to the rack using four mounting screws (and cage nuts and washers if your rack requires them.) Tighten the screws.. See Figure 31 on page 89 and Figure 32 on page 89 for examples of connecting the mounting rails and blades.

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Figure 31: Attach 1 U Router to Rack

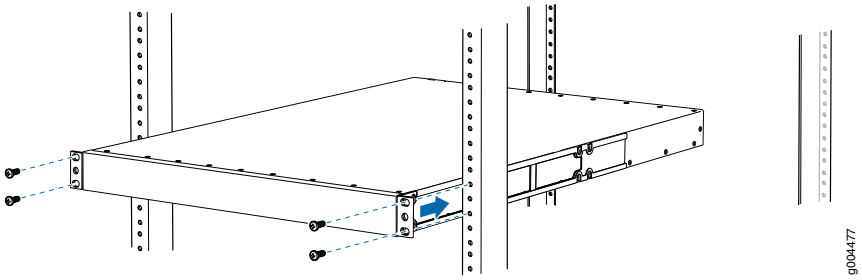
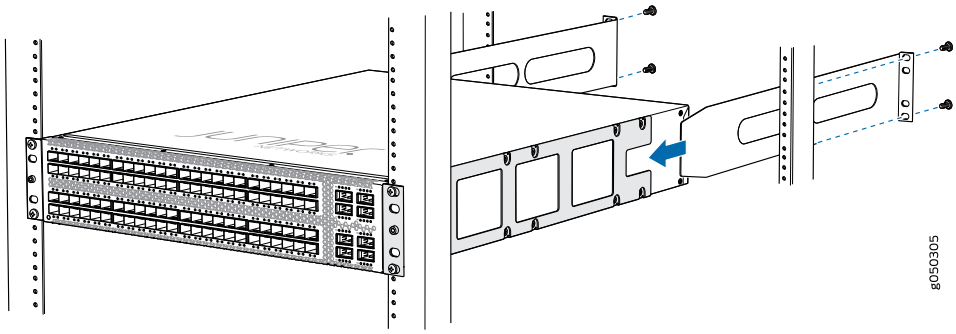
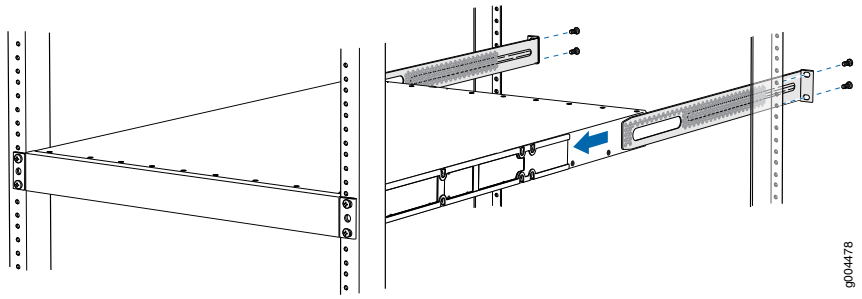


Figure 32: Slide Mounting Rail onto the ACX5096 Rear Mounting Blade



8. Continue to support the router while sliding the rear mounting-blades into the channel of the side mounting-rails and securing the blades to the rack. Use the four mounting screws (and cage nuts and washers if your rack requires them) to attach each blade to the rack. Use eight front-mounting screws for the ACX5096. Tighten the screws. See Figure 33 on page 89.

Figure 33: Slide Mounting Blades into 1 U Mounting Rail



1—Rearmounting-blades	3—Router chassis
2—Side mounting-rails	

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

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Two Post Procedure

You can center mount a ACX5096 on two posts of a 19-in. rack or cabinet by using the short mounting brackets provided with the router. Other product SKUs of the ACX5000 are not recommended for two post installation.

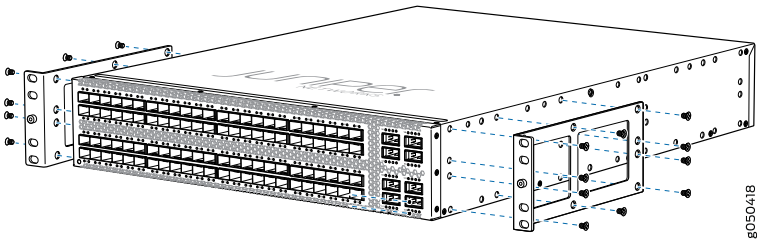
To mount the router on two posts in a rack using the provided mounting kit:

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

2. Decide whether the Field Replaceable Unit (FRU) end of the router or the port end is to be placed at the front of the rack. Position the router in such a manner that the **AIR OUT** labels on components are next to the hot aisle.

3. Align the tenmounting holes on the short mounting bracket with one of the three sets of corresponding holes along the side of the router chassis . See Figure 34 on page 90.

Figure 34: Attaching a Two-Post Mounting Bracket to ACX5096 Router



4. Attach the mounting bracket to the ACX5096 using eight mounting screws (and cage nuts and washers if your rack requires them).

5. Repeat this procedure for the mounting bracket on the opposite side of the router. Tighten all screws.

6. Use two people to attach the brackets to the posts.

   a. Have one person grasp both sides of the router and lift it into place.

   b. Ensure the router is level.

   c. Have the second person use the four mounting screws (and cage nuts and washers if your rack requires them) to screw the mounting bracket to the rack.

7. Attach a ground cable to earth ground and then attach it to the chassis grounding points, as described in "Connecting the ACX5000 Router to Earth Ground" on page 92.

See Also

- Rack-Mounting and Cabinet-Mounting Warnings on page 139

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Connecting the ACX5048 and ACX5096 to Power

- Connecting the ACX5000 Router to Earth Ground on page 92
- Connecting AC Power to an ACX5000 Router on page 93
- Connecting DC Power to an ACX5000 Router on page 96

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Connecting the ACX5000 Router to Earth Ground

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the ACX5000 router to earth ground before you connect it to power.

For installations that require a separate grounding conductor to the chassis, you must attach a protective earthing terminal bracket on the ACX5000 router left front mounting bracket to connect to the earth ground (see Figure 35 on page 93).

Before you connect earth ground to the protective earthing terminal of a ACX5000 router, ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable.



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



NOTE: **Mount your router in the rack or cabinet before attaching the grounding lug to the router. See** "Mounting an ACX5000 Router in a Rack or Cabinet" on page 85.

Ensure that you have the following parts and tools available:

- Protective earthing terminal bracket—This bracket attaches to the router chassis through the left front mounting bracket, providing a protective earthing terminal for the router.
- Grounding cable for your router—The grounding cable must be 14 AWG (2 mm^2), minimum 90° C wire, or as permitted by the local code.
- Grounding lug for your grounding cable—The grounding lug required is a Panduit LCD10-10A-L or equivalent.
- Two M4 hex nuts with integrated washers—Two nuts and washers are used to secure the grounding lug to the grounding lug bracket protective earthing terminal. Four nuts are provided in the accessory kit.
- 7-mm wrench or socket with driver to attach the two nuts.

An AC-powered ACX5000 router chassis gains additional grounding when you plug the power supply in the router into a grounded AC power outlet by using an AC power cord appropriate for your geographical location. See "AC Power Cord Specifications for an ACX5000 Router" on page 62.

To connect earth ground to a ACX5000 router:

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1. Secure the provided protective earthing terminal bracket through the ACX5000 router mounting bracket to the chassis with the nut provided. The posts on the protective earthing terminal bracket should point to the left. See Figure 35 on page 93 and Figure 36 on page 93.

Figure 35: Connecting a Grounding Cable to a 1 U ACX5048

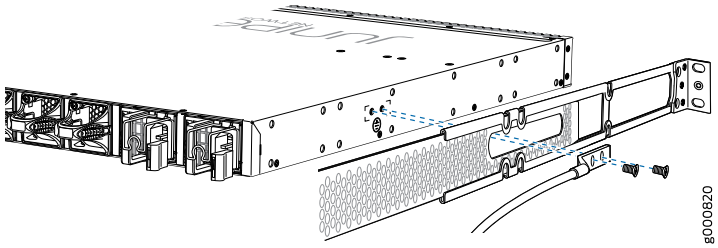
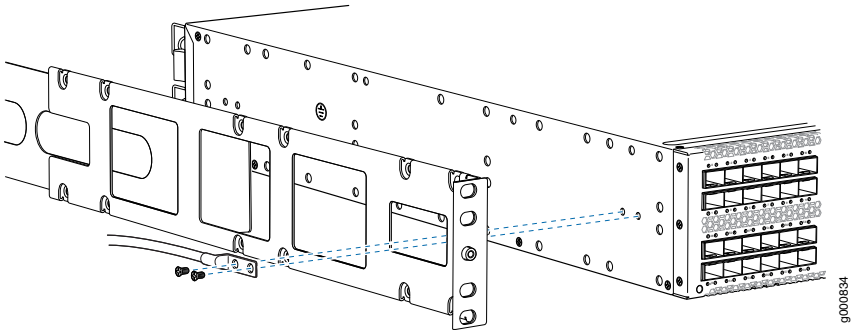


Figure 36: Connecting a Grounding Cable to the 2 U ACX5096



2. Connect one end of the grounding cable to a proper earth ground, such as the rack in which the router is mounted.

3. Place the grounding lug attached to the grounding cable over the protective earthing terminal on the protective earthing terminal bracket.

4. Secure the grounding lug to the protective earthing terminal with two nuts.

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

See Also
- General Safety Guidelines and Warnings on page 132

Connecting AC Power to an ACX5000 Router

The power supply in an ACX5000 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.

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

Before you begin connecting AC power to the router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).
- Ensure that you have connected the router chassis to earth ground.



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

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the router chassis to connect to the earth ground. For instructions on connecting earth ground, see "Connecting the ACX5000 Router to Earth Ground" on page 92. The router gains additional grounding when you plug the power supply in the router into a grounded AC power outlet by using the AC power cord appropriate for your geographical location (see "AC Power Supply for an ACX5000 Router" on page 55).

- Install the power supply in the chassis. For instructions on installing a power supply in a ACX5000 router, see "Installing a Power Supply in an ACX5000 Router" on page 116.



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

To connect AC power to an ACX5000 router:

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

2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure. If only one power supply is installed, ensure a that blank cover panel is installed over the second power supply slot.

3. Locate the power cord or cords shipped with the router; the cords have plugs appropriate for your geographical location. See "AC Power Cord Specifications for an ACX5000 Router" on page 62.



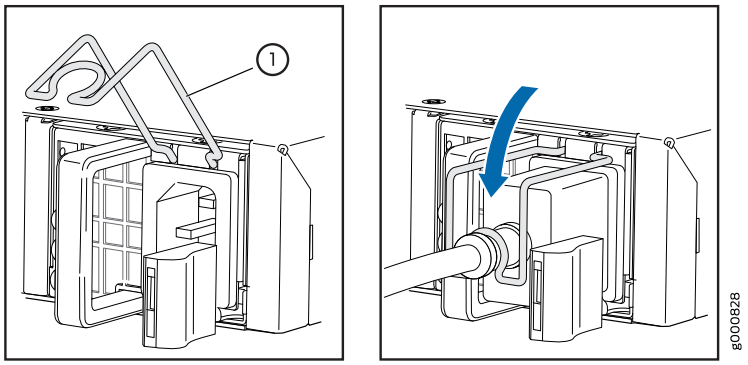
WARNING: Ensure that the power cord does not block access to device components or drape where people can trip on it.

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4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate.

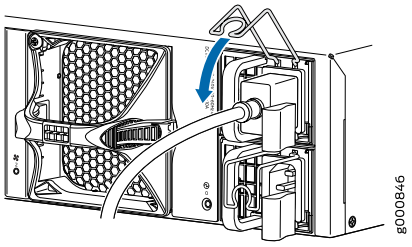
5. Push the power cord retainer onto the power cord (see Figure 37 on page 95 and Figure 38 on page 95).

Figure 37: Connecting an AC Power Cord to an AC Power Supply in a 1 U ACX5048



1— Power cord retainer	

Figure 38: Connecting an AC Power Cord to an AC Power Supply in a 2 U ACX5096



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



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

7. Insert the power cord plug into an AC power source outlet.

8. If the AC power source outlet has a power router, set it to the ON (**|**) position.

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

   If the amber fault LED is lit, remove power from the power supply, and replace the power supply (see "Removing a Power Supply from an ACX5000 Router" on page 114). Do not remove the power supply until you have a replacement power supply ready:

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the power supplies or a blank cover panel must be installed in the router to ensure proper airflow.



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



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 router. To check the current FPGA version, issue the **show chassis firmware** command.

See Also

- AC Power Supply for an ACX5000 Router on page 55
- AC Power Supply LEDs on an ACX5000 Router on page 57

Connecting DC Power to an ACX5000 Router

The power supply in an ACX5000 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 ACX5000 routers are intended for installation only in a restricted access location.



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

Before you begin connecting DC power to the router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).
- 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

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on the router chassis to connect to the earth ground. For instructions on connecting earth ground, see "Connecting the ACX5000 Router to Earth Ground" on page 92.

- Install the power supply in the chassis. For instructions on installing a power supply in a ACX5000 router, see "Installing a Power Supply in an ACX5000 Router" on page 116.

Ensure that you have the following parts and tools available:

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

To connect DC power to an ACX5000 router:

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

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

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

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

   NOTE: The V+ terminals are referred to as +RTN, and V– terminals are referred to as –48 V in "DC Power Wiring Sequence Warning" on page 161 and "ACX5000 DC Power Electrical Safety Guidelines and Warnings" on page 158.

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4. Ensure that the power supplies are fully inserted in the chassis.

5. Remove the terminal block cover. The terminal block cover is a piece of clear plastic that snaps into place over the terminal block (see Figure 39 on page 99).

6. Remove the screws on the terminals using the screwdriver. Save the screws.



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

7. Connect each power supply to the power sources. Secure power source cables to the power supplies by screwing the ring lugs attached to the cables to the appropriate terminals by using the screw from the terminals (see Figure 39 on page 99 and Figure 40 on page 99).

   The ACX5000 is designed to operate with a DC power supply that has a single, non-redundant, feed input. For source redundancy, two DC power supplies must be installed in ACX5000; connect source (A) to one power supply and connect source (B) to the second power supply. This configuration provides the commonly deployed A/B feed redundancy for the system.

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



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

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

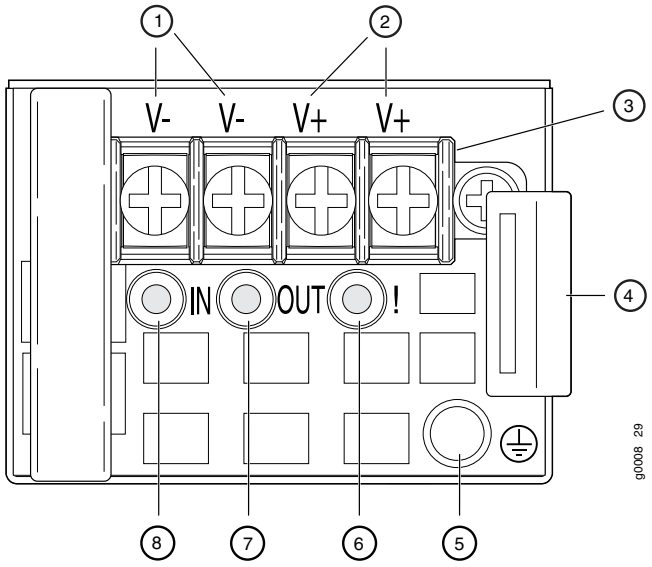
   a. Secure the ring lug of the positive (+) DC power source cable to the V+ terminal on the DC power supply.

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

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

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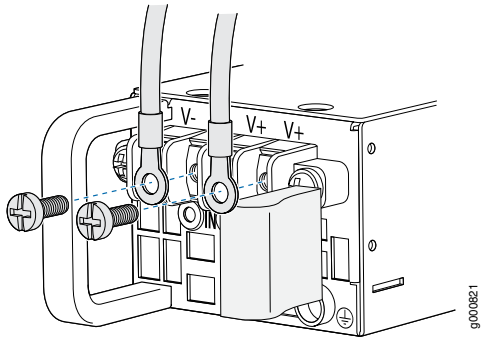
Figure 39: DC Power Supply Faceplate for a ACX5000 Router



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

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

Figure 40: Securing Ring Lugs to the Terminals on the ACX5000 DC Power Supply



8. Replace the terminal block cover.

9. Close the input circuit breaker.

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

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

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

See Also
- DC Power Supply for an ACX5000 Router on page 58
- DC Power Supply LEDs on an ACX5000 Router on page 60

Connecting the ACX5048 and ACX5096 to External Devices

- Connecting an ACX5000 Router to a Management Console on page 100
- Connecting an ACX5000 Router to a Network for Out-of-Band Management on page 101

Connecting an ACX5000 Router to a Management Console

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

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

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

To connect the ACX router to a management console (see Figure 41 on page 101 and Figure 42 on page 101):

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 41 on page 101) or management console (see Figure 42 on page 101).

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Figure 41: Connecting the ACX Router to a Management Console Through a Console Server

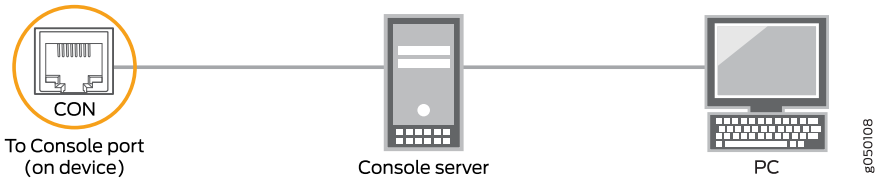


Figure 42: Connecting the ACX Router Directly to a Management Console



See Also

- Console Port Connector Pinouts for an ACX5000 Router on page 80

Connecting an ACX5000 Router to a Network for Out-of-Band Management

You can monitor and manage the ACX5000 router using a dedicated management channel. ACX5000 routers have a minimum of two management ports: a 10/100/1000BASE-T RJ-45 port and a 1-Gbps SFP ports. Some product SKUs have an additional 1-Gbps SFP port that can be used either for fiber or copper connections. Use the management ports to connect the ACX5000 router to a network for out-of-band management.

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

NOTE: You cannot use the management ports to perform the initial configuration of the ACX5000 router. You must configure the management ports before you can successfully connect to the ACX5000 router using these ports. See "Initially Configuring the ACX5000 Router" on page 102.

Ensure that you have an appropriate cable available. See "Cable Specifications for Console and Management Connections for an ACX5000 Router" on page 79.

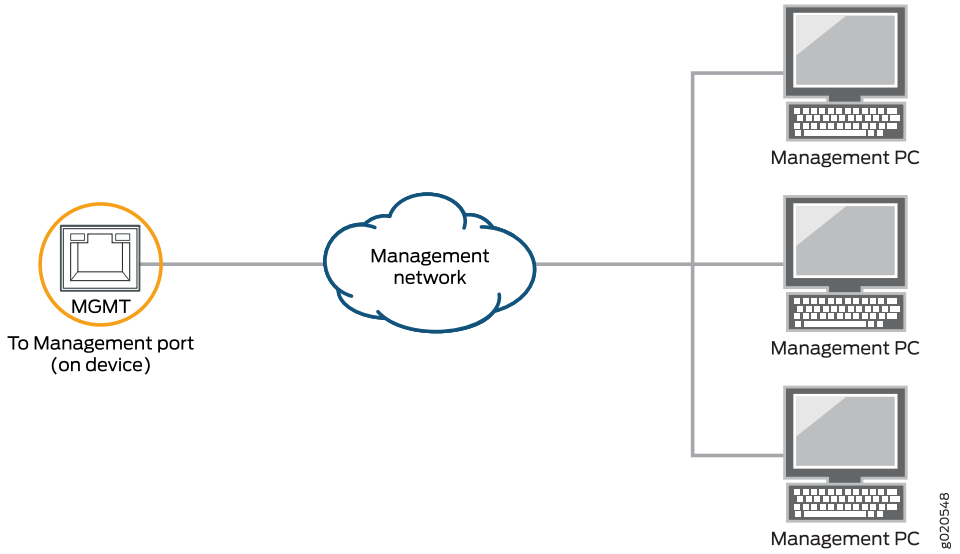
To connect a ACX5000 router to a network for out-of-band management (see Figure 43 on page 102):

1. Connect one end of the cable to one of the management ports (labeled **C0** and **C1**) on the ACX5000 router.

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2. Connect the other end of the cable to the management router (see Figure 43 on page 102).

Figure 43: Connecting a ACX5000 Router to a Network for Out-of-Band Management



See Also

- Management Panel of an ACX5000 Router on page 40
- Management Port Connector Pinouts for an ACX5000 Router on page 80

Initially Configuring the ACX5000 Router

You must perform the initial configuration of the ACX5000 router through the console port using the command-line interface (CLI).

Before you begin connecting and configuring an ACX5000 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

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To connect and configure the router from the console:

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

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

   ```
   login: root
   ```

3. Start the CLI.

   ```
   root@% cli
   ```

4. Enter configuration mode.

   ```
   root> configure
   ```

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

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

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

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

7. Configure the default gateway.

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

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

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



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



NOTE: The management ports, em0 (C0) and em1 (C1) are found on the FRU end of the ACX5000 router.

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

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

10. Enable telnet service.

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



NOTE: When Telnet is enabled, you cannot log in to a ACX5000 router through Telnet using root credentials. Root login is allowed only for SSH access.

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

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

Related Documentation

- ACX5048 and ACX5096 Installation Overview on page 83

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CHAPTER 4

Removing, Installing, and Maintaining Components

- Maintaining ACX5048 and ACX5096 Components on page 105
- Removing an ACX5000 Router from a Rack or Cabinet on page 120

Maintaining ACX5048 and ACX5096 Components

- Removing a Transceiver from an ACX5000 Router on page 105
- Installing a Transceiver in an ACX5000 Router on page 107
- Disconnecting a Fiber-Optic Cable from an ACX5000 Router on page 109
- Connecting a Fiber-Optic Cable to an ACX5000 Router on page 109
- Maintaining Fiber-Optic Cables in an ACX5000 Router on page 110
- Removing a Fan Module from an ACX5000 Router on page 111
- Installing a Fan Module in an ACX5000 Router on page 113
- Removing a Power Supply from an ACX5000 Router on page 114
- Installing a Power Supply in an ACX5000 Router on page 116
- Powering Off an ACX5000 Router on page 118

Removing a Transceiver from an ACX5000 Router

The transceivers for the ACX 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.

Before you begin removing a transceiver from the ACX routers, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for the ACX5000 Router" on page 144).

Ensure that you have the following parts and tools available:

- Antistatic bag or an antistatic mat
- Needle-nose pliers

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- Rubber safety caps to cover the transceiver and fiber-optic cable connector
- Dust cover to cover the port

To remove a transceiver from an ACX5000 router:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.

2. Label the cable connected to the transceiver so that you can reconnect it correctly.



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



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



CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.

3. Remove the cable connected to the transceiver (see "Disconnecting a Fiber-Optic Cable from an ACX5000 Router" on page 109). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.

4. Using your fingers, pull the ejector lever away from the transceiver to unlock the transceiver.



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

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



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

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6. Using your fingers, grasp the body of the transceiver and pull it straight out of the port.

7. Place the transceiver in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

8. Place the dust cover over the empty port.

Installing a Transceiver in an ACX5000 Router

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

Before you begin installing a transceiver in an ACX router, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for the ACX5000 Router" on page 144).

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

To install a transceiver in an ACX5000 router:



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

1. Remove the transceiver from its bag.

2. Check to see whether the transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a rubber safety cap.



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

3. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later.

4. Using both hands, carefully place the transceiver in the empty port. The connectors must face the device 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. See Figure 44 on page 108 through Figure 46 on page 108 for the correct orientation for your router.

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5. Slide the transceiver in gently until it is fully seated. See Figure 44 on page 108 for an example of inserting an SFP transceiver. Figure 45 on page 108, and Figure 46 on page 108 are examples of inserting QSFP+ transceivers into different ACX5000 router product SKU devices.

6. Remove the rubber safety cap when you are ready to connect the cable to the transceiver.



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

Figure 44: Installing an SFP Transceiver

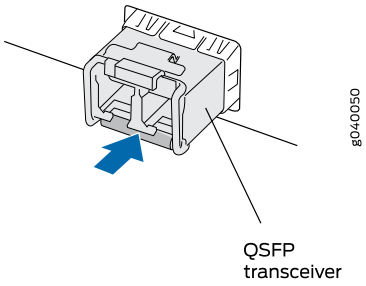


Figure 45: Installing a QSFP+ Transceiver—Vertical Orientation

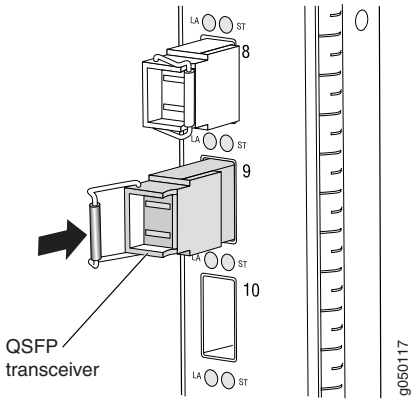
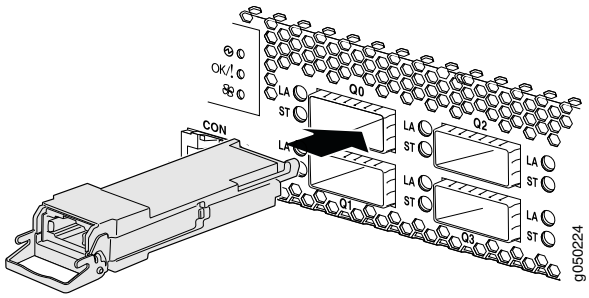


Figure 46: Installing a QSFP+ Transceiver—Horizontal Orientation



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Disconnecting a Fiber-Optic Cable from an ACX5000 Router

The ACX routers has field-replaceable unit (FRU) optical transceivers to which you can connect fiber-optic cables.

Before you disconnect a fiber-optic cable from an optical transceiver installed in an ACX router, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for the ACX5000 Router" on page 144).

Ensure that you have the following parts and tools available:

- Rubber safety cap to cover the transceiver
- Rubber safety cap to cover the fiber-optic cable connector

To disconnect a fiber-optic cable from an optical transceiver installed in an ACX5000 router:

1. (Recommended) Disable the port in which the transceiver is installed by including the **disable** statement at the **[edit interfaces]** hierarchy level for the specific interface.

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

   WARNING: Do not stare into the laser beam or view it directly with optical instruments even if the interface has been disabled.

2. Carefully unplug the fiber-optic cable connector from the transceiver.

3. Cover the transceiver with a rubber safety cap.

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

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

Connecting a Fiber-Optic Cable to an ACX5000 Router

The ACX routers has field-replaceable unit (FRU) optical transceivers to which you can connect fiber-optic cables.

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Before you connect a fiber-optic cable to an optical transceiver installed in an ACX router, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings for the ACX5000 Router" on page 144).

To connect a fiber-optic cable to an optical transceiver installed in an ACX5000 router:



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



WARNING: Do not stare into the laser beam or view it directly with optical instruments even if the interface has been disabled.

1. If the fiber-optic cable connector is covered by a rubber safety cap, remove the cap. Save the cap.
2. If the optical transceiver is covered by a rubber safety cap, remove the cap. Save the cap.
3. Insert the cable connector into the optical transceiver.
4. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on a loop helps cables maintain their shape.



CAUTION: Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.



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

Maintaining Fiber-Optic Cables in an ACX5000 Router

To maintain fiber-optic cables in an ACX5000 router:

- 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 cable to avoid stress on the connectors. When attaching a fiber-optic cable to a transceiver, be sure to secure the fiber-optic cable so that it is not supporting

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its own weight as it hangs to the floor. Never let a fiber-optic cable hang free from the connector.

- Do not bend fiber-optic cables beyond their minimum bend radius. Bending the cables beyond their minimum bend radius can damage the cables and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cables in and out of optical instruments can damage the instruments, which are expensive to repair. Attach a short fiber extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, which is easier and less expensive to replace than the instruments.
- Keep fiber-optic cable connections clean. Microdeposits of oil and dust in the canal of the transceiver or cable connector can cause loss of light, reduction in signal power, and possibly intermittent problems with the optical connection.

  To clean the transceiver canal, use an appropriate fiber-cleaning device such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the directions in the cleaning kit you use.

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

Removing a Fan Module from an ACX5000 Router

The fan modules in ACX5000 routers are hot-removable and hot-insertable field replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.



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

Before you remove a fan module from a ACX5000 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).

Ensure that you have the following parts and tools available to remove a fan module from a ACX5000 router:

- ESD grounding strap
- Antistatic bag or an antistatic mat

To remove a fan module from an ACX5000 router (see Figure 47 on page 112 and Figure 48 on page 112):

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1. Place the antistatic bag or the antistatic mat on a flat, stable surface.

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

3. Using a Phillips screwdriver, loosen the locking screw (3 or 4 turns).

4. Grasp the handle on the fan module and squeeze the outside of the handle to release the module.

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

5. Pull firmly to slide the fan module halfway out of the chassis.

6. When the fan stop spinning, slide the fan module completely out of the chassis.

7. Place the fan module in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

Figure 47: Removing a Fan Module from a 1 U ACX5048

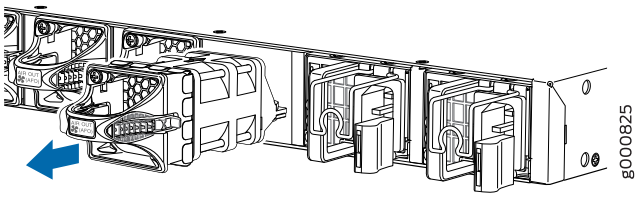
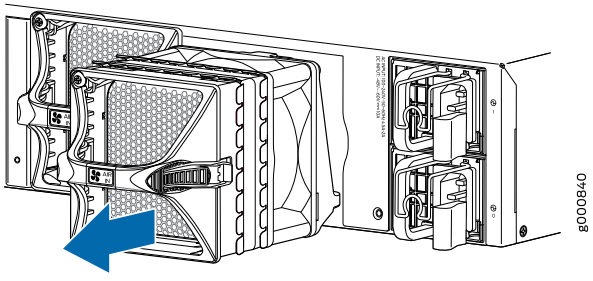


Figure 48: Removing a Fan Module from a 2 U ACX5096



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

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See Also

- Cooling System and Airflow in an ACX5000 Router on page 51
- Field-Replaceable Units in an ACX5000 Router on page 20
- Management Panel of an ACX5000 Router on page 40

Installing a Fan Module in an ACX5000 Router

The fan modules in an ACX5000 router are hot-removable and hot-insertable field replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.



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



NOTE: The fan module provides port-to-FRU airflow (AFO).

Before you install a fan module in a ACX5000 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).

To install a fan module in an ACX5000 router (see Figure 49 on page 114 and Figure 50 on page 114):

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

   CAUTION: Damage can occur if you attempt to install a fan module into a chassis with a different airflow direction. Compare the router product SKU with the airflow marking on the handle to ensure that you are installing a fan module with the same airflow direction as the chassis. The fan modules are designed so that they can only be inserted into the ACX5000 product SKU that supports the same airflow type. See "Cooling System and Airflow in an ACX5000 Router" on page 51 for more information.
4. Using a Phillips screwdriver, turn the locking screw until it is tight.

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Figure 49: Installing a Fan Module in a 1 U ACX5048

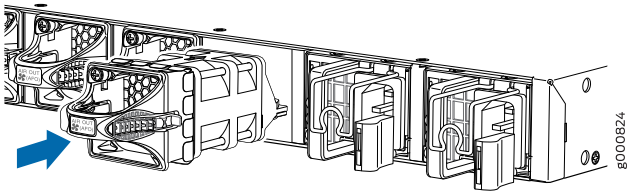
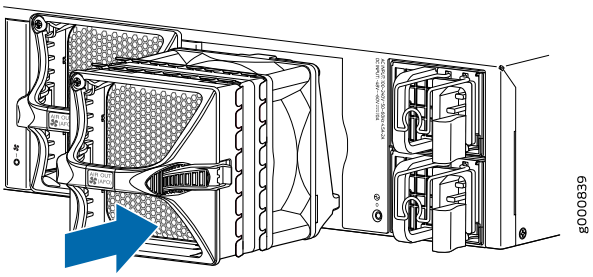


Figure 50: Installing a Fan Module in a 2 U ACX5096



See Also

- Cooling System and Airflow in an ACX5000 Router on page 51
- Field-Replaceable Units in an ACX5000 Router on page 20
- Management Panel of an ACX5000 Router on page 40

Removing a Power Supply from an ACX5000 Router

The power supplies in an ACX5000 router are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.

Before you remove a power supply from a ACX5000 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).

Ensure that you have the following parts and tools available to remove a power supply from a ACX5000 router:

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

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

To remove a power supply from an ACX5000 router (see Figure 51 on page 116 and Figure 52 on page 116):

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1. Place the antistatic bag or the antistatic mat on a flat, stable surface.

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

   NOTE: If only one power supply is installed in your ACX5000 router, you need to power off the router before removing the power supply. See "Powering Off an ACX5000 Router" on page 118.

3. Disconnect power to the router:

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

4. Remove the power source cable from the power supply faceplate:

   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the female end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.

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

6. Grasp the power supply handle and pull firmly to slide the power supply halfway out of the chassis.

7. Place one hand under the power supply to support it and slide it completely out of the chassis. Take care not to touch power supply components, pins, leads, or solder connections.

8. Place the power supply in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

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Figure 51: Removing Power Supply from an ACX5048

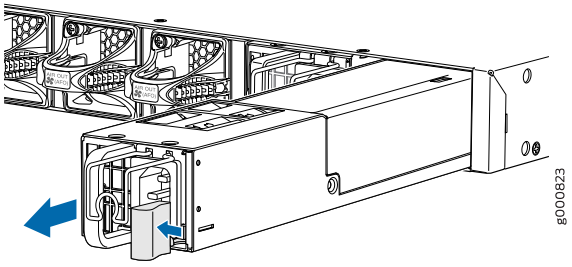
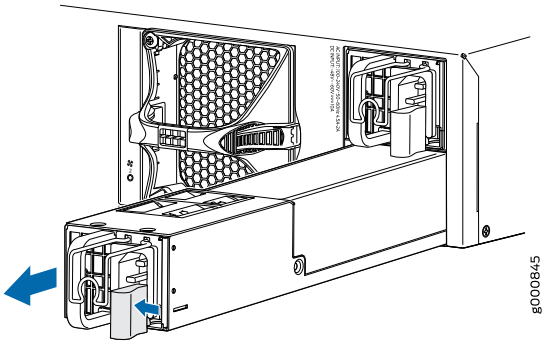


Figure 52: Removing Power Supply from an ACX5096



See Also

- AC Power Supply for an ACX5000 Router on page 55
- DC Power Supply for an ACX5000 Router on page 58

Installing a Power Supply in an ACX5000 Router

The power supplies in an ACX5000 router are hot-removable and hot-insertable field-replaceable units (FRUs): you can remove and replace them without powering off the router or disrupting routing functions.

- Before you install a power supply in a ACX5000 router, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 155).
- Ensure that the airflow direction of the power supply is the same as the chassis. Labels on the power supply handle indicate the direction of airflow. See "Cooling System and Airflow in an ACX5000 Router" on page 51 for more information.

To install a power supply in an ACX5000 router (see Figure 53 on page 117 and Figure 54 on page 117):

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

2. Taking care not to touch power supply components, pins, leads, or solder connections, remove the power supply from its bag.

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

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

Figure 53: Installing Power Supply in an ACX5048

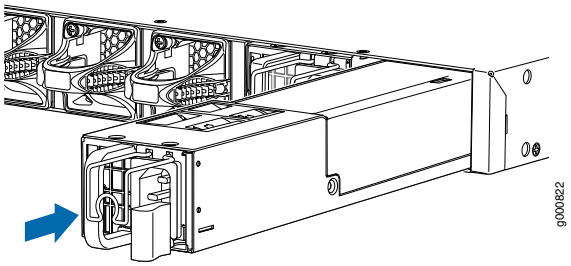
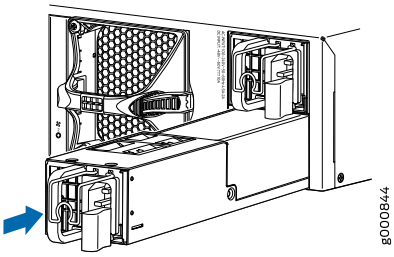


Figure 54: Installing Power Supply in an ACX5096



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

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

See Also

- AC Power Supply for an ACX5000 Router on page 55
- DC Power Supply for an ACX5000 Router on page 58

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Powering Off an ACX5000 Router

Before you power off an ACX5000 router:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 155.
- Ensure that you do not need to forward traffic through the router.

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

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

To power off an ACX5000 router:

1. Connect to the router using one of the following methods:
   - Connect a management device to the console (**CON**) port on an ACX5000 router. For instructions about connecting a management device to the console (**CON**) port, see "Connecting an ACX5000 Router to a Management Console" on page 100.
   - You can shut down the ACX5000 router from a management device on your out-of-band management network. For instructions about connecting a management device to the management (**CO** or **C1**) port, see "Connecting an ACX5000 Router to a Network for Out-of-Band Management" on page 101.
2. Shut down Junos OS from the external management device by issuing the **request system halt** operational mode CLI command. This command shuts down the 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:

```
request system halt
warning: This command will halt all the members.
If planning to halt only one member use the member option
Halt the system ? [yes,no] (no) yes
Shutdown at Thu Jul 30 21:20:07 2015.
[pid 2434]

{master:0}

*** System shutdown message from root@acx5k11-ac ***

System going down in 1 minute


root@>
*** System shutdown message from root@acx5k11-ac ***
```


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```
System going down in 30 seconds



*** FINAL System shutdown message from root@acx5k11-ac ***

System going down IMMEDIATELY



Terminated
.
Hangup
Jul 30 21:20:23 init: event-processing (PID 1030) exited with status=0 Normal
 Exit
Waiting (max 60 seconds) for system process `vnlru' to stop...done
Waiting (max 60 seconds) for system process `vnlru_mem' to stop...done
Waiting (max 60 seconds) for system process `bufdaemon' to stop...done
Waiting (max 60 seconds) for system process `syncer' to stop...
Syncing disks, vnodes remaining...3 3 0 0 0 done

syncing disks... All buffers synced.
Uptime: 10h20m10s
recorded reboot as normal shutdown
unloading fpga driver
Shutting down ACPI
Rebooting...
Stopping crond: [  OK  ]

Running guests on default URI: no running guests.
Stopping libvirtd daemon: [  OK  ]
Shutting down ntpd: [  OK  ]
Shutting down system logger: [  OK  ]
Shutting down sntpc: [  OK  ]
Stopping sshd: [  OK  ]
Stopping vehostd: [  OK  ]
Stopping watchdog: [  OK  ]
Stopping xinetd: [  OK  ]
Sending all processes the TERM signal... [  OK  ]
Sending all processes the KILL signal... [  OK  ]
Saving random seed:  [  OK  ]
Syncing hardware clock to system time [  OK  ]
Unmounting file systems:  [  OK  ]
init: Re-executiRE-FPGA-DRV: reboot notifier called with 0x0003
ng /sbin/init
tmc-fpga: TMC FPGA driver shutdown called.
Halting system...
Power down.
```



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

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

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

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

5. Remove the power source cable from the power supply faceplate:

   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the female end of the power cord connected to the power supply faceplate.
   - DC power supply—Remove the screws securing the ring lugs attached to the power source cables to the power supply using the screwdriver, and remove the power source cables from the power supply. Replace the screws on the terminals and tighten them.

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

See Also

- Connecting AC Power to an ACX5000 Router on page 93
- Connecting DC Power to an ACX5000 Router on page 96

Removing an ACX5000 Router from a Rack or Cabinet

If you need to relocate an installed ACX5000 router, use the procedure described in this topic.



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

Before removing an ACX5000 router from a rack:

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed ACX5000 router in its new location and along the path to the new location.
- Read "General Safety Guidelines and Warnings" on page 132.
- Use the appropriate power off sequence to safely powered off the device. See "Powering Off an ACX5000 Router" on page 118.
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the ACX5000 router ports.

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Ensure that you have the following parts and tools available:

- A Phillips (+) screwdriver, number 2 or number 3, depending on the size of your rack mounting screws, for mounting the ACX5000 router on the rack.

To remove an ACX5000 router from a rack or cabinet:

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

Related Documentation

- Mounting an ACX5000 Router in a Rack or Cabinet on page 85

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CHAPTER 5

Troubleshooting Hardware

- Troubleshooting ACX5048 and ACX5096 on page 123

Troubleshooting ACX5048 and ACX5096

- Understanding the ACX5000 Router Alarms on page 123
- ACX5000 Router Interface Alarm Messages on page 124

Understanding the ACX5000 Router Alarms

The ACX5000 router support different alarm types and severity levels. Table 36 on page 123 provides a list of alarm terms and definitions that may help you in monitoring the device.

Table 36: Alarm Terms and Definitions

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

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

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Table 36: Alarm Terms and Definitions (continued)

Term	Definition
Alarm types	Alarms include the following types: • Chassis alarm—Predefined alarm triggered by a physical condition on the device such as a power supply failure or excessive component temperature. • Interface alarm—Alarm you configure to alert you when an interface link is down. Applies to **ethernet**, **fibre-channel**, and **management-ethernet** interfaces. You can configure a red (major) or yellow (minor) alarm for the link-down condition, or have the condition ignored. • System alarm—Predefined alarm that might be triggered by a missing rescue configuration, failure to install a license for a licensed software feature, or high disk usage.

See Also
- *Interface Alarm Messages*
- *show chassis alarms*
- *show system alarms*

ACX5000 Router Interface Alarm Messages

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

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

NOTE: When red alarms or major alarms are issued on an ACX5000 router, the alarm LED glows amber instead of red.

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CHAPTER 6

Contacting Customer Support

- Contacting Customer Support and Returning the Chassis or Components on page 125

Contacting Customer Support and Returning the Chassis or Components

- Contacting Customer Support on page 125
- Returning an ACX5000 Router or Component for Repair or Replacement on page 126
- Locating the Serial Number on an ACX5000 Router or Component on page 126
- Packing an ACX5000 Router or Component for Shipping on page 129

Contacting Customer Support

You can contact Juniper Networks Technical Assistance Center (JTAC) 24 hours a day, 7 days a week in one of the following ways:

- On the Web, using the Service Request Manager link at:

  https://support.juniper.net/support/

- By telephone:
  - From the US and Canada: 1-888-314-JTAC
  - From all other locations: 1-408-745-9500



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

When requesting support from JTAC by telephone, be prepared to provide the following information:

- Your existing service request number, if you have one
- Details of the failure or problem
- Type of activity being performed on the device when the problem occurred

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- Configuration data displayed by one or more **show** commands
- Your name, organization name, telephone number, fax number, and shipping address

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

Returning an ACX5000 Router or Component for Repair or Replacement

If you need to return an ACX5000 router or component to Juniper Networks for repair or replacement, follow this procedure:

1. Determine the serial number of the component. For instructions, see "Locating the Serial Number on an ACX5000 Router or Component" on page 126.

2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) contacting the Juniper Customer Care, as described in "Contacting Customer Support" on page 125.

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

3. Pack the router or component for shipping as described in "Packing an ACX5000 Router or Component for Shipping" on page 129.

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

See Also
- ACX5000 Universal Metro Router Overview on page 17

Locating the Serial Number on an ACX5000 Router or Component

If you are returning a router or component to Juniper Networks for repair or replacement, you must locate the serial number of the router or component. You must provide the serial number to the Juniper Networks Technical Assistance Center (JTAC) when you contact them to obtain a Return Materials Authorization (RMA). See "Contacting Customer Support" on page 125.

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.

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

- Listing the Chassis and Component Details Using the CLI on page 127
- Locating the Chassis Serial Number ID Label on an ACX5000 Router on page 128
- Locating the Serial Number ID Labels on FRU Components on page 128

Listing the Chassis and Component Details Using the CLI

To list the ACX5000 router and components and their serial numbers, use the **show chassis hardware** CLI operational mode command.

```
user@device> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                VF3714190019      ACX5048
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           ACX5K Routing Engine
FPC 0            REV 05   650-056267   VF3714190019      ACX5048
  CPU                     BUILTIN      BUILTIN           FPC CPU
  PIC 0                   BUILTIN      BUILTIN           48x10G-6x40G
    Xcvr 0       REV 01   740-011613   PD63CUT           SFP-SX
    Xcvr 9       REV 01   740-021308   ARS17R5           SFP+-10G-SR
    Xcvr 12      REV 01   740-011782   P92080R           SFP-SX
    Xcvr 14      REV 01   740-031851   AM1229SY9ZX       SFP-SX
    Xcvr 20      REV 01   740-031851   PN340SM           SFP-SX
    Xcvr 24      REV 02   740-011613   PJ215BU           SFP-SX
    Xcvr 29      REV 01   740-013111   7161618           SFP-T
    Xcvr 32      REV 01   740-021308   ARS1778           SFP+-10G-SR
    Xcvr 34      REV 01   740-021308   ARR3RM2           SFP+-10G-SR
    Xcvr 37      REV 01   740-021308   ARS1769           SFP+-10G-SR
    Xcvr 39      REV 01   740-021308   ARR3WHU           SFP+-10G-SR
    Xcvr 40      REV 02   740-011613   PJ216BK           SFP-SX
    Xcvr 41      REV 01   740-031851   PM734F3           SFP-SX
    Xcvr 46      REV 01   740-021308   ARR41L8           SFP+-10G-SR
    Xcvr 47      REV 02   740-011613   AM0943SEMZ5       SFP-SX
    Xcvr 48      REV 01   740-032986   QD417082          QSFP+-40G-SR4
    Xcvr 49      REV 01   740-032986   QD416522          QSFP+-40G-SR4
    Xcvr 52      REV 01   740-032986   QE120433          QSFP+-40G-SR4
Power Supply 0   REV 03   740-043886   1GA44090680       JPSU-650W-DC-AFO
Power Supply 1   REV 03   740-043886   1GA44090685       JPSU-650W-DC-AFO
Fan Tray 0                                              ACX5K Fan Tray 0, Front
 to Back Airflow - AFO
Fan Tray 1                                              ACX5K Fan Tray 1, Front
 to Back Airflow - AFO
Fan Tray 2                                              ACX5K Fan Tray 2, Front
 to Back Airflow - AFO
Fan Tray 3                                              ACX5K Fan Tray 3, Front
 to Back Airflow - AFO
Fan Tray 4                                              ACX5K Fan Tray 4, Front
 to Back Airflow - AFO
```

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

Locating the Chassis Serial Number ID Label on an ACX5000 Router

The location for the chassis serial number ID label is product SKU-dependent. On the ACX5000 router product SKUs, the serial number ID label is located on the left side of the port panel. See Figure 55 on page 128 and Figure 56 on page 128 for examples of where to find the serial number ID.

Figure 55: Location of the Serial Number ID Label on a ACX5096

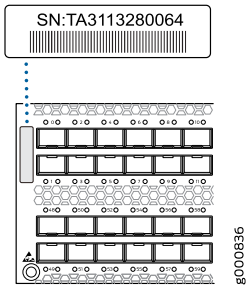
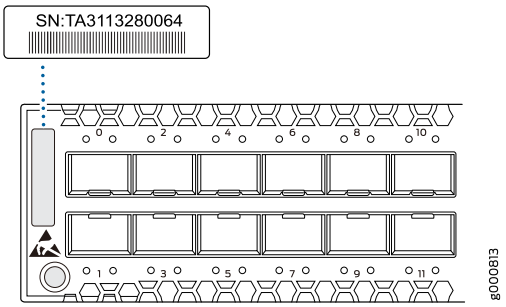


Figure 56: Location of the Serial Number ID Label on a ACX5048



Locating the Serial Number ID Labels on FRU Components

The power supplies, fan module, and expansion modules installed in ACX5000 routers are field-replaceable units (FRUs). For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

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

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Packing an ACX5000 Router or Component for Shipping

If you are returning an ACX5000 router or component to Juniper Networks for repair or replacement, pack the item as described in this topic.

Before you pack a ACX5000 router or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 155.
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials. See "Contacting Customer Support" on page 125.

Ensure that you have the following parts and tools available:

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

This topic describes:

- Packing an ACX5000 Router for Shipping on page 129
- Packing an ACX5000 Router Components for Shipping on page 130

Packing an ACX5000 Router for Shipping

To pack a ACX5000 router for shipping:

1. Power down the router and remove the power cables. See "Powering Off an ACX5000 Router" on page 118.
2. Remove the cables that connect the ACX5000 router to all external devices.
3. Remove all field-replaceable units (FRUs) from the router.
4. Have one person support the weight of the router while another person unscrews and removes the mounting screws.
5. Remove the router from the rack or cabinet (see "Chassis and Component Lifting Guidelines" on page 137) and place the router in an antistatic bag.
6. Place the router in the shipping carton.
7. Place the packing foam on top of and around the router.

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8. If you are returning accessories or FRUs with the router, pack them as instructed in "Packing an ACX5000 Router Components for Shipping" on page 130.

9. Replace the accessory box on top of the packing foam.

10. Close the top of the cardboard shipping box and seal it with packing tape.

11. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing an ACX5000 Router Components for Shipping



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

To pack and ship ACX5000 router components:

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

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CHAPTER 7

Safety and Compliance Information

- General Safety Guidelines and Warnings on page 132
- Definitions of Safety Warning Levels on page 133
- Qualified Personnel Warning on page 134
- Warning Statement for Norway and Sweden on page 135
- Fire Safety Requirements on page 135
- Installation Instructions Warning on page 136
- Chassis and Component Lifting Guidelines on page 137
- Restricted Access Warning on page 137
- Ramp Warning on page 138
- Rack-Mounting and Cabinet-Mounting Warnings on page 139
- Grounded Equipment Warning on page 143
- Radiation from Open Port Apertures Warning on page 143
- Laser and LED Safety Guidelines and Warnings for the ACX5000 Router on page 144
- Maintenance and Operational Safety Guidelines and Warnings on page 149
- General Electrical Safety Guidelines and Warnings on page 154
- Action to Take After an Electrical Accident on page 155
- Prevention of Electrostatic Discharge Damage on page 155
- AC Power Electrical Safety Guidelines on page 156
- AC Power Disconnection Warning on page 157
- ACX5000 DC Power Electrical Safety Guidelines and Warnings on page 158
- DC Power Copper Conductors Warning on page 159
- DC Power Disconnection Warning on page 159
- DC Power Grounding Requirements and Warning on page 161
- DC Power Wiring Sequence Warning on page 161
- DC Power Wiring Terminations Warning on page 163
- Multiple Power Supplies Disconnection Warning on page 164
- TN Power Warning on page 165

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- Agency Approvals for an ACX5000 Router on page 165
- Compliance Statements for EMC Requirements for the ACX5000 Router on page 166

General Safety Guidelines and Warnings

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

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

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

Definitions of Safety Warning Levels

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Qualified Personnel Warning



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

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

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

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

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

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

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

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

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

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

Warning Statement for Norway and Sweden



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

Advarsel Apparatet skal kobles til en jordet stikkontakt.

Varning! Apparaten skall anslutas till jordat nätuttag.

Fire Safety Requirements

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

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

Fire Suppression

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

Fire Suppression Equipment

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

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this type of inert oxygen displacement extinguisher instead of an extinguisher that leaves residues on equipment.

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

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



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

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

Installation Instructions Warning



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

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

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

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

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

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

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

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

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

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

Chassis and Component Lifting Guidelines

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

Restricted Access Warning



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

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

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

Attention Cet appareil est à installer dans des zones d'accès réservé. Ces dernières sont des zones auxquelles seul le personnel de service peut accéder en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout

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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.

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

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

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

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

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

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

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

Rack-Mounting and Cabinet-Mounting Warnings

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



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

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

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

- De Juniper Networks switch moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.
- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.

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- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.
- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

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

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

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

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

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

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

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- 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:

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

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

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

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

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

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Grounded Equipment Warning



WARNING: The device is intended to be grounded. During normal use, ensure that you have connected earth ground to the chassis.

Waarschuwing Deze apparatuur hoort geaard te worden Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.

Varoitus Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaite on yhdistetty maahan normaalikäytön aikana.

Attention Cet équipement doit être relié à la terre. S'assurer que l'appareil hôte est relié à la terre lors de l'utilisation normale.

Warnung Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.

Avvertenza Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.

Advarsel Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

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

Radiation from Open Port Apertures Warning



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

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

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

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

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

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

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

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

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

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

Laser and LED Safety Guidelines and Warnings for the ACX5000 Router

ACX5000 routers are equipped with laser transmitters:

- SFP and SFP+ transceivers are classified as Class 1 Laser Products (complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice 50, dated July 26, 2001) or Class 1 LED Products.
- QSFP+ and QSFP28 transceivers are classified as Class 1M Laser Products (IEC 60825-1 2001–01).

Observe the following guidelines and warnings:

- General Laser Safety Guidelines on page 145
- Class 1M Laser Product Warning on page 145
- Class 1M Laser Radiation Warning on page 145
- Class 1 Laser Product Warning on page 146
- Class 1 LED Product Warning on page 146

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- Laser Beam Warning on page 146
- Unterminated Fiber-Optic Cable Warning on page 147

General Laser Safety Guidelines

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

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



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

Class 1M Laser Product Warning



WARNING: Class 1M laser product.

Waarschuwing Laserproducten van Klasse 1M (IEC).

Varoitus Luokan 1M (IEC) lasertuotteita.

Attention Produits laser catégorie 1M (IEC).

Warnung Laserprodukte der Klasse 1M (IEC).

Avvertenza Prodotti laser di Classe 1M (IEC).

Advarsel Klasse 1M (IEC) laserprodukter.

Aviso Produtos laser Classe 1M (IEC).

¡Atención! Productos láser de Clase 1M (IEC).

Varning! Laserprodukter av Klass 1M (IEC).

Class 1M Laser Radiation Warning



WARNING: Class 1M laser radiation when open. Do not view directly with optical instruments.

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Class 1 Laser Product Warning



WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning



WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning



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

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

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

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

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

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

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

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

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

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

Unterminated Fiber-Optic Cable Warning



WARNING: Invisible laser radiation might be emitted from the unterminated connector of a fiber-optic cable. To avoid injury to your eye, do not view the fiber optics with a magnifying optical device, such as a loupe, within 100 mm.

Waarschuwing Er kunnen onzichtbare laserstralen worden uitgezonden vanuit het uiteinde van de onafgebroken vezelkabel of connector. Niet in de straal kijken of deze rechtstreeks bekijken met optische instrumenten. Als u de laseruitvoer met bepaalde optische instrumenten bekijkt (zoals bijv. een oogloep, vergrootgras of microscoop) binnen een afstand van 100 mm kan dit gevaar voor uw ogen opleveren.

Varoitus Päättämättömän kuitukaapelin tai -liittimen päästä voi tulla näkymätöntä lasersäteilyä. Älä tuijota sädettä tai katso sitä suoraan optisilla välineillä. Lasersäteen katsominen tietyillä optisilla välineillä (esim. suurennuslasilla tai mikroskoopilla) 10 cm:n päästä tai sitä lähempää voi olla vaarallista silmille.

Attention Des émissions de radiations laser invisibles peuvent se produire à l'extrémité d'un câble en fibre ou d'un raccord sans terminaison. Ne pas fixer du regard le rayon ou l'observer directement avec des instruments optiques. L'observation du laser à l'aide certains instruments optiques (loupes et

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microscopes) à une distance inférieure à 100 mm peut poser des risques pour les yeux.

Warnung Eine unsichtbare Laserstrahlung kann vom Ende des nicht angeschlossenen Glasfaserkabels oder Steckers ausgestrahlt werden. Nicht in den Laserstrahl schauen oder diesen mit einem optischen Instrument direkt ansehen. Ein Betrachten des Laserstrahls mit bestimmten optischen Instrumenten, wie z.B. Augenlupen, Vergrößerungsgläsern und Mikroskopen innerhalb eines Abstands von 100 mm kann für das Auge gefährlich sein.

Avvertenza L'estremità del connettore o del cavo ottico senza terminazione può emettere radiazioni laser invisibili. Non fissare il raggio od osservarlo in modo diretto con strumenti ottici. L'osservazione del fascio laser con determinati strumenti ottici (come lupette, lenti di ingrandimento o microscopi) entro una distanza di 100 mm può provocare danni agli occhi.

Advarsel Usynlig laserstråling kan emittere fra enden av den ikke-terminerte fiberkabelen eller koblingen. Ikke se inn i strålen og se heller ikke direkte på strålen med optiske instrumenter. Observering av laserutgang med visse optiske instrumenter (for eksempel øyelupe, forstørrelsesglass eller mikroskoper) innenfor en avstand på 100 mm kan være farlig for øynene.

Aviso Radiação laser invisível pode ser emitida pela ponta de um conector ou cabo de fibra não terminado. Não olhe fixa ou diretamente para o feixe ou com instrumentos ópticos. Visualizar a emissão do laser com certos instrumentos ópticos (por exemplo, lupas, lentes de aumento ou microscópios) a uma distância de 100 mm pode causar riscos à visão.

¡Atención! El extremo de un cable o conector de fibra sin terminación puede emitir radiación láser invisible. No se acerque al radio de acción ni lo mire directamente con instrumentos ópticos. La exposición del ojo a una salida de láser con determinados instrumentos ópticos (por ejemplo, lupas y microscopios) a una distancia de 100 mm puede comportar lesiones oculares.

Varning! Osynlig laserstrålning kan komma från änden på en oavslutad fiberkabel eller -anslutning. Titta inte rakt in i strålen eller direkt på den med optiska instrument. Att titta på laserstrålen med vissa optiska instrument (t.ex. lupper, förstoringsglas och mikroskop) från ett avstånd på 100 mm kan skada ögonen.

Related Documentation

- General Safety Guidelines and Warnings on page 132
- Radiation from Open Port Apertures Warning on page 143
- Installation Instructions Warning on page 136
- Grounded Equipment Warning on page 143

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Maintenance and Operational Safety Guidelines and Warnings

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

- Battery Handling Warning on page 149
- Jewelry Removal Warning on page 150
- Lightning Activity Warning on page 151
- Operating Temperature Warning on page 152
- Product Disposal Warning on page 153

Battery Handling Warning



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

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

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

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

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

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

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

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente

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recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

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

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

Jewelry Removal Warning



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

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

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

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

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

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

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

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

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

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

Lightning Activity Warning



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

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

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

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

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

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

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

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

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¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning



WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

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

Attention Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura

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máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning



WARNING: Disposal of this device must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Attention La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

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General Electrical Safety Guidelines and Warnings



WARNING: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be metallically connected to interfaces that connect to the OSP or its wiring. The intrabuilding ports on the device are suitable for connection to intrabuilding or unexposed wiring or cabling only. The addition of primary protectors is not sufficient protection for connecting these interfaces metallically to OSP wiring.



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

- Install the device in compliance with the following local, national, and international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
  - Evaluated to the TN power system.
  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.
- Make sure that grounding surfaces are cleaned and brought to a bright finish before grounding connections are made.
- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.
- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.
- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.
- Operate the device within marked electrical ratings and product usage instructions.
- To ensure that the device and peripheral equipment function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

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You can remove and replace many device components without powering off or disconnecting power to the device, as detailed elsewhere in the hardware documentation for this device. Never install equipment that appears to be damaged.

Action to Take After an Electrical Accident

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

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

Prevention of Electrostatic Discharge Damage

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

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

  If a grounding strap is not available, hold the component in its antistatic bag (see Figure 57 on page 156) in one hand and touch the exposed, bare metal of the device with the other hand immediately before inserting the component into the device.

  WARNING: **For safety, periodically check the resistance value of the ESD grounding strap. The measurement must be in the range 1 through 10 Mohms.**

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

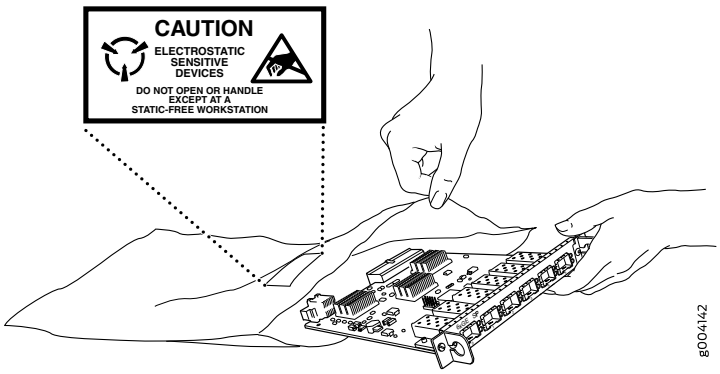
  If no grounding strap is available, touch the exposed, bare metal of the device to ground yourself before handling the component.

- Avoid contact between the component that is subject to ESD damage and your clothing. ESD voltages emitted from clothing can damage components.
- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an

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antistatic bag (see Figure 57 on page 156). If you are returning a component, place it in an antistatic bag before packing it.

Figure 57: 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.

AC Power Electrical Safety Guidelines

CAUTION: For devices with AC power supplies, an external surge protective device (SPD) must be used at the AC power source.

The following electrical safety guidelines apply to AC-powered devices:

- Note the following warnings printed on the device:

  "**CAUTION:** THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK."

  "**ATTENTION:** CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE."

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.

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- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

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

注意

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

g017253

AC Power Disconnection Warning



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

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

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

Attention Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

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

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

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

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

ACX5000 DC Power Electrical Safety Guidelines and Warnings

The following electrical safety guidelines apply to a DC-powered router:

- A DC-powered device is equipped with a DC terminal block that is rated for the power requirements of a maximally configured device.

  NOTE: To supply sufficient power, terminate the DC input wiring on a facility DC source that is capable of supplying:

  - Minimum of 7 A at –48 VDC for ACX5000 router

  Incorporate an easily accessible disconnect device into the facility wiring. Be sure to connect the ground wire or conduit to a solid office earth ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.

- Run two wires from the circuit breaker box to a source of 48 VDC.
- A DC-powered device that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

  NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker must protect against excess currents, short circuits, and earth grounding faults in accordance with NEC ANSI/NFPA 70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- For personal safety, connect the green and yellow wire to safety (earth) ground at both the device and the supply side of the DC wiring.
- The marked input voltage of –48 VDC for a DC-powered device is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the device is a positive ground system, you must connect the positive lead to the terminal labeled RTN, the negative lead to the terminal labeled –48 VDC, and the earth ground to the device grounding points.

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Related Documentation

- DC Power Copper Conductors Warning on page 159
- DC Power Disconnection Warning on page 159
- DC Power Grounding Requirements and Warning on page 161
- DC Power Wiring Sequence Warning on page 161
- DC Power Wiring Terminations Warning on page 163

DC Power Copper Conductors Warning



WARNING: Use copper conductors only.

Waarschuwing Gebruik alleen koperen geleiders.

Varoitus Käytä vain kuparijohtimia.

Attention Utilisez uniquement des conducteurs en cuivre.

Warnung Verwenden Sie ausschließlich Kupferleiter.

Avvertenza Usate unicamente dei conduttori di rame.

Advarsel Bruk bare kobberledninger.

Aviso Utilize apenas fios condutores de cobre.

¡Atención! Emplee sólo conductores de cobre.

Varning! Använd endast ledare av koppar.

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,

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käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

Attention Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

Warnung Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

Avvertenza Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

Advarsel Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

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

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

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

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DC Power Grounding Requirements and Warning

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



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

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

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

Attention Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.

Warnung Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.

Avvertenza In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.

Advarsel Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.

Aviso Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.

¡Atención! Al instalar el equipo, conectar la tierra la primera y desconectarla la última.

Varning! Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

DC Power Wiring Sequence Warning



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

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

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

Attention Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis –48 V à –48 V. En débranchant la puissance, l'ordre approprié de câblage est –48 V à –48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, –48 V til – 48 V. Riktig frakoples tilkoplingssekvens er –48 V til – 48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces –48 V a –48 V. Al desconectar potencia, la secuencia apropiada del cableado es –48 V a –48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

¡Atención! Wire a fonte de alimentação de DC Usando os talões apropriados na extremidade da fiação. Ao conectar a potência, a seqüência apropriada da fiação é moída para moer, +RTN a +RTN, então –48 V a –48 V. Ao desconectar a potência, a seqüência apropriada da fiação é –48 V a –48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

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

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DC Power Wiring Terminations Warning



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

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

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

Attention Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

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

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

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

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

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

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

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

Multiple Power Supplies Disconnection Warning



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

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

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

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

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

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

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

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

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

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

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TN Power Warning



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

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

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Attention Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Agency Approvals for an ACX5000 Router

The ACX5000 router complies with the following standards:

- Safety
  - CAN/CSA-C22.2 No. 60950-1 Information Technology Equipment - Safety
  - EN 60950-1 Information Technology Equipment - Safety
  - IEC 60825-1
  - IEC 60950-1 Information Technology Equipment - Safety CB Scheme report
  - UL 60950-1 Information Technology Equipment - Safety
- EMC
  - EN 55022, Class A
  - CISPR 22, Class A
  - Australian Communications and Media Authority (ACMA) AS/NZS CISPR 22: Class A
  - FCC Part 15, Subpart B, for Class A digital devices

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- Industry Canada ICES 003, Class A
- VCCI Regulations for Voluntary Control Measures of Radio Interference Generated by Information Technology Equipment, (Class A).
- EN 300 386, Class A
- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 55024
- CISPR 24

Related Documentation

- Compliance Statements for EMC Requirements for the ACX5000 Router on page 166

Compliance Statements for EMC Requirements for the ACX5000 Router

This topic describes the EMC requirements for the ACX5000 router for:

- Canada on page 166
- European Community on page 167
- Israel on page 167
- Japan on page 167
- Korea on page 168
- United States on page 168
- Nonregulatory Environmental Standards on page 168

Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the users' satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect the equipment to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single line individual service may be extended by means of a certified connector assembly. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this

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equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

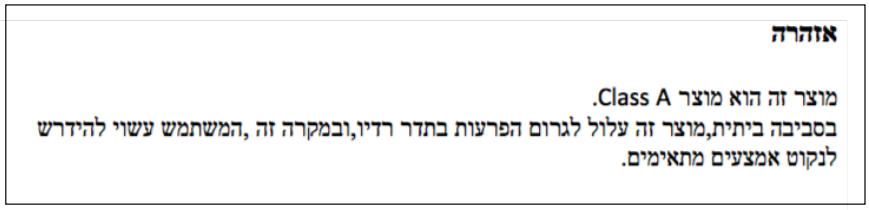
CAUTION: **Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.**

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

European Community

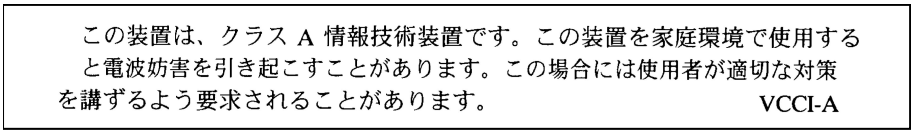
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Israel



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

Japan



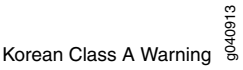
The preceding translates as follows:

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

VCCI-A

Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.



The preceding translates as follows:

This equipment is Industrial (Class A) electromagnetic wave suitability equipment and seller or user should take notice of it, and this equipment is to be used in the places except for home.

United States

The router 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, may 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.

Nonregulatory Environmental Standards

ACX5000 routers are designed to be Network Equipment Building System (NEBS) compliant.

Those device product SKUs are designed to meet the following NEBS compliance standards:

- SR-3580 NEBS Criteria Levels (Level 3 Compliance)
- GR-1089-CORE, Issue 6: EMC and Electrical Safety—Generic Criteria for Network Telecommunications Equipment
  - The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
  - The battery return connection is to be treated as an Isolated DC return (DC-I), as defined in GR-1089-CORE.
- GR-63-CORE: NEBS, Physical Protection
  - The equipment is suitable for installation as part of the Common Bonding Network (CBN).
  - The equipment is suitable for installation in a central office (CO).

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Related Documentation

- Agency Approvals for an ACX5000 Router on page 165

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