JUNIPer
NETWORKS

Engineering
Simplicity

MX304 Universal Routing Platform Hardware Guide

Published
2024-10-29

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

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at https://support.juniper.net/support/eula/. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

3 **Site Planning, Preparation, and Specifications**

4 Initial Installation and Configuration

5

About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the MX304 Universal Routing Platform. Once you've completed the installation and basic configuration procedures in this guide, refer to the Junos OS documentation for details on how to further configure the MX304.

RELATED DOCUMENTATION

Junos OS for MX Series 5G Universal Routing Platforms

1

CHAPTER

Fast Track: Initial Installation

Fast Track to Rack Installation and Power

SUMMARY

This procedure guides you through the simplest steps for the most common installation to get your MX304 router in a rack and connect it to power.

IN THIS SECTION

Install the MX304 Router in a Rack

You can install the MX304 router in either a two-post or four-post rack. We'll walk you through the steps to install an AC-powered switch in a four-post rack or cabinet.

Before you install, review the following:

- "MX304 Site Guidelines and Requirements" on page 50.

- General Safety Guidelines and Warnings.

- "Verify the MX304 Router Parts Received" on page 88.

> ⚠️ **CAUTION**: If you're installing more than one router in a rack, install them from the bottom up.

> ⚠️ **CAUTION**: Before front-mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

> ⚠️ **CAUTION**: Lifting the chassis and mounting it in a rack requires two people (one person to hold the router in place and a second person to install the screws). A fully loaded AC-powered router weighs up to 70.54 lb (32 kg).

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end to a site ESD point.

2. (Optional) Install the cable management brackets on each side of the front of the chassis. Secure each bracket with screws at the bottom and top of the bracket as shown:
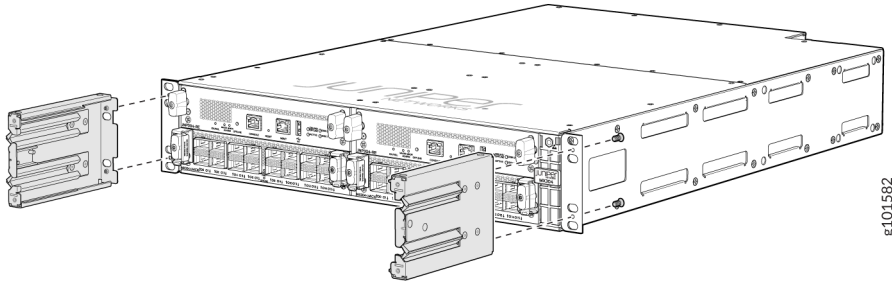
3. Position the router in front of the four-post rack or the cabinet.

4. With one person holding on to each side of the chassis, carefully lift the bottom of the chassis so that rack mounting brackets (with optional cable management brackets) contact the rack rails.

5. Attach the chassis to the front of the rack as shown:
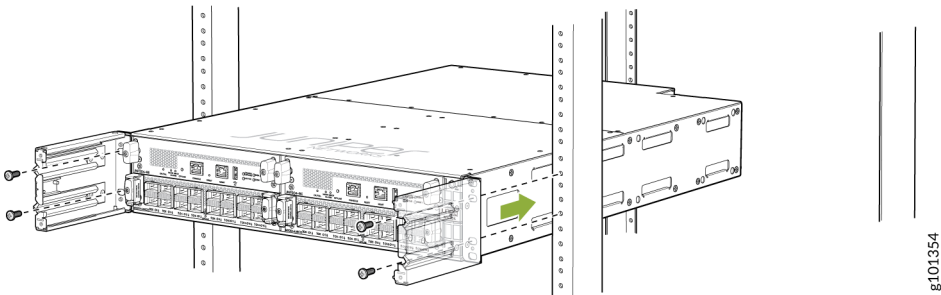
6. On the rear of the chassis, slide the rear-mounting brackets on both sides of the chassis until they contact the rack rails. Insert the rack mounting screws through the mounting brackets and mounting holes on the rack and tighten them. Be sure to tighten the screws in the two bottom holes first, and then tighten the screws in the top two holes.
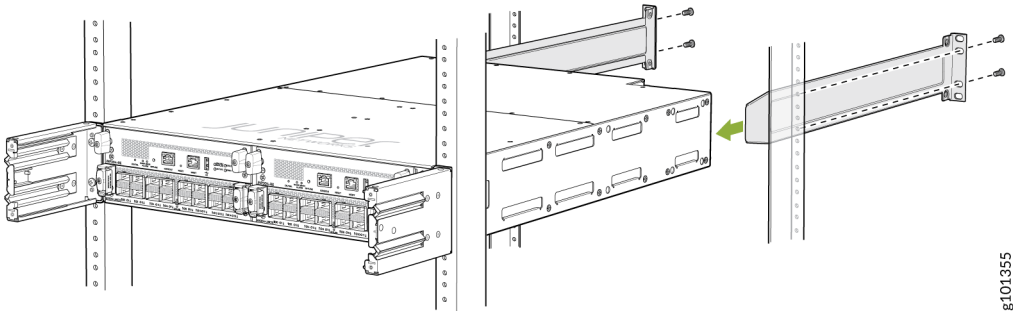
7. Verify that the mounting brackets on each side of the rack are level.
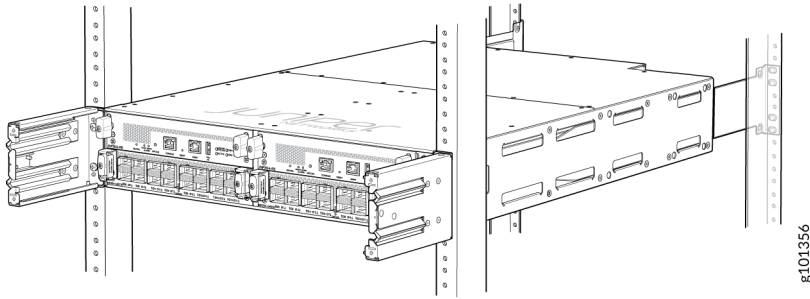
8. (Optional) Secure the front cover with the air filter to the chassis. Tighten the four screws, turning them clockwise.
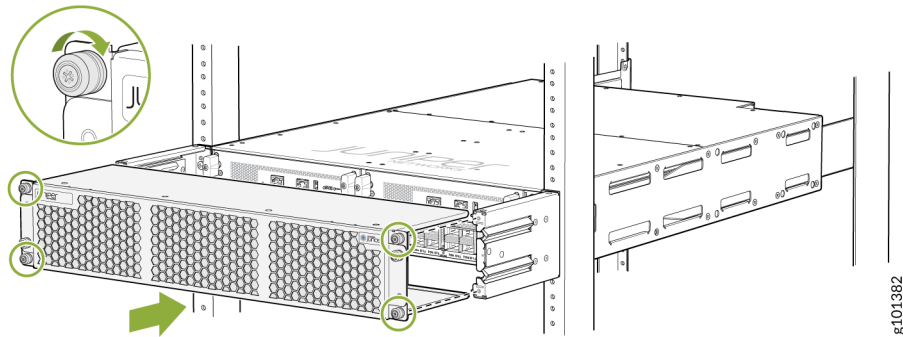
Connect to Power

IN THIS SECTION

- Ground the MX304 Router | **5**
- Connect the Power Cord and Power On the Router | **6**

Now that you've mounted your router in the rack, you're ready to ground your router and connect it to AC power.

Ground the MX304 Router

> ⚠️ **WARNING**: The router is a pluggable type A equipment installed in a restricted-access location. The chassis has a separate protective earthing terminal (sized for M6 hex screws) in addition to the power supply cord's grounding pin. This separate protective earthing terminal must be permanently connected to earth.

Before you ground the router:

- Verify that a licensed electrician has attached the cable lug that ships with the router to the grounding cable.

- Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.

To ground the MX304 router, do the following:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Connect one end of the grounding cable to a proper earth ground, such as the rack.

3. Detach the ESD grounding strap from the site ESD grounding point and connect it to one of the ESD points on the chassis.

4. Place the grounding lug attached to the grounding cable over the grounding points on the chassis, and secure it with M6 pan head screws.
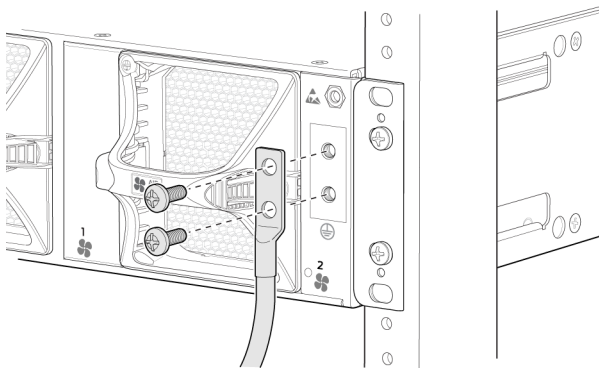
5. Dress the grounding cable, and ensure that it doesn't block access to or touch other device components, and that it doesn't drape where people could trip over it.

Connect the Power Cord and Power On the Router

The AC-powered MX304 router comes with two AC power supplies preinstalled on the rear panel.

> **NOTE**: Each power supply must be connected to a dedicated AC power feed and a dedicated customer-site circuit breaker. We recommend using a circuit breaker rated for 15 A (110 VAC) minimum, or as required by local code.

To connect the power cord and power on the router, do the following:

1. Ensure that the power supplies are fully inserted in the router.

2. Turn off the AC power switch on the power supply.

3. Plug in the AC power cord to the power socket on the power supply.

4. Push the retainer clip through the loop and tighten it until it fits snug around the power cord.
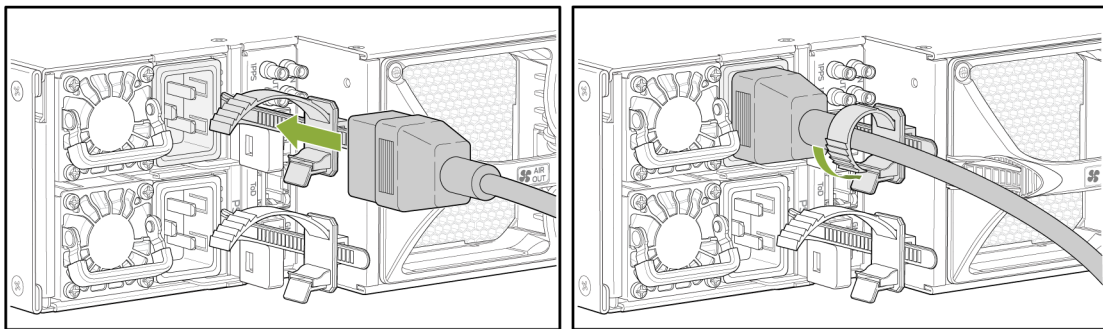
5. Route the power cord so that it doesn't block the air exhaust and access to router components, or drape where people could trip on it.

6. If the AC power source outlet has a power switch, turn it off.

7. Plug the power cord into the AC power source outlet.

8. If the AC power source outlet has a power switch, turn it on.

9. Repeat Step 1 through Step 8 to install the other power supply.

Onboard, Configure, and Monitor MX304

SUMMARY

This topic provides you with pointers to onboard, configure, and monitor MX304 routers using Juniper Paragon Automation, Mist, or Junos OS CLI.

Juniper Paragon Automation

You can use Juniper Paragon Automation to onboard, manage, and monitor MX304. See the Juniper Paragon Automation Documentation page for more information.

Mist Routing Assurance

The MX304 is a cloud-ready router, and you can onboard and monitor the performance of the router through the Mist Routing Assurance portal. You can use the routing insights that Juniper Mist Routing Assurance provides to proactively respond to network events and anomalies. See Table 1 on page 7 for more information.

Table 1: Onboard and Monitor MX304 Using Mist Routing Assurance

If you want to	Then
Setup Mist Routing Assurance, onboard routers, and monitor their performance	See Mist Routing Assurance.
Use the Mist Routing Assurance	See Mist Routing Assurance User Guide.
See all documentation available for Mist AI Routing	Visit Mist Routing Assurance documentation.

Junos OS CLI

You can configure and monitor MX304 routers using the Junos OS CLI. See Table 2 on page 8 for more information.

Table 2: Configure MX304 Using Junos OS CLI

If you want to	Then
Customize basic configuration	See "Perform Initial Configuration on the MX304 Router" on page 118
Explore the software features supported on the MX304	See Feature Explorer
Configure Junos features on the MX304	See User Guides

2
CHAPTER

Overview

MX304 System Overview

The MX304 router provides a highly compact, 2-U platform with the flexibility to scale out services with 4.8 Tbps system capacity. Based on Juniper Networks Trio 6 chipset, the MX304 router is designed and optimized for a wide range of demanding edge requirements (business, residential, mobile, cable, data center and more) anywhere in the network. The MX304 router runs the Junos operating system (Junos OS). It has pluggable Routing Engines (it supports one or two Routing Engines), two dedicated AC, DC, or HVAC/HVDC power supply modules, and front-to-back cooling.

The MX304 router supports a maximum of 12x400 Gbps ports, 48x100 Gbps ports or a combination. It accepts up to three line card MICs (LMICs), each LMIC has 1 YT chip and 1.6 Tbps of forwarding capacity.

Benefits of the MX304 Router

- **Increased scalability—**The MX304 scales to 4.8 Tbps in a single chassis. It supports 400 GbE, 100 GbE, 50 GbE, 40 GbE, 25 GbE, and 10 GbE interfaces, giving hyperscalers, cloud providers and service providers the performance and scalability needed as networks grow. With a chipset designed specifically for the unique needs and opportunities of the multiservice edge, the MX304 router delivers massive logical scale, flexibility and programmability. The purpose-built ASICs in the MX304 provide enhanced packet processing for both full IP functionality and MPLS transport, accommodating the service scale as traffic continues to increase.

- **Space-optimized, power-efficient cloud-era routing platform—**The MX304 compact form factor enables the chassis to be deployed in cabinets, meeting the installation requirements for co-locations, central offices, and regional networks in emerging markets and transport-focused environments.

- **Always-on infrastructure base**—The MX304 is engineered with full hardware redundancy for the Routing Engines, power supplies, and cooling fans allowing service providers to meet stringent service-level agreements (SLAs) across the core.

- **Multiservice Edge delivered at high scale**—The MX304 is based on the TRIO 6 chipset making it a true multiservice edge box. It integrates with existing service provider and cloud use cases, for example Business Edge, Peering, Backhaul, VPC Gateway, and Enterprise WAN. The Routing Engine is based on the latest CPU with 8 cores and 128 GB RAM, enabling the MX304 to meet the high scale requirements of control plane features.

- **Inline MACsec**—MX304 has MACsec available on all ports and at all speeds in the inline mode. Inline MACsec means no added latency in throughput performance and without the need for an external component (PHY/Crypto Engine).

MX304 Router Hardware Overview

The MX304 router contains redundant, pluggable, Routing Engines and supports up to three line-card MICs (LMICs). Each LMIC has 4x400 Gbps ports, 16x100 Gbps ports, or a combination. LMIC's have the optics directly on the linecard and are Field Replaceable Unit (FRU)s, but the LMICs aren't hot-removable-or hot-pluggable.

The MX304 is a compact 2 U router. You can stack several routers in a single floor-to-ceiling rack for increased port density per unit of floor space.

The router provides two dedicated line card slots for LMICs. You can also add a third LMIC into one of the Routing Engine slots. As listed in , the MX304 router has up to two redundant Routing Engines, two power supply modules, and three fan modules. The two dedicated power supply modules support AC, DC, or HVAC/DC power, the cooling system has three fan modules.

Table 3: MX304 Router Components

Component	Description
LMIC	2 or 3
Routing Engine	1 or 2
Power supply module	2

Table 3: MX304 Router Components *(Continued)*

Component	Description
Fan module	3

> **NOTE**: For a complete list of supported optics on the MX304 router, see MX304 Transceivers.

MX304 Hardware Components and CLI Terminology

The MX304 router supports the components in Table 4 on page 12, listed in alphabetic order.

Table 4: MX304 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	MX304-BASE	`Chassis`	1 Routing Engine, 2 power supplies and 3 fan trays. "MX304 Chassis Description" on page 16
	MX304-PREM	`Chassis`	2 Routing Engines, 2 power supplies and 3 fan trays. "MX304 Chassis Description" on page 16
Fan module	JNP-FAN-2RU	• `Fan Tray 0` • `Fan Tray 1` • `Fan Tray 2`	"MX304 Cooling System Description" on page 24
Power system components			

Table 4: MX304 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
Power supply module	• JNP-PWR2200-AC • JNP-PWR2200-DC • JNP-PWR2200-HV	• PEM 0 • PEM 1	• "MX304 AC Power System Description" on page 30 • "MX304 DC Power System Description" on page 33 • "MX304 High-Voltage AC/DC Universal System Power Description" on page 35
LMIC	MX304-LMIC16-BASE	FPC 0 • PIC 0 • PIC 1 • PIC 2	"MX304 LMIC (FRU)" on page 43
Routing Engine	• JNP304-RE-S (standard version) • JNP304-RE-LT-R (limited version)	• Routing Engine 0 • Routing Engine 1	"MX304 Routing Engine Description" on page 38
JNP304 Air filter assembly	JNP-FLTRDR-2RU		"MX304 Cooling System Description" on page 24
Air Filter	JNP-AIRFLTR-2RU		"MX304 Cooling System Description" on page 24
Transceiver	See the Hardware Compatibility Tool for a list of supported optics.	Xcvr	See the Hardware Compatibility Tool

MX304 Component Redundancy

Only a fully configured router provides complete redundancy. All other configurations provide partial redundancy. The following major hardware components are redundant:

- Routing Engines—A redundant system consists of two Routing Engines which are available as field-replaceable units (FRUs). One Routing Engine functions as the primary and the other functions as the backup. If the primary host subsystem (or either of its components) fails, the backup takes over as the primary. The Routing Engine installed in slot **0** functions as the default primary Routing Engine.

- Power supplies—The router requires two power modules for 1+1 redundancy. Table 5 on page 14 shows the power redundancy supported on the AC, DC, and high-voltage AC/DC (HVAC/DC) routers. If one power supply fails in a fully redundant system, the other power supply provides full power to the router without interruption.

Table 5: Power Redundancy

Power Supply	Power Supply Module Redundancy
AC	1+1
DC	1+1
HVAC/DC	1+1

- Cooling system—The redundant cooling system has three fan modules. The fan modules are at the rear of the router. The host subsystem controls and monitors the fans. All three fans are required for full redundancy. If a fan fails or the temperature rises above the temperature threshold, the host subsystem automatically adjusts the speed of the remaining fans to keep the temperature within the acceptable range.

> ⚠️ **CAUTION**: For a fully configured router, all the three fan modules must be operational. If a fan module failures, replace it immediately.

SEE ALSO

Contact Customer Support and Returning the Chassis or Components | **194**

MX304 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site (see Table 6 on page 15). Replacing most FRUs requires minimal router downtime. The router uses the following types of FRUs:

- Hot-removable and hot-insertable FRUs—You can remove and replace these components without powering off the router or disrupting the routing functions.

- Hot-pluggable FRUs—You can remove and replace these components without powering off the router. Removing the component interrupts the routing functions of the system.

Table 6 on page 15 lists the FRUs for the router.

Table 6: Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs	Field Replaceable (not hot-pluggable or hot-removable)
- Backup Routing Engine (if redundant) - Power supply modules (if redundant) - Fan modules (if redundant)	Routing Engine (non-redundant)	LMICs **NOTE**: See "Replace an MX304 LMIC" on page 152

MX304 Chassis

IN THIS SECTION

MX304 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the router components. Figure 1 on page 16 and Figure 2 on page 16 show the front of the chassis configured with two Routing Engines. Figure 3 on page 17 and Figure 4 on page 17 show the front of the chassis with one Routing Engine configured. The chassis measures 3.5 in. (8.89 cm) high, 17.63 in. (44.8 cm) wide, and 24.01 in. (61 cm) deep. The chassis installs in a standard 800-mm-deep open rack, 19-in. equipment racks, or telco open-frame racks. The total weight of a fully-loaded router (two Routing Engines and two LMICs): up to 70.54 lb (32 kg). For more information, see "MX304 Site Guidelines and Requirements" on page 50.

Figure 1: Front View of the MX304 Router (Two Routing Engines Installed)

Figure 2: Components on the Front View of the MX304 Router (Two Routing Engines Installed)
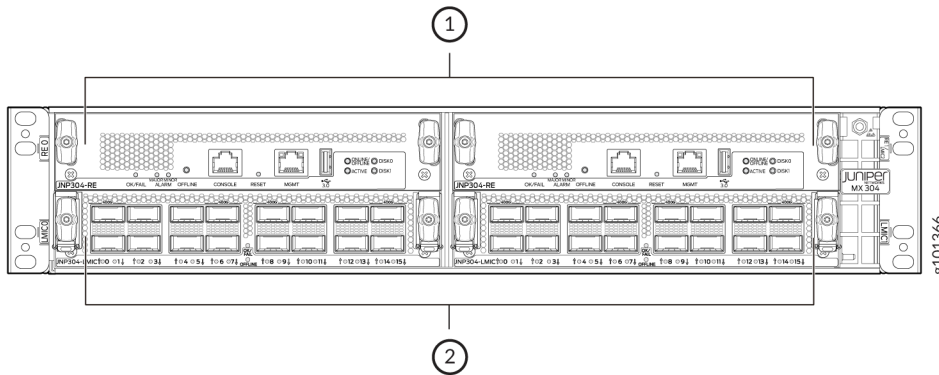
1– Routing Engines in slot **RE 0** and **RE 1/LMIC2**	2– LMICs installed in LMIC slots **LMIC 0** and **LMIC 1**

Figure 3: Front View of the MX304 Router (One Routing Engine Installed)

Figure 4: Components on the Front View of the MX304 Router (One Routing Engine Installed)
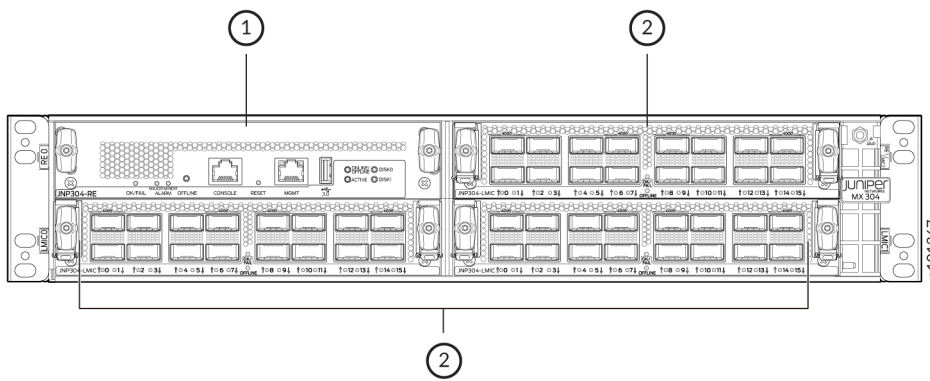
1– Routing Engine in slot **RE 0**	2– LMICs installed in LMIC slots **LMIC 0**, **LMIC 1**, and **RE 1/LMIC2**

The router comes in three variants: AC-powered, DC-powered, and high-voltage AC/DC (HVAC/DC) powered. Figure 5 on page 17 and Figure 6 on page 18 show the rear view of the AC-powered MX304 router. Figure 7 on page 18 and Figure 8 on page 18 show the rear view of the DC-powered MX304 router. Figure 9 on page 19 and Figure 10 on page 19 show the rear view of the HVAC/DC-powered MX304 router.

Figure 5: Rear View of the AC-Powered MX304 Router

Figure 6: Components of the Rear View of the AC-Powered MX304 Router
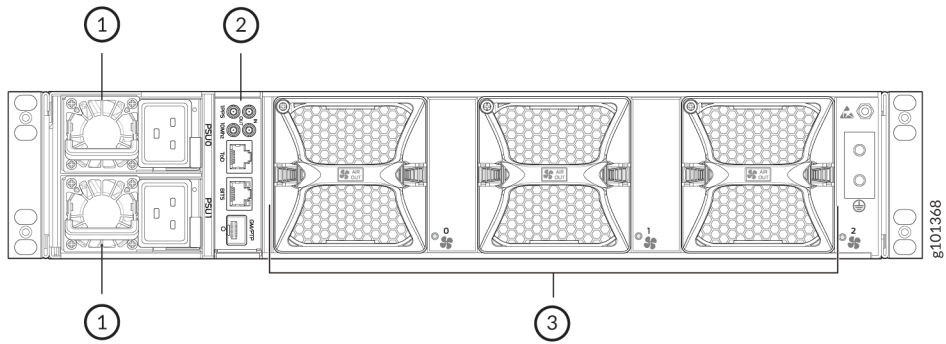
1– AC power supplies	3– Fan modules
2– Timing interface ports	

Figure 7: Rear View of the DC-Powered MX304 Router

Figure 8: Components of the Rear View of the DC-Powered MX304 Router
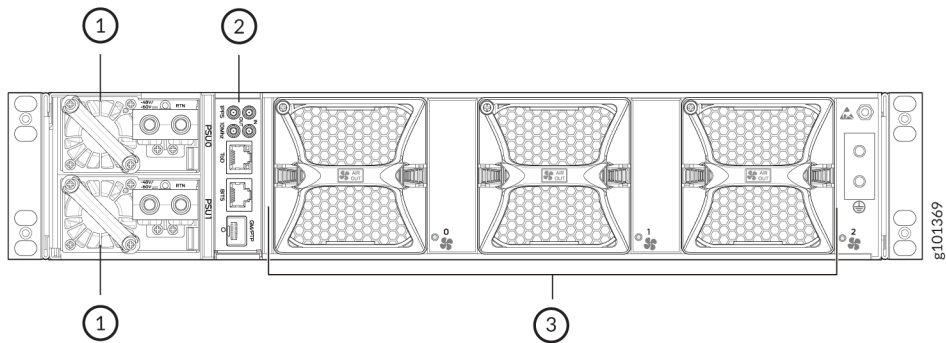
1– DC power supplies	3– Fan modules
2– Timing interface ports	

Figure 9: Rear View of the HVAC/DC-Powered MX304 Router

Figure 10: Rear View of the HVAC/DC-Powered MX304 Router
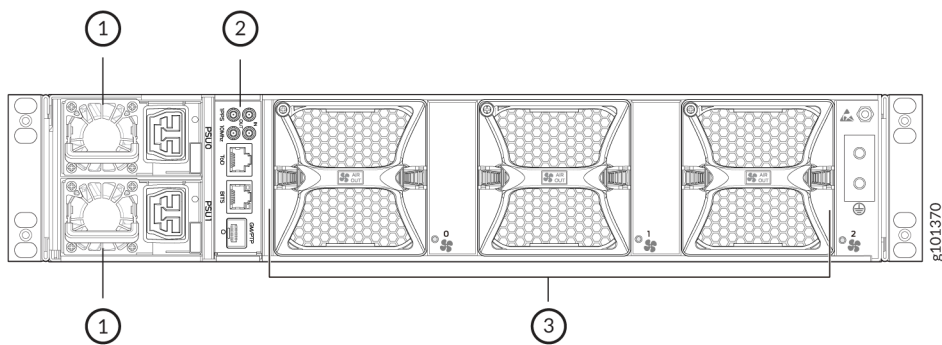
1– HVAC/DC power supplies	3– Fan modules
2– Timing interface ports	

Figure 11 on page 20 shows the electrostatic discharge (ESD) points on the router.

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

Figure 11: ESD Points on the MX304 Router
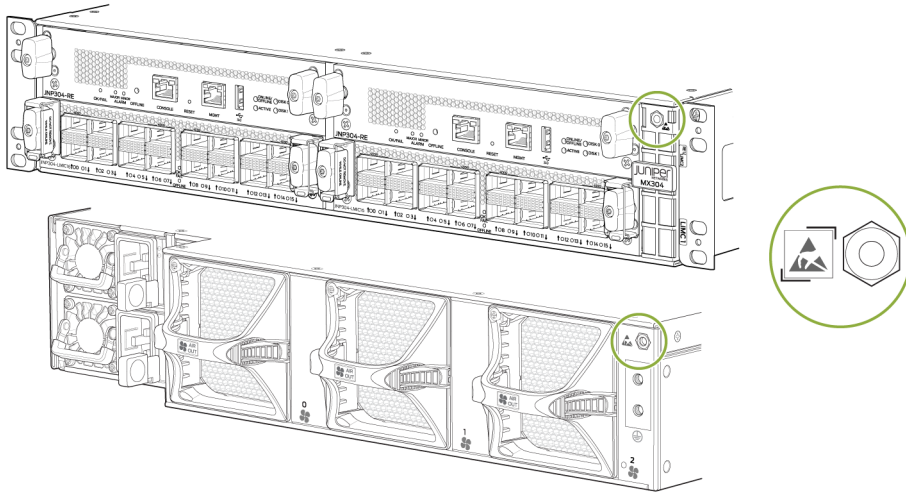
MX304 Front and Rear Panel Components

IN THIS SECTION

● MX304 Timing Ports Module LEDs | **22**

The slots in the MX304 router's front panel contains the Routing Engine(s), LMIC ports, and the air filter unit. The Routing Engine LEDs provide at-a-glance status of the components.

Front Panel Components

Table 7 on page 21 lists the components on the MX304 router front panel.

Table 7: Front Panel Components in a Fully Configured MX304 Router

Component	Slots	Number of FRUs
Routing Engines with LEDs for the router components, online/offline, reset buttons, auxiliary ports, console ports, and management ports	**RE0** and **RE1/LMIC2**	1 or 2
LMICs with 4x400 GbE ports or 16x100 GbE ports or a combination.	**LMIC0, LMIC1**, and **RE1/LMIC2** (if 3 LMICs are installed).	2 or 3
Air filter unit consists of three parts:the outer filter cover, the air filter, and the inner cage		1

Rear Panel Components

lists the MX304 router's rear panel components.

Table 8: Rear Panel Components in a Fully Configured MX304 Router

Component	Slots	Number of FRUs
Power supply module	**0** through **1**	2
Fan module	**0** through **2**	3

Timing Interface Ports

lists the components on the MX304 router's timing interface ports.

Figure 12: Timing Interface Ports
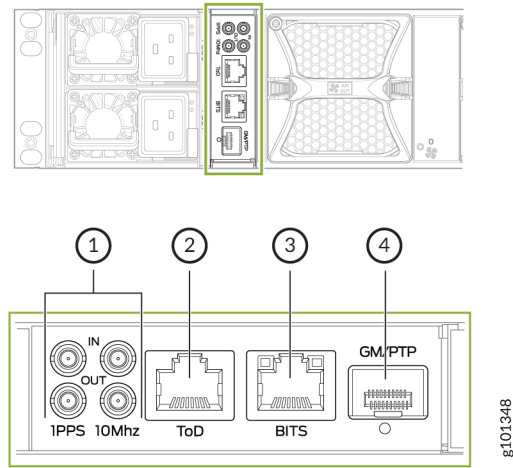
1– **10MHz** (one input and one output), **1PPS** (one input and one output)		3– **BITS**—Building-integrated timing supply (BITS)	
2– **ToD**—Time of day (TOD)		4– **GM/PTP**—PTP grandmaster clock port	

Here's a definition of the ports and labels on the timing interface ports. See Figure 12 on page 22 for a description of the timing ports LED indicators.

- BITS—Building-integrated timing supply (BITS) external clocking interface for connecting to external clocking devices.

- ToD—Time-of-day (TOD) port for connecting to external timing signal sources.

- 10MHz—10-MHz input and output clocking ports for connecting to external clock signal sources. The clocking ports synchronize clock inputs based on the clock's priority.

- PPS—1-pulse per second (PPS) input and output connectors for connecting to external clock signal sources. The clocking ports synchronize clock inputs based on the clock's priority.

- GM/PTP—PTP grand master clocking port. It support 1-GbE and 10-GbE.

MX304 Timing Ports Module LEDs

Table 3 shows the status LED for GM and BITS ports.

Table 9: Timing Ports LEDs on the MX304 Chassis

LED	Color	State	Description
Link LED for GM port	Unlit	Off	No transceiver is present.
	Green	On steadily	A link is established. The interface is up.
	Green	Blinking or flickering	The beacon feature is enabled.
	Yellow	Blinking	An error has occurred.
BITS	Green	On steadily	Clock is active.
	Yellow	On steadily	Loss of clock.

MX304 Cable Management Bracket Description

The cable management bracket (see Figure 13 on page 23) consists of dividers and installs on the front of the chassis. The cable management bracket enables you to route the cables outside the router and away from the Routing Engines and LMICs. The cable management kit (JNP-CABLEMGMT-2RU) is orderable.

Figure 13: Cable Management Bracket
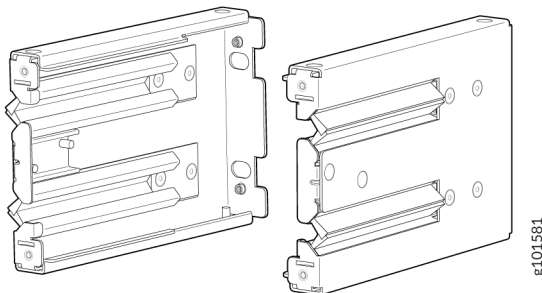
The air filter unit (optional) is installed on the cable management brackets. Before installing the air filter unit, ensure that the cable management brackets are already installed on the front of the router. Figure 14 on page 24 shows the air filter unit along with the cable management brackets installed on the router.

Figure 14: Cable Management Brackets and Air Filter Unit Installed on the Router
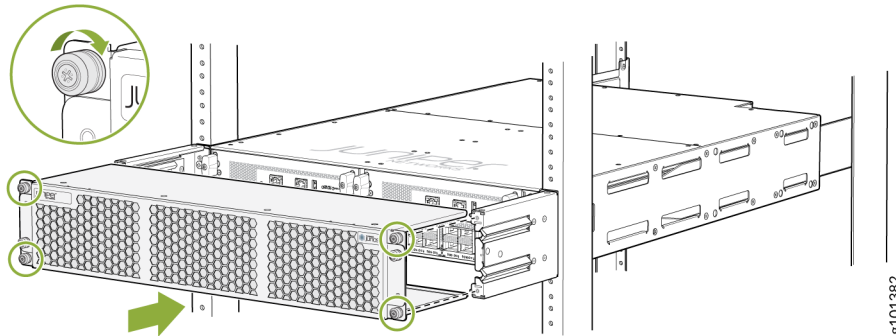
MX304 Cooling System

IN THIS SECTION

- MX304 Cooling System Description | **24**

MX304 Cooling System Description

IN THIS SECTION

- MX304 Fan Module LED | **28**

The cooling system components work together to keep all router components within the acceptable temperature range.

The cooling system consists of the following components:

Fan Modules

The chassis monitors the temperature of the router components. When the router is operating normally, the fans function at a lower speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range. If the ambient maximum temperature specification is exceeded and the system cannot be adequately cooled, the Routing Engine shuts down the router by disabling output power from each power supply.

The MX304 router has three fan modules that install at the rear of the router. All three fan modules must be installed in order to power up the router. The fan modules are hot-swappable and hot-removable field-replaceable units (FRUs) (see Figure 15 on page 26 and Figure 16 on page 26). Each fan module uses two 80 mm x 80 mm counter rotating fans.

If one of the fans in a fan module fails, the MX304 router will raise an alarm for the fan tray slot with the failed fan module, and continue to operate without issues. You can leave the failed fan module in the chassis until a replacement fan module is available. When a replacement fan module is available and the router is online, you must replace one fan module at a time. During replacement, the router will raise a major alarm for the missing fan module and continue to operate for a certain period after which it will shut down. See Table 10 on page 25 for information on the maximum time available to replace a fan module under different temperatures.

> **NOTE**: If more than one fan module is removed while the router is online, the router will shut down immediately. To avoid disturbing the air flow and cooling, don't operate the chassis when a fan module is removed.

Table 10: Fan Replacement

Ambient Temperature	Maximum Time to Replace a Fan Module (Seconds)
25°C (77°F)	240
40°C (104°F)	40

Figure 15: Fan Module
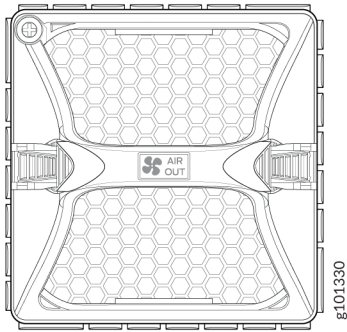
Figure 16: Fan Tray
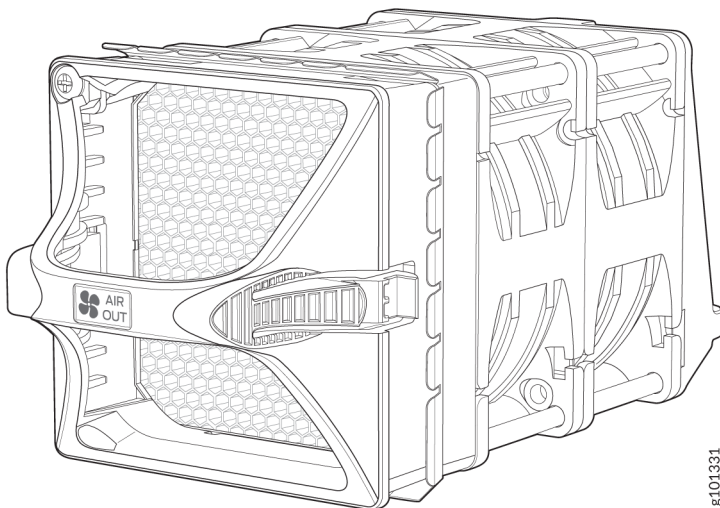
Airflow

The router has a front-to-back (**AIR OUT**) cooling system (see Figure 17 on page 27). Cool air is pulled through the vents on the front the chassis and hot air exhausts through the vents on the rear of the chassis.

Figure 17: Airflow through the Router

Ports   FRUs

g101349
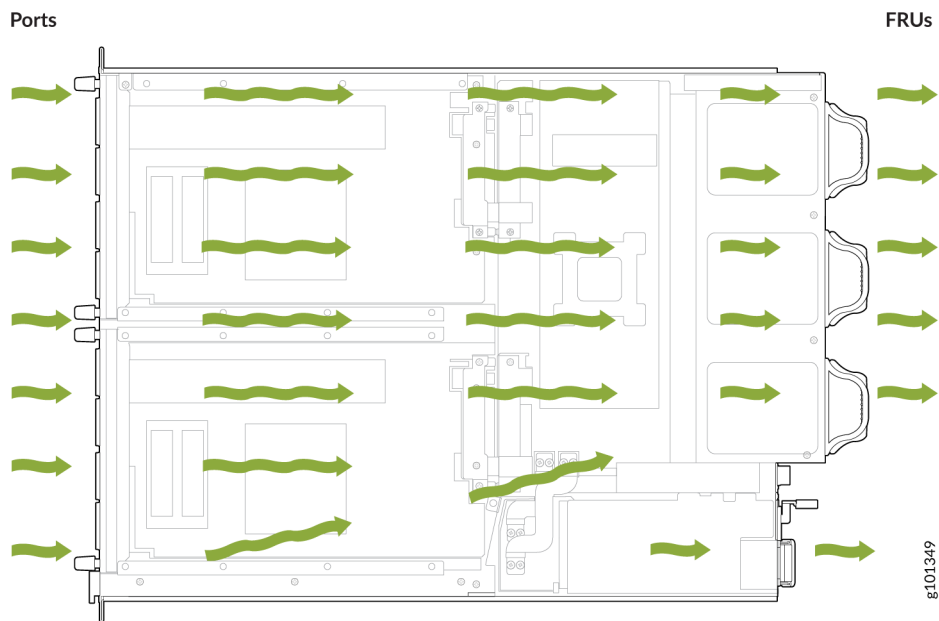
Air Filter Unit

The air filter unit consists of three parts:the outer filter cover, the air filter, and the inner cage (see Figure 18 on page 28). The air filter sits right inside the outer filter cover and the inner cage. The air filter unit is installed into the cable management brackets, and are held tightly by captive screws.

Figure 18: Air Filter Unit
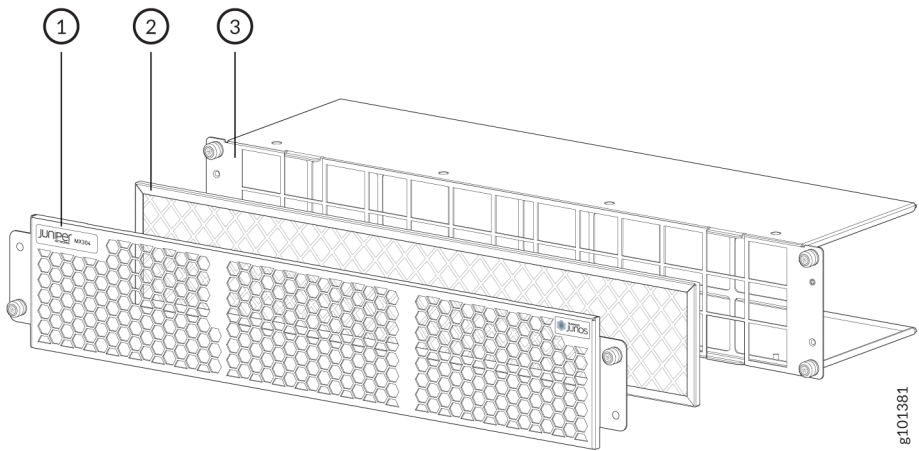
1– Outer filter cover	3– Inner cage
2– Air filter	

Table 11: Air Filter

Product Number	Description	Oderable
JNP-FLTRDR-2RU	JNP304 Air filter assembly	Spare
JNP-AIRFLTR-2RU	Air Filter	Spare

Power Supply Cooling System

The self-cooling power supplies and exhaust vents are in the rear of the router (to the left of the chassis).

MX304 Fan Module LED

Each fan module contains two bicolor LEDs. "MX304 Cooling System Description" on page 24 shows the fan module LED.

Table 3 describes the behavior of the fan module LEDs.

Table 12: Fan Module LEDs

Label	Color	State	Description
STATUS	Green	Blinking	Fan module hardware initialization complete and software initialization pending
		On steadily	Software initialization complete and the fan is functioning normally
	Yellow	On steadily	Faulty and not functioning normally
		Blinking	Fan locator beacon to identify a fan module
		Off	Fan is off

MX304 Power System

SUMMARY

The MX304 routers support AC, DC, high-voltage alternating current (HVAC) and high-voltage direct current (HVDC) by offering the following power supplies:

- JNP-PWR2200-AC

- JNP-PWR2200-DC

- JNP-PWR2200-HV

The MX304 uses either AC, DC, or HVAC/DC power supply modules. The router contains two power supplies at the rear of the chassis in slots **PSM0** through **PSM1**. The AC, DC, or HVAC/DC power supplies directly plug into the midplane and are located symmetrically on the left side of the chassis for better thermal management. Each power supply has a handle, an ejection lever, and a status LED. The power supplies connect to the power adapter board, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements. A minimum of one power supply is required for non-redundant operation. If one power supply in a redundant configuration fails, the second power supply assumes the entire electrical load without interruption. See "MX304 Component Redundancy" on page 14 for more information on power redundancy supported on the AC and DC powered router. Each power supply is cooled by its own internal cooling system. The chassis operates in *1 + 1* PSU redundancy mode. Feed redundancy is not supported.

All of the power supplies are hot-insertable and hot-removable, field-replaceable units (FRUs). The router ships with two power supplies labeled PSU 0 through PSU 1 (top to bottom) in the rear of the chassis. Don't keep the power supply slot empty.

> ⚠️ **CAUTION**: Do not mix AC and DC power supplies in the same chassis. AC and HVAC can coexist in the same chassis during the hot-swap of AC for HVAC. Do not mix AC and HVAC power supplies in a running environment.

MX304 AC Power System Description

The MX304 uses either AC, DC, or HVAC/DC power supply modules (see Figure 19 on page 31).

Redundant power supplies are hot-removable and hot-insertable. When you remove a power supply from a router that uses only one power supply, the router might shut down depending on your configuration.

> ⚠️ **CAUTION**: Do not mix AC, DC, or HVAC/DC power supplies in the same chassis.

> **⚠ CAUTION**: Before you begin installing the router, ensure that a licensed electrician has attached an appropriate grounding lug to the grounding cable that you supply. Using a grounding cable with an incorrectly attached lug can damage the router.

> **⚠ CAUTION**: You can prevent AC power cables from being exposed to hot air exhaust by always routing the power cables away from the fan trays and power supplies.

Each inlet requires a dedicated AC power feed and a dedicated customer-site circuit breaker. We recommend that you use a minimum 16 A customer-site circuit breaker, or as required by local code.

Each AC power supply weighs approximately 2.42 lb (1.1 kg) and consists of a handle, an ejector lever, an AC appliance inlet, a fan, and an LED to monitor the status of the power supply. Figure 19 on page 31 shows the power supply. Each inlet requires a dedicated AC power feed and a dedicated customer-site circuit breaker.

Figure 19: AC Power Supply
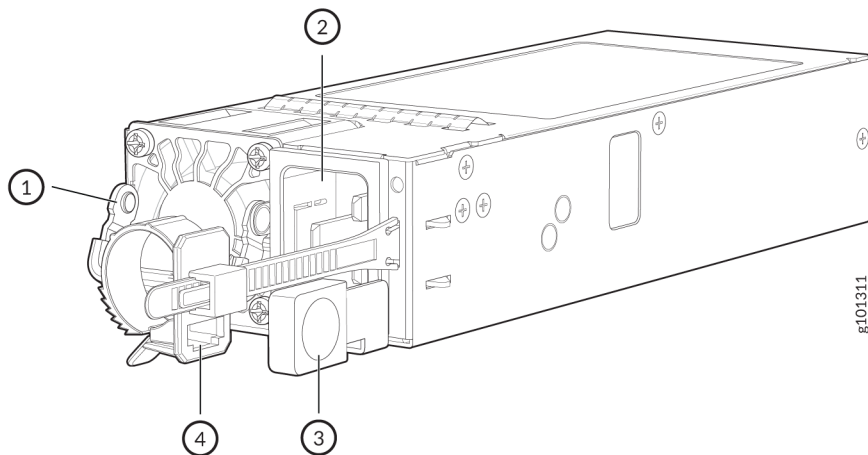
1– Handle	3– Ejector lever
2– AC inlet plug	4– Power cord retainer

MX304 AC Power Supply Module LEDs

shows the AC power supplies components along with the status LED.

Figure 20: AC Power Supplies Components
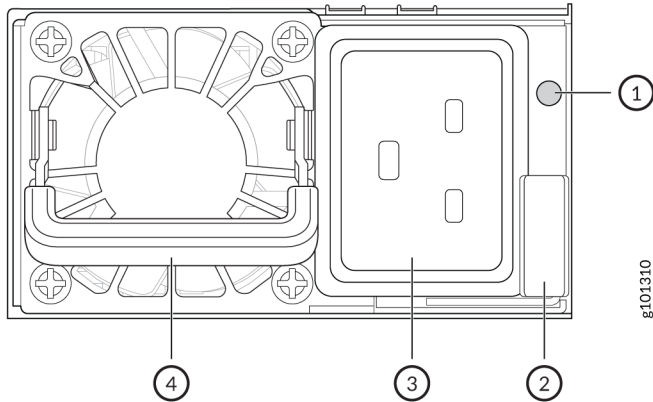
1– Status LED	3– AC inlet plug
2– Ejector lever	4– Handle

Table 13: Power Supply Module LEDs

Label	Color	State	Description
STATUS	Green	Blinking (1Hz)	Power supply is in standby state
		Blinking (2Hz)	Power supply firmware is updating
		On steadily	Output is ON and OK
	Amber	On steadily	Power supply is faulty and not functioning normally; failure, overcurrent, short circuit, over voltage, fan failure, or over temperature
		Blinking (1Hz)	AC cord is unplugged or AC power is lost

Table 13: Power Supply Module LEDs *(Continued)*

Label	Color	State	Description
			Power supply warning events where the power supply continues to operate; high temperature or high power
	Off		No AC power to all the power supply

SEE ALSO

Routine Maintenance Procedures for MX304 Routers | 126

MX304 DC Power System Description

IN THIS SECTION

- MX304 DC Power System Description | 33

MX304 DC Power System Description

Each DC power supply weighs approximately 2.42 lb (1.1 kg) and consists of a handle, an ejector lever, a status LED, and a terminal block that provides a single DC input (–48/–60 VDC and return). The DC power supply requires a dedicated customer-site circuit breaker. We recommend that you use a dedicated customer-site circuit breaker rated for 60 A (60 VDC), or as required by local code.

> ⚠️ **CAUTION**: Do not mix AC, DC, or HVAC/DC power supplies in the same chassis.

Figure 21 on page 34 shows the power supply.

Figure 21: DC Power Supply
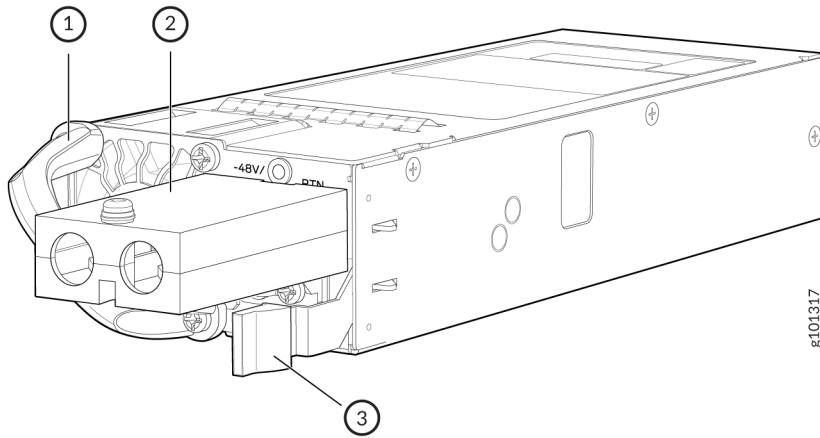
1– Handle	3– Ejector lever
2– DC inlet cable lug point	

MX304 DC Power Supply Module LEDs

Figure 22 on page 34 shows the DC power supplies components along with the status LED.

Figure 22: DC Power Supply Components
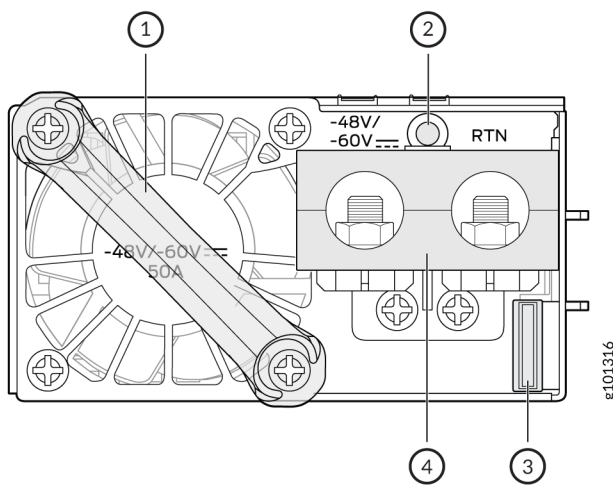
1– Handle	3– Ejector lever
2– Status LED	4– DC inlet cable lug point

Table 14: Power Supply Module LEDs

Label	Color	State	Description
STATUS	Green	Blinking (1Hz)	Power supply is in standby state.
		Blinking (2Hz)	Power supply firmware is updating.
		On steadily	Output is ON and OK.
	Amber	On steadily	Power supply is faulty and not functioning normally; failure, overcurrent, short circuit, over voltage, fan failure, or over temperature. DC cord is unplugged or DC power is lost.
		Blinking (1Hz)	Power supply warning events where the power supply continues to operate; high temperature or high power.
	Off		No DC power to both the power supplies.

MX304 High-Voltage AC/DC Universal System Power Description

The MX304 uses either AC, DC, or HVAC/DC power supply modules (see Figure 23 on page 36).

Redundant power supplies are hot-removable and hot-insertable. When you remove a power supply from a router that uses only one power supply, the router might shut down depending on your configuration.

CAUTION: Do not mix AC, DC, HVAC/DC power supplies in the same chassis.

Each HVAC/DC power supply weighs approximately 2.42 lb (1.1 kg) and consists of a handle, an ejector lever, an AC anderson inlet, a fan, and an LED to monitor the status of the power supply. Figure 23 on page 36 shows the power supply.

Each inlet requires a dedicated HVAC or HVDC power feed and a dedicated customer-site circuit breaker. We recommend that you use a minimum 16-A customer-site circuit breaker, or as required by local code.

> ⚠ **WARNING**: The router is a pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for M6 hex screws) 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.

Figure 23: High-Voltage AC/DC Universal Power Supply
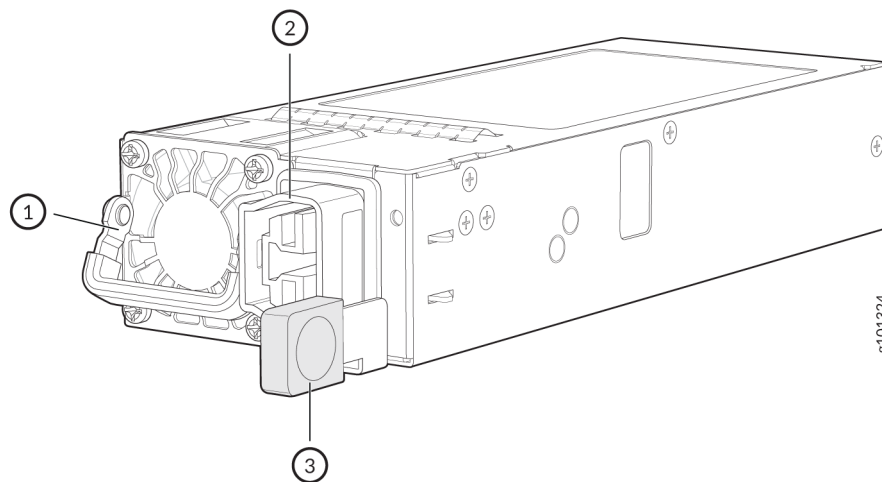
1–	Handle	3–	Ejector lever
2–	AC/DC inlet plug		

MX304 High-Voltage Universal Power Supply Module LEDs

shows the HVAC/HVDC power supplies components along with the status LED.

Figure 24: High-Voltage Universal Power Supply Components
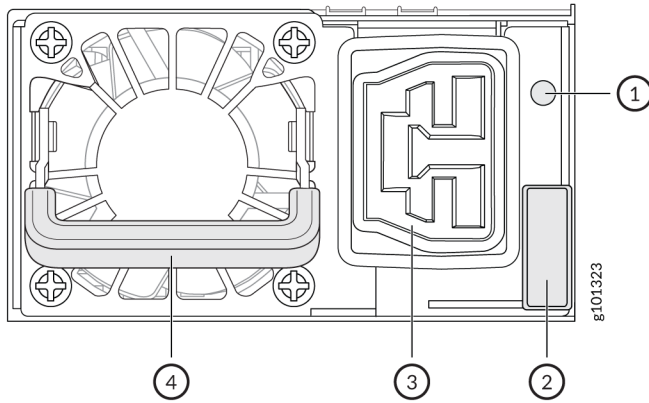
1–	Status LED	3–	HVAC/DC inlet
2–	Ejector lever	4–	Handle

Table 15: Power Supply Module LEDs

Label	Color	State	Description
STATUS	Green	Blinking (1Hz)	Power supply is in standby state.
		Blinking (2Hz)	Power supply firmware is updating.
		On steadily	Output ON and OK.
	Amber	On steadily	Faulty and not functioning normally; failure, overcurrent, short circuit, over voltage, fan failure, or over temperature. HVAC/HVDC cord unplugged or power lost.
		Blinking (1Hz)	Power supply warning events where the power supply continues to operate; high temperature or high power.
	Off		No HVAC or HVDC power to both the power supplies.

MX304 Routing Engine

MX304 Routing Engine Description

The MX304 host subsystem consists of up to two Routing Engines. The host subsystem provides routing protocol processes, as well as software processes that control the router's interface, the chassis components, system management, and user access to the router. A redundant system would host two Routing Engine cards, one being the primary and the other, the backup. The MX304 Routing Engine is a hot-swappable FRU and has front panel interfaces. You can install one or two Routing Engines on the router. The Routing Engine processor runs routing protocols and software daemons for chassis and FRU management.

NOTE: Install two Routing Engines for redundant protection. If you install only one Routing Engines, you can install it in slot **0** or slot **1**. By default, slot **0** functions as the primary.

CAUTION: If one of the Routing Engine fails, do not remove the failed Routing Engine until you have a replacement or blank panel to install.

The MX304 router supports JNP304-RE.

This topic covers:

Routing Engine Functions

Each Routing Engine supports:

- Intel Icelake Based Multicore Processor CPU.

- Four DDR-4 DIMM slots, on two double data rate (DDR) channels with ECC support.

- Default configuration of 4x32-GB DDR4 RAM for a maximum capacity of 128 GB.

- Two SSDs (2x200GB). Provides storage for redundant software images, configuration files, log files etc. Supports M.2 SATA SSDs

- One USB port on the front panel supporting USB 3.0.

- One 10/100/1000 BASE-T RJ45 management port.

- One RJ45 serial console port.

- Trusted platform module (TPM) 2.0 cryptographically downloads the image and avoids hardware tampering.

- Secure boot.

- Real time clock with battery backup and facility to monitor battery.

Routing Engine Front Panel

shows the front panel of the MX304 Routing Engine (model number: JNP304-RE).

Figure 25: JNP304-RE Ports
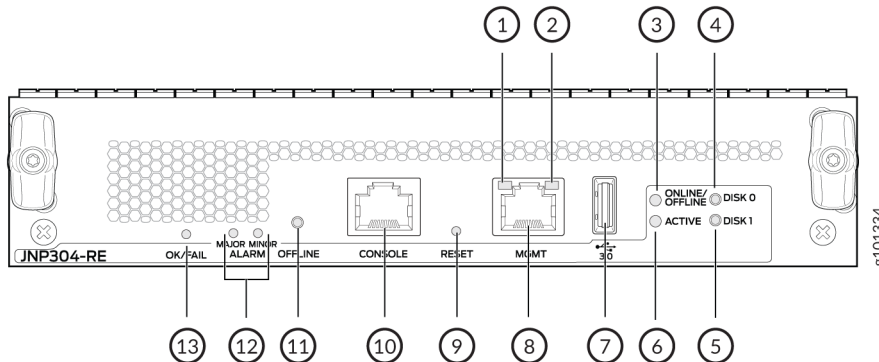
1– Management (MGMT) port link activity LED	8– Management (MGMT) port
2– Management (MGMT) port status LED	9– Reset button
3– Offline and Online LED	10– Console port
4– Disk 0 LED	11– Offline button
5– Disk 1 LED	12– Major and Minor Alarm LED
6– Active LED	13– OK/Fail LED
7– USB port	

The MX304 router with JNP304-RE-LT-R supports only Junos Limited image. The Junos Limited image does not have data-plane encryption and is intended only for countries in the Eurasian Customs Union because these countries have import restrictions on software containing data-plane encryption. Unlike the Junos worldwide image, the Junos Limited image supports control plane encryption through Secure Shell (SSH) and Secure Sockets Layer (SSL), thus allowing secure management of the system. The Limited Restriction **Routing Engines** boots only the encryption free Junos software and fails to boot if the fully encrypted Junos software is used for booting. The Junos upgrade and VMHost upgrade using non-limited version of Junos software fails on the JNP304-RE-LT-R.

The command `show chassis hardware [models | clei-models | extensive]` displays the model number and helps identifying the different SKUs.

Routing Engine Interface Ports

The ports located on the Routing Engine connect the Routing Engine to one or more external devices on which system administrators can issue Junos OS CLI commands to manage the router.

The Routing Engine interface ports with the indicated labels function are as follows (see):

- **CONSOLE**—Connects the Routing Engine to a system console through a serial cable with an RJ-45 connector.

- **MGMT**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support 10 Mbps, 100 Mbps, or 1000 Mbps connections. Two small LEDs (a link activity LED and a status LED) on the port indicate the connection in use.

- **USB**—Provides a removable media interface through which you can install Junos OS manually. Junos OS supports USB version 1.0 and later.

MX304 Routing Engine LEDs

The Routing Engine is an integrated board and a single FRU that provides Routing Engine functionality.

The LEDs—labeled **OK/FAIL**, **MAJOR/MINOR ALARM**, **MGMT**, **OFFLINE/ONLINE**, **ACTIVE**, **DISK 0/ DISK 1**—are located directly on the faceplate of the Routing Engine. Table 16 on page 41 describes the functions of the Routing Engine interface.

> **NOTE**: The functioning of the MX304 router is controlled by the Routing Engine, and the LEDs present on the Routing Engine displays the status and functioning of the MX304 chassis.

Table 16: MX304 Routing Engine LEDs

Label	Color	State	Description
OK/FAIL	Red	On steadily	Routing Engine fault condition.
	Green	On steadily	Operating okay.
	Off		Offline.
MAJOR ALARM	Red	On steadily	Major alarm is active.
	Off		No alarm.
MINOR ALARM	Amber	On steadily	Minor alarm is active.
	Off		No alarm.

Table 16: MX304 Routing Engine LEDs *(Continued)*

Label	Color	State	Description
MGMT (Status LED)	Off	Off	Link down.
	Yellow	On steadily	Link up in 10 Mbps/100 Mbps.
	Green	On steadily	Link up in 1000 Mbps.
MGMT (Link Activity LED)	Green	Blinking	Link up, activity.
ONLINE/ OFFLINE	Green	On	Routing Engine is on and working okay.
	Off	Off	Offline
	Green	Blinking	Routing Engine is starting Junos OS.
ACTIVE	Green	On	Routing Engine is active (primary).
	Off		Routing Engine is redundant.
DISK 0	Green	Blinking	Activity is present.
	Off		No activity.
DISK 1	Green	Blinking	Activity is present.
	Off		No activity.

MX304 Line-card MICs (LMICs)

IN THIS SECTION

MX304 LMIC (FRU)

Figure 26: MX304-LMIC16-BASE
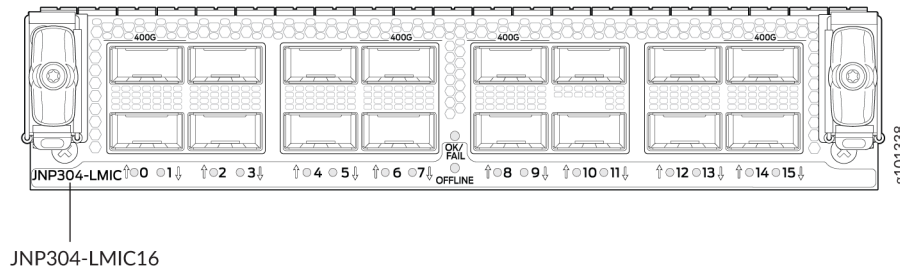
JNP304-LMIC16

Description

- Weight: 6.17 lb (2.8 kg).

- Model number: MX304-LMIC16-BASE.

- Power requirement:

  Approximately 410 W at 46°C, with 16x100GbE ports with each transceiver at 5 W each.

  Approximately 386 W at 25°C, with 16x100GbE ports with each transceiver at 5 W each.

- Name in the CLI: Slot 0: PIC 0, PIC 1 (MRATE LC-MIC 16x100G/4x400G).

Hardware features	• Support maximum data throughput of 1.6 TB ingress and 1.6 TB egress. It has a single YT ASIC which internally has two slices of 800 Gbps Packet Forwarding Engines. • Supports 400GbE and 100GbE interface speeds. • Supports a mix of 100GbE and 400GbE transceivers. • 1588 Class-c support. • Supports MACsec on all 16 ports.
Software features	• Flexible PIC/Port mode configuration for 400G/100G/40G/10G speeds. • Supports Routing Engine redundancy. • FIPS certified Platform • *Dynamic Power Management* for effective utilization of available power. • *Inline Active Flow Monitoring* for higher scalability and performance. • *Flexible Queuing Mode* to supports up to 128,000 queues per LMIC or 384,000 queues per system. • *Hyper Mode* to speed up packet processing. • Supports Agile licensing model. • Optical diagnostics and related alarms.
Cables and connectors	**TIP**: See the Hardware Compatibility Tool for information about the pluggable transceivers for your Juniper Networks device.

Table 17 on page 45 summarizes the port speed capability of MX304 LMICs. Figure 27 on page 45 shows the ports that support 4x400GbE.

Table 17: MX304 LMIC (Multi-Rate) Port Speed

LMIC	Port Number	Port Speed Supported
PIC 0	0-15	16X100GbE. 4x400GbE on ports 0, 6, 8, and 14. **NOTE**: Ports 0, 2, 4, 6, 8, 10, 12 and 14 support 100G optics upto 11 W, and ports 1, 3, 5, 7, 9, 11, 13 and 15 support 100G optics upto 6 W. Only ports 1, 3, 5, 7, 9, 11, 13 and 15 support 4x1G, 40G, 4x10G, and 4x25G operation.
PIC 1	0-15	16X100GbE. 4x400GbE on ports 0, 6, 8, and 14. **NOTE**: Ports 0, 2, 4, 6, 8, 10, 12 and 14 support 100G optics upto 11 W, and ports 1, 3, 5, 7, 9, 11, 13 and 15 support 100G optics upto 6 W. Only ports 1, 3, 5, 7, 9, 11, 13 and 15 support 4x1G, 40G, 4x10G, and 4x25G operation.
PIC 2	0-15	16X100GbE. 4x400GbE on ports 0, 6, 8, and 14. **NOTE**: Ports 0, 2, 4, 6, 8, 10, 12 and 14 support 100G optics upto 11 W, and ports 1, 3, 5, 7, 9, 11, 13 and 15 support 100G optics upto 6 W. Only ports 1, 3, 5, 7, 9, 11, 13 and 15 support 4x1G, 40G, 4x10G, and 4x25G operation.

Figure 27: MX304 LMIC (Multi-Rate) Port Speed
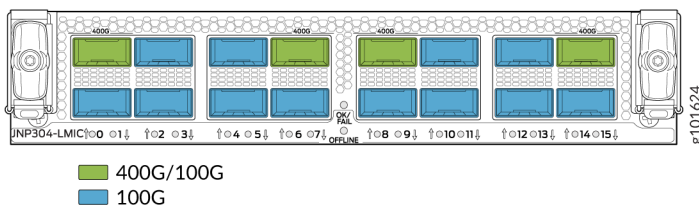
MX304 Port and Interface Numbering

In the physical part of the interface name, a hyphen (-) separates the media type from the *MPC* number (represented as an `FPC` in the CLI), and a slash (/) separates the logical PIC and port numbers:

type-fpc/pic/port

- *type*—Media type, which identifies the network device. For example:

  - xe—10GbE interface

  - et—100GbE interfaces (40GbE, 100GbE, 400GbE)

- *fpc*—The CLI displays `FPC 0` for all the LMICs.

- *pic*—Logical PIC on the LMIC.

- *port*—Port number.

MX304 LMIC LEDs

describes the link LEDs on the MX304 LMIC (multi-rate) front panel.

Table 18: MX304 LMIC LEDs

LED Status	Color	State	Description
OK/FAIL	Green	On steadily	LMIC is functioning normally, and the link is up.
	Red	-	LMIC has failed.
	Amber/ Blinking		LMIC is transitioning.
	Off		LMIC is plugged-in but not powered on.
OFFLINE	Off	-	LMIC is offline.

MX304 LMIC Port LEDs

Table 19 on page 47 describes the link LEDs for the LMIC ports on the MX304 front panel.

Table 19: LMIC Port LEDs

Color	State	Description
Green	On steadily	No breakout, port is up. Breakout, all lanes in that port are up.
Red	On steadily	Optics transceiver hardware failure.
Amber	On steadily	Any other fault except LOS and transceiver hardware failure.
Off		Pluggable not inserted. No breakout; Loss of signal detected. Breakout; Loss of signal on all lanes.

3

CHAPTER

Site Planning, Preparation, and Specifications

MX304 Site Preparation Checklist

The checklist in Table 20 on page 49 summarizes the tasks you must perform before you install your router.

Table 20: MX304 Site Preparation Checklist

Item or Task	For More Information
Environment	
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"MX304 Router Environmental Specifications" on page 51
Power	
Locate sites to use for grounding the system.	"MX304 Router Grounding Specifications" on page 52
Measure the distance between external power sources and the router installation site.	"MX304 Router AC Power Specifications" on page 67 "MX304 Router High-Voltage AC/DC Power Specifications" on page 69 "MX304 Router DC Power Specifications" on page 68
Calculate the power consumption and requirements.	"Calculating Power Requirements for MX304 Router" on page 64
Rack	
Select the type of rack or cabinet.	"Install the MX304 Router in a Four-Post Rack" on page 90 "Install the MX304 Router in a Two-Post Rack" on page 93
Plan where you want to locate the rack or cabinet, including the required space clearances.	"MX304 Router Rack Requirements" on page 59 "MX304 Router Cabinet Requirements and Specifications" on page 61

Table 20: MX304 Site Preparation Checklist *(Continued)*

Item or Task	For More Information
If you're installing the router in a rack, secure the rack to the floor and building structure.	"MX304 Router Cabinet Requirements and Specifications" on page 61
Cables	
Gather cables and connectors: • Determine the number of cables you need based on your configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components you're connecting.	"MX304 Network Cable and Transceiver Planning" on page 77

MX304 Site Guidelines and Requirements

IN THIS SECTION

MX304 Router Environmental Specifications

Refer to for the environmental specifications required for normal router operation. Also, make sure the site is as dust-free as possible.

Table 21: Router Environmental Specifications

Description	Value
Altitude	No performance degradation up to 6,000 ft (1,800 m).
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing.
Temperature	Normal operation ensured in temperature range of 32°F (0°C) through 104°F (40°C). Nonoperating storage temperature in shipping container: –40°F (–40°C) through 158°F (70°C).
Seismic	Designed to meet Telcordia Technologies Zone 4 earthquake requirements.
Maximum thermal output (1200 W) **NOTE**: This specification assumes there are two Routing Engines and two LMICs with 32x 100 Gigabit Ethernet transceivers at 5 W each at 25°C.	1200 W * 3.412 = 4095 BTU/hour.

NOTE: Install the router 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.

MX304 Router Grounding Specifications

Specifications for Grounding Points

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. To ground AC-powered, DC-powered, and HVDC/AC-powered routers, you must connect a grounding cable to earth ground and then attach it to the chassis grounding points by using the two screws provided.

shows the grounding point location on the router.

You need a protective earthing terminal bracket for connecting the chassis to earth ground. This two-holed bracket attaches on the rear of the chassis and provides a protective earthing terminal for the switch. The grounding points are studs sized for M6 hex screws. The accessory kit includes the M6 hex screws with integrated washers. The grounding points are spaced at 0.63-in. (16-mm) centers.

There are two threaded holes on the rear side of the chassis for connecting the router to earth ground. The grounding points fit M6 pan head screws.

NOTE: Additional grounding is provided to an AC-powered router when you plug its power supplies into grounded AC power receptacles.

Figure 28: Grounding Point on the MX304 Router
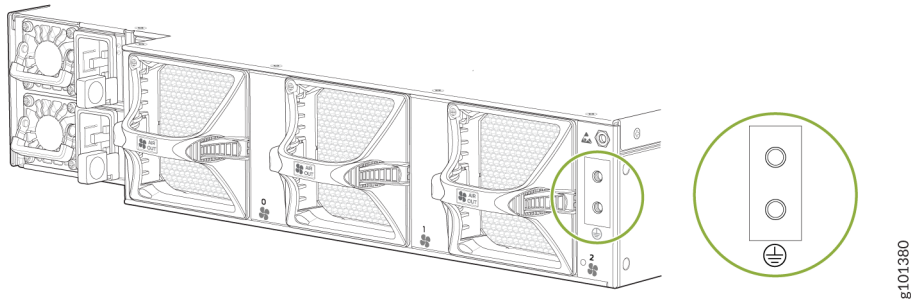
Grounding Cable Lug Specifications

The accessory box shipped with the router includes the grounding lug and the M6 hex screws for securing the grounding cable to the grounding points.

> ⚠️ **CAUTION**: Before you install 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.

Grounding Cable Specifications

The grounding lug required is a Panduit LCD6-14A-L or equivalent (provided). The grounding lug accommodates #6 AWG (4.11 mm²) stranded wire. The grounding cable that you provide for the chassis must be the same size or heavier than the input wire of each power supply. Minimum recommendations are 6 AWG (4.11 mm²) stranded wire, 60°C wire, or as permitted by local code.

Figure 29: Grounding Lug

.25 in. dia.

.48 in.

.63 in.

2.24 in.

.81 in.

.162 in.
#6 AWG

.08 in.

LCD6-14A-L

g101374
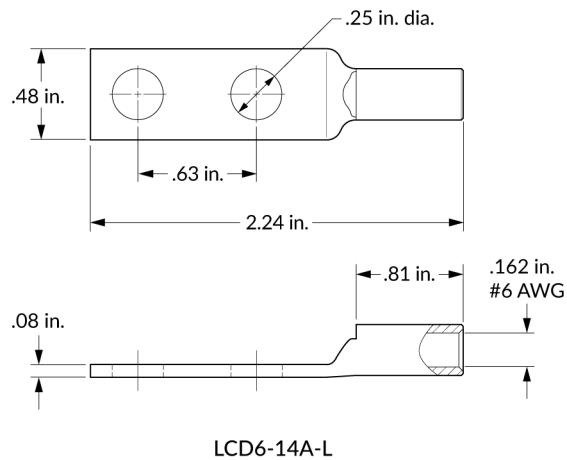
MX304 Router Clearance Requirements for Airflow and Hardware Maintenance

When planning the installation site, allow sufficient clearance around the rack (see):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. Allow at least 6 in. (15.2 cm) of clearance between routers. Allow 2.8 in. (7 cm) between the side of the chassis and any non-heat-producing surface such as a wall.

- For service personnel to remove and to install hardware components, there must be adequate space at the front and back of the router. At least 24 in. (61 cm) are required both in front of and behind the router. It is recommends that you allow at least 30 in. (76.2 cm) in front of the rack and 24 in. (61 cm) behind the router.

- To accommodate power cable bend radius at the rear of the chassis and the interface cable bend radius at the front of the chassis, provide at least 2.75 in. (7 cm) at the rear and 3.5 in. (8.9 cm) at the front.

Figure 30: MX304 Chassis Dimensions and Clearance Requirements (for a Rack Enclosure)
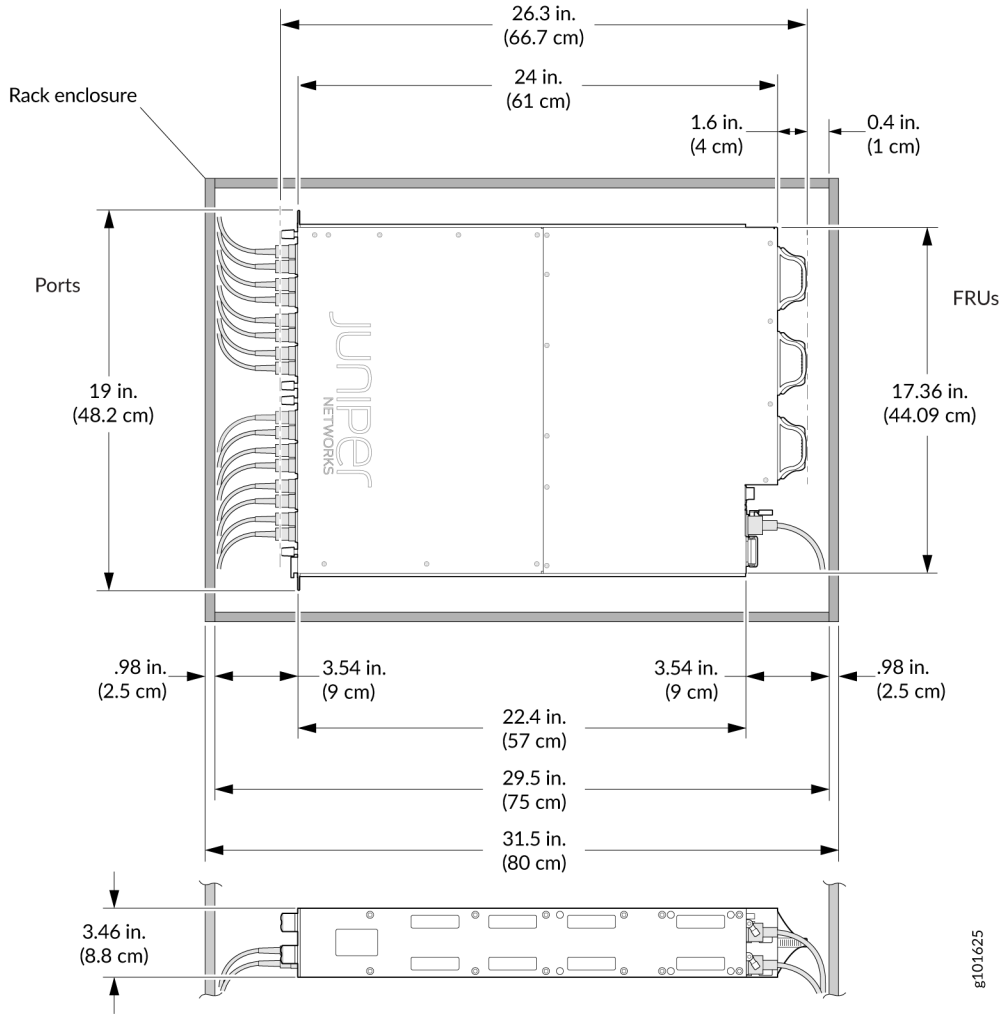
Figure 31: MX304 Clearance Requirements for Airflow
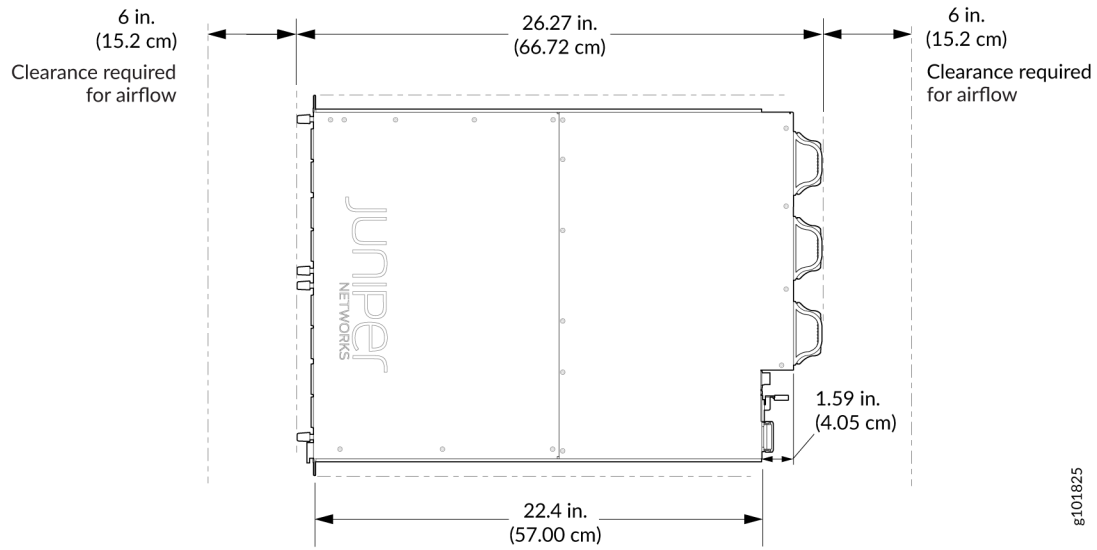
Figure 32: MX304 Clearance Requirements for Maintenance (with the Air Filter and Cover)
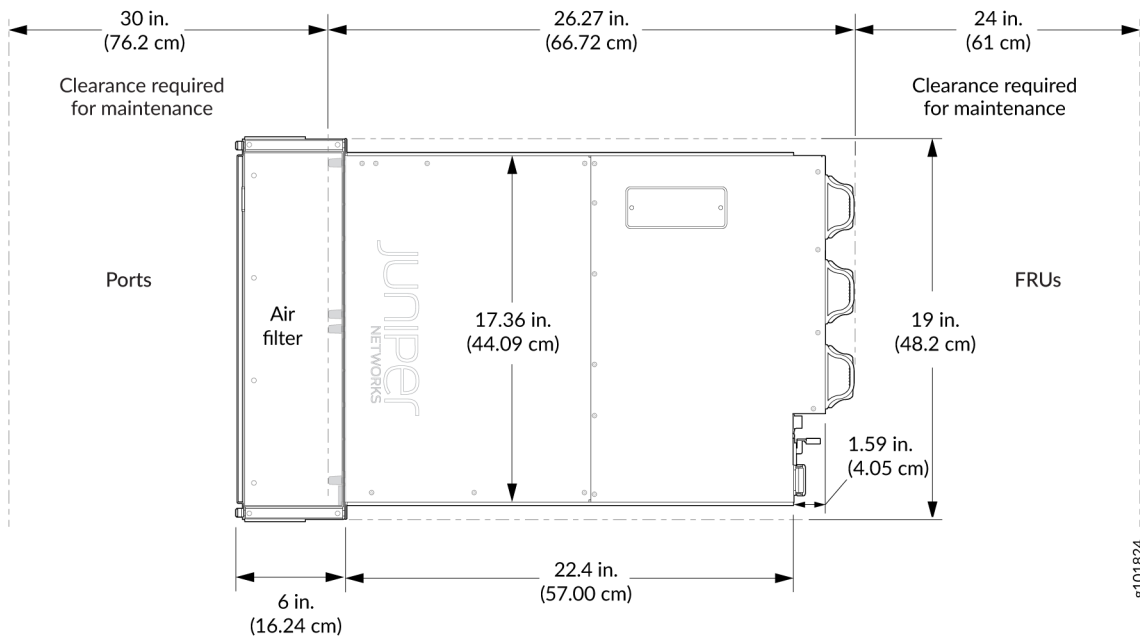
Figure 33: MX304 Clearance Requirements for Maintenance (without the Air Filter and Cover)
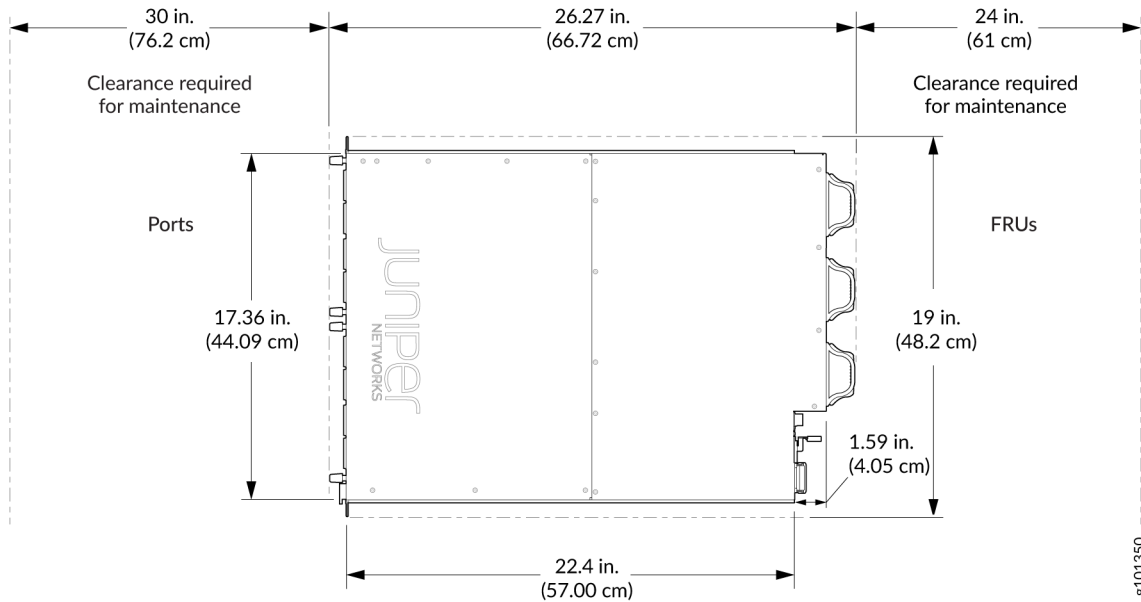
MX304 Router Physical Specifications

Table 22 on page 57 summarizes the physical specifications for the router.

Table 22: Router Physical Specifications

Description	Weight	Width	Depth	Height
Chassis fully loaded with all FRUs (two Routing Engines and two LMICs)	AC-powered chassis: 70.54 lb (32 kg)	17.36 in. (44.08 cm)	30.78 in. (78.2 cm) with the cable management brackets, and handles for fans and power supplies	3.5 in. (8.89 cm; 2 U)
	DC-powered chassis: 70.54 lb (32 kg)	17.36 in. (44.08 cm)	30.78 in. (78.2 cm) with the cable management brackets, air filter unit, and handles for fans and power supplies	3.5 in. (8.89 cm; 2 U)

Table 22: Router Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
	HVAC/DC-powered chassis: 70.54 lb (32 kg)	17.36 in. (44.08 cm)	30.78 in. (78.2 cm) with the cable management brackets,and handles for fans and power supplies	3.5 in. (8.89 cm; 2 U)
Chassis without any FRUs	35.27 lb (16 kg)	17.36 in. (44.08 cm)	24.01 in. (61 cm) without the cable management brackets, air filter unit, and handles for fans and power supplies	3.5 in. (8.89 cm)
LMIC (model number: MX304-LMIC16-BASE;	6.17 lb (2.8 kg)	8.01 in. (20.35 cm)	13.07 in. (33.2 cm)	1.58 in. (4.01 cm)
Routing Engine	3.41 lb (1.55 kg)	8.01 in. (20.35 cm)	8. in. (20.32 cm)	1.58 in. (4.01 cm)
Fan module	1.32 lb (.60 kg)	0.31 in. (0.80 cm)	5.62 in. (14.3 cm)	0.31 in. (0.78 cm)
AC power supply	2.42 lb (1.1 kg)	2.89 in. (7.35 cm)	7.81 in. (19.85 cm)	1.57 in. (4.01 cm)
DC power supply	2.42 lb (1.1 kg)	2.89 in. (7.35 cm)	7.81 in. (19.85 cm)	1.57 in. (4.01 cm)
HVAC/DC power supply	2.42 lb (1.1 kg)	2.89 in. (7.35 cm)	7.81 in. (19.85 cm)	1.57 in. (4.01 cm)
JNP-FLTRDR-2RU	3.25 lb (1.47 kg)	18.9 in. (48.2 cm)	5.31 in. (13.5 cm)	3.46 in. (8.8 cm)
JNP-AIRFLTR-2RU	0.2 lb (0.09 kg)	17.32 in. (44 cm)	0.2 in. (0.60 cm)	0.78 in. (1.98 cm)
JNP304-BLNK	0.9 lb (0.40 kg)	8.01 in. (20.35 cm)	2.79 in. (7.1 cm)	1.58 in. (4.01 cm)
JNP-CABLEMGMT-2RU	1.0 lb (0.45 kg)	0.98 in. (2.5 cm)	5.01 in. (12.75 cm)	3.42 in. (8.70 cm)

> **NOTE**: For router maintenance and to accommodate power cable bend radius, allow at least 30 in. (76.2 cm) in front of the rack and 24 in. (61 cm) behind the router (see "MX304 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 54).

MX304 Router Rack Requirements

The router can be installed in a standard 19-in. rack. Many types of racks are acceptable, including four-post (telco) racks and open-frame racks. Table 23 on page 59 summarizes rack requirements and specifications for the router.

Table 23: Router Rack Requirements and Specifications

Rack Requirement	Guidelines
Rack type and mounting bracket hole spacing	Use a four-post rack. You can mount the router on any four-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75-in./4.44-cm) increments and that meets the size and strength requirements specified in this table. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/).

Table 23: Router Rack Requirements and Specifications *(Continued)*

Rack Requirement	Guidelines
Rack size and strength	- Ensure that the rack is a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/). - Ensure that the rack is one of the following standard lengths: 30.0 in. (762 mm) 31.5 in. (800 mm) - The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions (see "MX304 Router Physical Specifications" on page 57). The outer edges of the mounting brackets extend the width to 19 in. (48.3 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "MX304 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 54. - The router ships with the front-mounting brackets fixed in the front-mount position on the chassis. You can move the rear-mounting brackets based on the depth of the rack. - The chassis height of 3.5 in. (8.89 cm) is approximately 2 U (rack unit). - The rack must be strong enough to support the weight of the fully configured router. - Either end of the router must be mounted flush with the rack and still be adjustable for racks with different depths. The front and rear rack rails must be spaced between 23.6 in. (60 cm) and 31.4 in. (80 cm) front to back. - Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in "MX304 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 54. **NOTE**: The rack must be strong enough to support the weight of the fully loaded router.

Table 23: Router Rack Requirements and Specifications *(Continued)*

Rack Requirement	Guidelines
Rack connection to the building structure	- Secure the rack to the building structure. - If earthquakes are a possibility in your geographic area, secure the rack to the floor. - Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.

MX304 Router Cabinet Requirements and Specifications

summarizes cabinet requirements and specifications for MX304 router.

Table 24: Cabinet Requirements and Specifications for an MX304 Router

Cabinet Requirement	Guidelines for the MX304 Router
Cabinet size and clearance	- The minimum-sized cabinet that can accommodate the router is 19-in. (482-mm) wide, and 30.0-in. (762-mm) deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. If you provide adequate cooling air and airflow clearance, you can stack several routers in a cabinet that has sufficient usable vertical space. Each router requires 2 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronic Components Industry Association (ECIA) (http://www.ecianow.org). - With adequate cooling air and airflow clearance, you can stack multiple MX304 routers in a cabinet with a four-post rack. In all cases, the rack must meet the strength requirements to support the weight. - The minimum total clearance inside the cabinet is 30.7 in. (780 mm) between the inside of the front door and the inside of the rear door.

Table 24: Cabinet Requirements and Specifications for an MX304 Router *(Continued)*

Cabinet Requirement	Guidelines for the MX304 Router
Cabinet airflow requirements	When you install the router in a cabinet, you must ensure that ventilation through the cabinet is sufficient to prevent overheating. Consider the following requirements to when planning for chassis cooling: • Airflow must always be from front to back with respect to the rack. If the device has side to rear airflow, then provisions must be made to ensure that fresh air from the front of the rack is supplied to the inlets, and exhaust exits from the rear of the rack. The device must not interfere with the cooling of other systems in the rack. Fillers must be used as appropriate in the rack to ensure there is no recirculation of heated exhaust air back to the front of the rack. Care must also be taken around cables to ensure no leakage of air in situations where recirculation might result. • Ensure that the cabinet allows the chassis hot exhaust air to exit from 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. For an illustration of chassis airflow, see Figure 34 on page 63. • Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in "MX304 Router Clearance Requirements for Airflow and Hardware Maintenance" on page 54. • Install the router as close as possible to the front of the cabinet so that the chassis just clears the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.

Figure 34: Airflow Through Chassis

Ports

FRUs

g101349

MX304 Power Planning

IN THIS SECTION

Calculating Power Requirements for MX304 Router

Power Requirements for MX304 Components

Table 25 on page 64 displays the power requirements at different ambient temperatures for the router with two routing engines and two LMICs (100-Gigabit Ethernet ports with QSFP28 transceivers on each LMIC).

Table 25: 3.2 Tbps Capacity Configuration with Two Routing Engines and Two LMICs (100-Gigabit Ethernet Ports on each LMIC)

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Routing Engine (RE) (Active)	1	49	59	49	59
Routing Engine (RE) (Standby) approximate	1	49	59	49	59
Switch Fabric Board (SFB) +Control Board(CB) +Processor Mezzanine Board(PMB)	3	155	228	155	228
LMIC + 16x100-Gigabit Ethernet (5 W transceivers)	2	318	410	636	820

Table 25: 3.2 Tbps Capacity Configuration with Two Routing Engines and Two LMICs (100-Gigabit Ethernet Ports on each LMIC) *(Continued)*

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Fans	3	48	90	144	270
Total Chassis Power (W)				1033	1436

displays the power requirements at different ambient temperatures for the router with two routing engines and two LMICs (400-Gigabit Ethernet ports with QSFP-DD transceivers on each LMIC).

Table 26: 3.2T Configuration with Two Routing Engine and Two LMICS (400-Gigabit Ethernet ports on each LMIC)

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Routing Engine (Active)	1	49	59	49	59
Routing Engine (Standby) approximate	1	49	59	49	59
Switch Fabric Board (SFB) +Control Board(CB) +Processor Mezzanine Board(PMB)	3	155	228	155	228
LMIC + 4x400-Gigabit Ethernet (20 W transceivers)	2	318	386	636	772
Fans	3	48	90	144	270

Table 26: 3.2T Configuration with Two Routing Engine and Two LMICS (400-Gigabit Ethernet ports on each LMIC) *(Continued)*

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Total Chassis Power (W)				1033	1388

displays the power requirements at different ambient temperatures for the router with routing engines and three LMICs (100-Gigabit Ethernet Ports with QSFP28 transceivers on each LMIC).

Table 27: 4.8T Configuration with One Routing Engine and Three LMIC (100-Gigabit Ethernet Ports on each LMIC)

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Routing Engine (Active)	1	49	59	49	59
Routing Engine (Standby) approximate	0	49	59	0	0
Switch Fabric Board (SFB) +Control Board(CB) +Processor Mezzanine Board(PMB)	3	185	246	211	246
LMIC + 16x100-Gigabit Ethernet (5 W transceivers)	3	318	410	1029	1230
Fans	3	57	95	225	285
Total Chassis Power (W)				1514	1820

Table 28 on page 67 displays the power requirements at different ambient temperatures for routers with one routing engine and three LMICs (400-Gigabit Ethernet ports with QSFP-DD transceivers on each LMIC).

Table 28: 4.8T Configuration with One Routing Engine and Three LMIC (400-Gigabit Ethernet Ports on each LMIC)

Module	Quantity	Each Module Power (W) @ 25° C	Each Module Power (W) @ 46° C	Total Module Power (W) @ 25° C	Total Module Power (W) @ 46° C
Routing Engine (Active)	1	49	59	49	59
Routing Engine (Standby) approximate	0	49	59	0	0
Switch Fabric Board (SFB) +Control Board(CB) +Processor Mezzanine Board(PMB)	3	185	246	211	246
LMIC + 4x400-Gigabit Ethernet (5W transceivers)	3	318	386	954	1158
Fans	3	57	95	225	285
Total Chassis Power (W)				1439	1748

MX304 Router AC Power Specifications

Table 29 on page 68 lists the AC power system electrical specifications.

Table 29: AC Power Supply Electrical Specifications

Item	Specification
Maximum output power	100V – 120V: 1100W 200V – 240V: 2200W
AC input nominal voltage	100-240 VAC
AC input voltage	Operating range: 90 - 264 VAC
AC input line frequency	47 through 63 Hz (nominal)
AC system current rating	13 A @ 100 VAC through 240 VAC

MX304 Router DC Power Specifications

lists the DC power supply electrical specifications.

Table 30: DC Power Supply Electrical Specifications

Item	Specification
Maximum output power	2200 W
DC input voltage	Minimum: –40 VDC Nominal: –48 VDC, –60 VDC Operating range: –40 through –72 VDC
DC input current rating	50 A maximum

MX304 Router High-Voltage AC/DC Power Specifications

Table 31 on page 69 lists the HVAC/DC power system electrical specifications.

Table 31: HVAC/DC Power Supply Electrical Specifications

Item	Specification
Maximum output power	2200 W
HVAC nominal input	200-277 VAC
HVDC nominal input	240-380 VDC
HV input voltage	HVDC: 190 VDC to 410 VDC HVAC: 180 VAC to 305 VAC
HV input current rating	13 A @ 240 to 380 VDC 13 A @ 200 to 277 VAC

AC Power Cord Specifications for the MX304 Routers

A detachable AC power cord is supplied with the AC power supplies. The coupler is type C19 as described by International Electrotechnical Commission (IEC) standard 60320. The plug end of the power cord fits into the power source outlet that is standard for your geographical location.

Detachable AC power cords are shipped with the AC power supplies. Table 32 on page 70 lists the default power cord that is provided for each country. The plug end of the power cord fits into the power source outlet that is standard for your geographical location.

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

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

gives the AC power cord specifications for the countries and regions listed in the table.

Table 32: MX304 AC Power Supplies
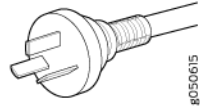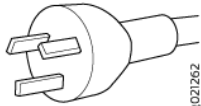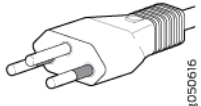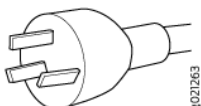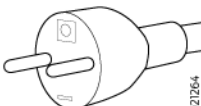
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number	Graphic
Argentina	250 VAC, 16 A, 50 Hz	IRAM 2073	CBL-EX-PWR-C19-AR	
Australia	250 VAC, 15 A, 50 Hz	AS/NZS 3112	CBL-EX-PWR-C19-AU	
Brazil	250 VAC, 16 A, 50 Hz	NBR 14136	CBL-EX-PWR-C19-BR	
China	250 VAC, 16 A, 50 Hz	GB 2099	CBL-EX-PWR-C19-CH	
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 16 A, 50 Hz	CEE (7) 7	CBL-EX-PWR-C19-EU	

Table 32: MX304 AC Power Supplies *(Continued)*
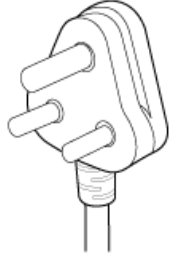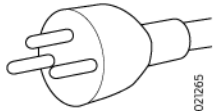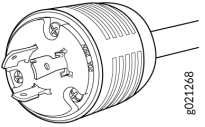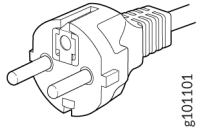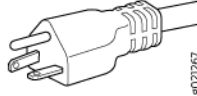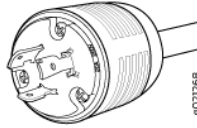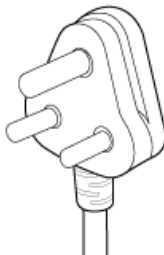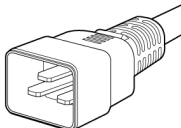
Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number	Graphic
India	250 AC, 16 A, 50 Hz	SABS 164/1:1992 Type ZA/3	CBL-EX-PWR-C19-SA	
Israel	250 AC, 16 A, 50 Hz	SI 32	CBL-EX-PWR-C19-IL	
Italy	250 VAC, 16 A, 50 Hz	CEI 23-16	CBL-EX-PWR-C19-IT	
Japan	250 VAC, 15 A, 50 Hz or 60 Hz	NEMA L6-20	CBL-PWR-C19-HT-JP	
	125 VAC, 15 A, 50 Hz or 60 Hz	NEMA5-15Type N5/15	CBL-EX-PWR-C19-JP110V	
Korea	250 VAC, 16 A, 50 Hz	KC 8305	CBL-EX-PWR-C19-KR	

Table 32: MX304 AC Power Supplies *(Continued)*

Country/Region	Electrical Specifications	Plug Standards	Juniper Model Number	Graphic
North America	250 VAC, 16 A, 60 Hz	NEMA 6-20 Type N6/20	CBL-EX-PWR-C19-US	
	250 VAC, 16 A,60 Hz	NEMA L6-20P Type NEMA Locking	CBL-EX-PWR-C19-USL	
South Africa	250 VAC, 16 A, 50 Hz	SABS 164-1	CBL-EX-PWR-C19-SA	
Switzerland	250 VAC, 16 A, 50 Hz	SEV 5934/2 (Type 23 16A plug)	CBL-EX-PWR-C19-SZ	
United Kingdom	250 VAC, 13 A, 50 Hz	BS 1363(A)	CBL-EX-PWR-C19-UK	
Worldwide (except Japan)	250 VAC, 16 A, 50 Hz	EN 60320-2-2/1	CBL-EX-PWR-C19-C20	

SEE ALSO

DC Power Circuit Breaker Requirements for the MX304 Router

Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated circuit breaker. We recommend that you use a dedicated customer-site circuit breaker rated for 60 A (60 VDC), or as required by local code. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

DC Power Cable Specifications for the MX304 Router

IN THIS SECTION

DC Power Cable Lug Specifications

The accessory box shipped with the router includes the cable lugs that attach to the terminal of each power supply.

The DC power cable lug is provided. The DC power lug accommodates #6 AWG (4.11 mm²) stranded wire. The grounding cable that you provide for the chassis must be the same size or heavier than the input wire of each power supply. Minimum recommendations are 6 AWG (4.11 mm²) stranded wire, minimum 60°C wire, or as permitted by local code.

Install heat-shrink tubing insulation around the power cables at the connection point of the DC power supply terminal.

Figure 35: DC Power Cable Lug
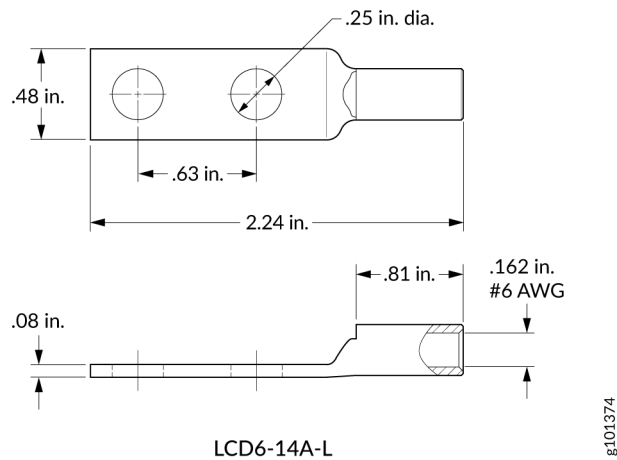
LCD6-14A-L

> **CAUTION**: Before you install 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.

DC Power Cable Specifications

You must supply four DC power cables that meet the following specifications: 6 AWG (4.11 mm²) stranded wire,minimum 60°C wire, or as permitted by local code.

> **NOTE**: Install heat-shrink tubing insulation around the power cables at the connection point of the DC power supply terminal.

SEE ALSO

DC Power Source Cabling for MX304 Router

The DC power supply in **PSM0** must be powered by a dedicated power feed derived from feed **A**, and the DC power supply in **PSM1** must be powered by a dedicated power feed derived from feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system.

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

> ⚡ **WARNING**: For field-wiring connections, use copper conductors only.

> ⚠️ **CAUTION**: Power cords and cables must not block access to device components or drape where people could trip on them.

SEE ALSO

High-Voltage (AC/DC) Power Cable Specifications for the MX304

One end of the cable has an Anderson APP-400 connector, the other end of the cable is bare wire. See Table 33 on page 76 . These cables are separately orderable and are not shipped automatically with power supply orders. An example of the right-angle cable and connector is shown in Figure 37 on page 76 .

For connection to AC systems, Juniper provides a cable with either a NEMA I7-20P connector (see).

Figure 36: NEMA I7-20P Connector
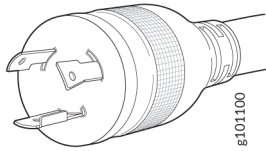
Table 33: 30-A Cabling Options

	Locale	Cord Set Rating	Connector	Spare Juniper Model Number
HVDC power cord	Any	30- A, 400 VAC	Anderson/straight to bare wire	CBL-PWR2-BARE
HVAC power cord	North America	20 A, 277 V	NEMA I7-20P	CBL-JNP-SG4-HVAC

Figure 37: Straight, Bare Cable with Anderson Connector
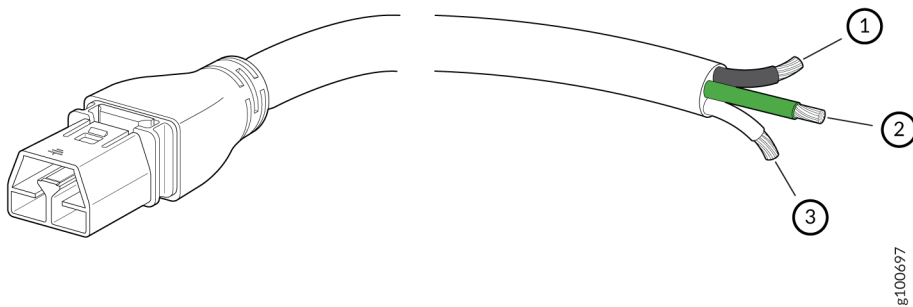
1– Black wire–Return (+)	3– White wire–Neutral
2– Green wire-Ground	

SEE ALSO

MX304 Network Cable and Transceiver Planning

IN THIS SECTION

Calculating Power Budget and Power Margin for Fiber-Optic Cables

IN THIS SECTION

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:

Calculate Power Budget for Fiber-Optic Cables

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

$P_B = P_T - P_R$

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

$P_B = P_T - P_R$

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

$P_B = 13 \text{ dB}$

How to Calculate Power Margin for Fiber-Optic Cables

After calculating a link's P_B, you can calculate the power margin (P_M), which represents the amount of power available after subtracting attenuation or link loss (LL) from the 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 34 on page 78 lists an estimated amount of loss for the factors used in the following sample calculations. For information about the actual amount of signal loss caused by equipment and other factors, refer to vendor documentation.

Table 34: 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

Table 34: Estimated Values for Factors Causing Link Loss *(Continued)*

Link-Loss Factor	Estimated Link-Loss Value
Modal and chromatic dispersion	Single mode—None Multimode—None, if product of bandwidth and distance is less than 500 MHz-km
Faulty connector	0.5 dB
Splice	0.5 dB
Fiber attenuation	Single mode—0.5 dB/km Multimode—1 dB/km

The following sample calculation for a 2-km-long multimode link with a P_B of 13 dB uses the estimated values from . This example calculates 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 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 P_B of 13 dB uses the estimated values from . This example calculates 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 pP_M is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 5.5\ dB$

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

Routing Engine Interface Cable and Wire Specifications for MX Series Routers

Table 35 on page 80 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

Table 35: Cable and Wire Specifications for Routing Engine and Alarm Interfaces

Port	Cable Specification	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	1.83 m	RJ-45 socket
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	100 m	RJ-45 autosensing

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)

- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

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 a higher bandwidth and can carry signals for longer distances.

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

Attenuation and Dispersion in Fiber-Optic Cable

Correct functioning of an optical data link depends on modulated light reaching the receiver with enough power to be demodulated correctly. *Attenuation* is the reduction in power of the light signal as it is transmitted. Attenuation is caused by passive media components such as cables, cable splices, and connectors. Although attenuation is significantly lower for optical fiber than for other media, it still occurs in both multimode and single-mode transmission. An efficient optical data link must have enough light available to overcome attenuation.

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

- Chromatic dispersion—Spreading of the signal over time, resulting from the different speeds of light rays.

- Modal dispersion—Spreading of the signal over time, resulting from the different propagation modes in the fiber.

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

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

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

MX304 Management and Console Port Specifications and Pinouts

IN THIS SECTION

RJ-45 Connector Pinouts for MX Series Routing Engine and Console Ports

The port labeled— **CONSOLE**—on the routing engine is an asynchronous serial interface that accept an RJ-45 connector. The port connects the Routing Engine to an auxiliary or console management device. Table 36 on page 83 describes the RJ-45 connector pinout.

Table 36: RJ-45 Connector Pinout for the CONSOLE Ports

Pin	Signal	Description
1	RTS	Request to Send
2	DTR	Data Terminal Ready
3	TXD	Transmit Data
4	Ground	Signal Ground
5	Ground	Signal Ground
6	RXD	Receive Data
7	DSR/DCD	Data Set Ready
8	CTS	Clear to Send

RJ-45 Connector Pinouts for an MX Series Routing Engine Management Port

The port on Routing Engine labeled **MGMT** is an autosensing 10/100/1000-Mbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management).

describes the RJ-45 connector pinout.

Table 37: RJ-45 Management Port Connector Pinouts for the Routing Engine MGMT Port

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

Table 37: RJ-45 Management Port Connector Pinouts for the Routing Engine MGMT Port *(Continued)*

Pin	Signal	Description
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

4

CHAPTER

Initial Installation and Configuration

MX304 Installation Overview

To install the router:

1. Prepare your installation site.

   See "MX304 Site Preparation Checklist" on page 49.

2. Review the safety guidelines and warnings:

   - See "General Safety Guidelines and Warnings" on page 206.

   - See "General Safety Warnings for Juniper Networks Devices" on page 208.

3. Unpack the router and verify the parts:

   a. See "Unpack the MX304 Router" on page 87.

   b. See "Verify the MX304 Router Parts Received" on page 88.

4. (*Optional*) Remove components from the MX304 router chassis before installing it in a rack.

   See these individual topics listed in for removing components.

5. Install the router onto the rack.

   See "Install the MX304" on page 90.

6. (*Optional*; Required only if you have removed the components from the router in step 4) reinstall components in the MX304 router after installing the chassis in a rack.

   See individual topics for installing components.

   - "Maintain MX304 Cooling System Components" on page 126

   - "Maintain MX304 Power System Components" on page 138

   - "Maintain the MX304 Routing Engine" on page 187

   - "Maintain MX304 Interface Modules" on page 150

7. Connect cables to the network and external devices.

   See "Connect the MX304 Router to External Devices and Cables" on page 107.

8. Connect the grounding cable.

   See "Ground the MX304 Router" on page 97.

9. Connect the AC power cord, DC power cables, or HVAC/DC power cables:

   - "Connect Power to an AC-Powered MX304 Router" on page 99

   - "Connect Power to a DC-Powered MX304 Router" on page 101

   - "Connect Power to an HVAC/DC Powered MX304 Router" on page 105

10. Power on the router:

- See .

11. Perform the initial system configuration.

   See .

Tools and Parts Required to Unpack the MX304 Router

To unpack the router and prepare for installation, you need the following tools:

- Phillips (+) screwdriver, number 1, 2, and 3

- Blank panels to cover any slots not occupied by a component

Unpack the MX304 Router

The router ships in a cardboard carton with foam packing material. The carton also contains an accessory box and a pointer card with links to the quick start instructions.

> **NOTE**: The router is maximally protected inside the shipping carton. Do not unpack it until you are ready to begin installation.

To unpack the 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 router.
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 parts inventory on the label attached to the carton.
5. Pull out the packing material holding the router in place.
6. Verify the contents of the carton against the packing list included with the router.
7. Save the shipping carton and packing materials in case you later need to move or ship the router.

Verify the MX304 Router Parts Received

Check the parts in the shipment against the items on the packing list. The packing list specifies the part numbers and descriptions of each part in your order.

If any part is missing, contact a customer service representative.

A fully-configured router contains the router chassis with installed components ( ), and an accessory box, which contains the parts listed in . The parts shipped with your router can vary depending on the configuration you ordered.

Table 38: Parts List for a Fully-Configured Router

Component	Quantity
Chassis	1
JNP304-RE (Base) or JNP304-RE-LT (Limited Encryption)	1 or 2
MX304-LMIC16-BASE	2 or 3
AC, DC, or HVAC/DC power supply	2
Fan module	3
AC power cables (for AC power supply orders)	2
Blank panel for slots without components installed	One blank panel for each slot not occupied by a component.

Table 39: Accessory Box Parts List

Part	Quantity
3 in. x 5 in. pink bag	2
9 in. x 12 in. pink bag, ESD	2

Table 39: Accessory Box Parts List *(Continued)*

Part	Quantity
Chassis mounting screws (M5)	8
ESD wrist strap with cable	1
SFP transceiver dust cover	1
QSFP transceiver dust cover	0-48 (16 per LMIC)
Cable manager brackets	2
Cable manager screws	4
Ground lug	1
Ground lug screws	2
DC terminal lugs (for DC power supply orders)	4
Documentation Roadmap card	1

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)

- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

Install the MX304

Tools Required to the Install MX304 Router in a Rack

To install the router, you need the following tools and parts:

- Phillips (+) screwdriver, number 2

- ESD grounding wrist strap

SEE ALSO

MX304 Site Preparation Checklist | **49**

Install the MX304 Router in a Four-Post Rack

Here's how to install the router in a four-post rack or a cabinet:

> **NOTE**: The four-post mounting kit (JNP304-4PST-RMK) is included with the MX304. If the four-post kit is lost, you can order a replacement.

> ⚠ **CAUTION**: If you're installing more than one router in a rack, install them from the bottom up.

> **CAUTION**: Before front-mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

> **CAUTION**: Lifting the chassis and mounting it in a rack requires two people (one person to hold the router in place and a second person to install the screws). A fully loaded AC-powered, DC-powered, HVAC/DC-powered router weighs up to 70.54 lb (32 kg).

1. Position the router in front of the four-post rack or the cabinet.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and to a site ESD point.

3. (Optional) Install the cable management brackets on each side of the front of the chassis, and secure each bracket with screws at the bottom and top of the bracket as shown below:

Figure 38: Install the Cable Manager
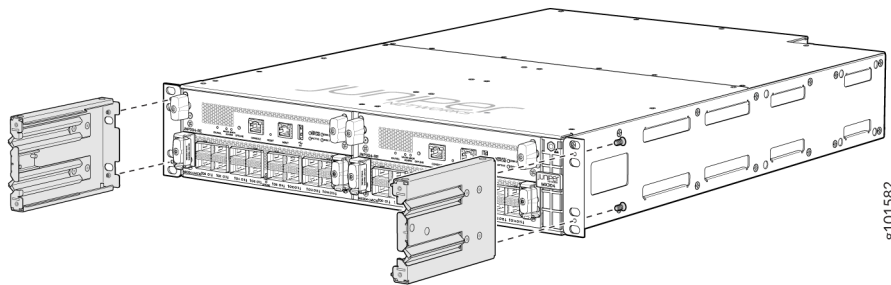
4. With one person holding on to each side of the chassis, carefully lift the bottom of the chassis so that rack mounting brackets (with optional cable management brackets) contact the rack rails.

5. Attach the chassis to the front of the rack as shown below: .

Figure 39: Attach the Chassis to the Rack Front Posts
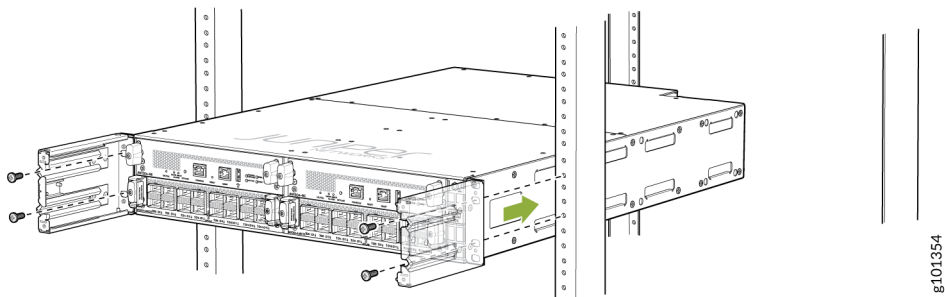
6. On the rear of the chassis, slide the rear-mounting brackets on both sides of the chassis until they contact the rack rails. Starting from the bottom of the rack, insert the mounting screws through the mounting brackets and mounting holes on the rack and tighten them. See Figure 40 on page 92.

Figure 40: Attach the Rear Brackets
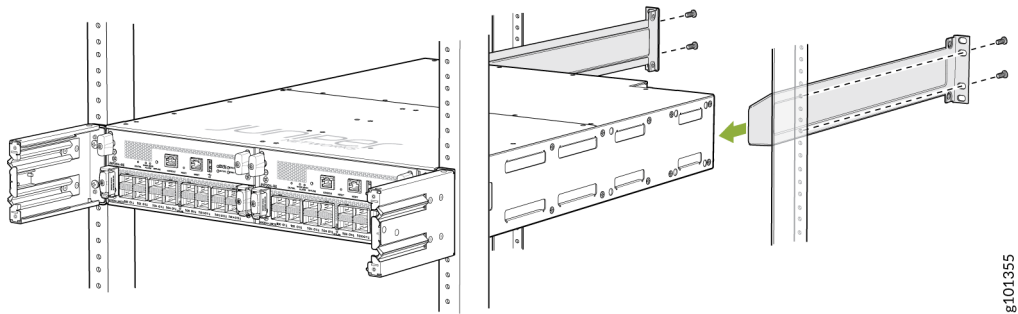
7. Verify that the mounting screws on each side of the rack are aligned and the router is level.

Figure 41: Secure the Chassis in the Rack
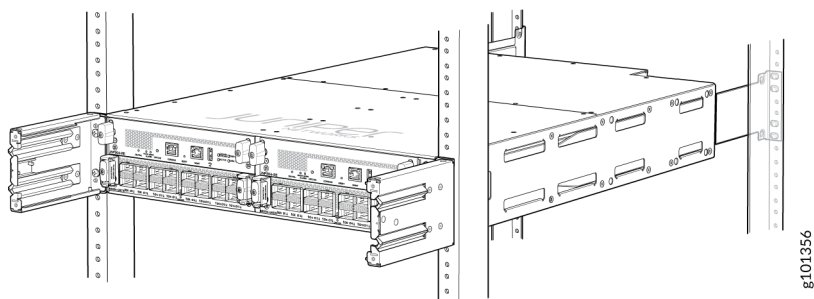
8. (Optional) Secure the front cover with the air filter to the chassis. Tighten the four screws turning them clockwise. See Figure 42 on page 93.

Figure 42: Installing the Cover with the Air Filter
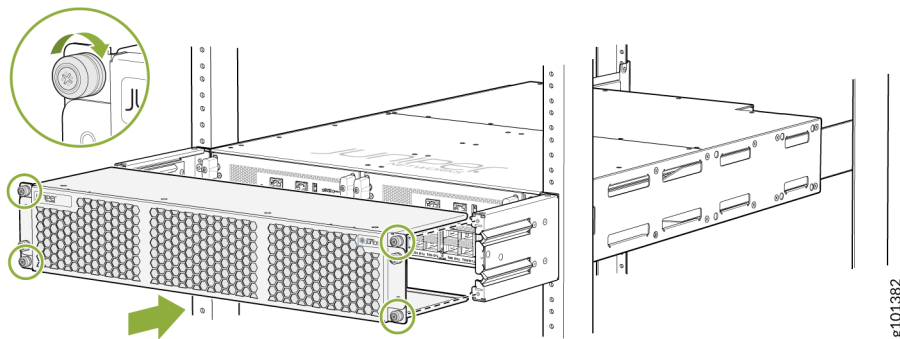
Install the MX304 Router in a Two-Post Rack

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

> **NOTE**: The two-post mounting kit is not included with the chassis. You can order the two-post kit (JNP304-2PST-RMK).

> ⚠️ **CAUTION**: If you are installing more than one router in a rack, install the lowest one first.

> ⚠️ **CAUTION**: Before front-mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

> ⚠️ **CAUTION**: Lifting the chassis and mounting it in a rack requires two people (one person to guide the router in place and a second person to install the screws). A fully loaded AC-powered, DC-powered, HVAC/DC-powered router weighs up to 70.54 lb (32 kg).

1. Position the router in front of the two-post rack or the cabinet.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and to a site ESD point.

3. Remove the mounting bracket that is preinstalled on the chassis. See .

Figure 43: Remove the Preinstalled Bracket
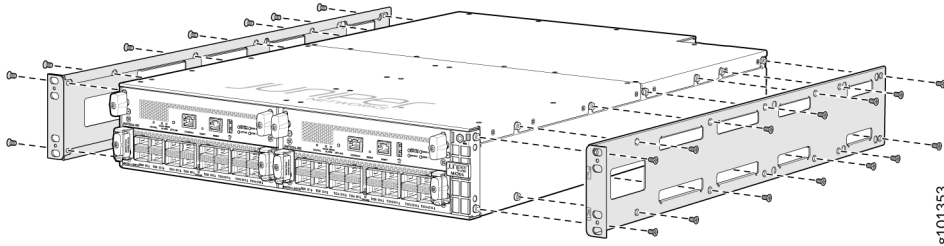
4. Align the holes in the mounting bracket with the screw holes on the side of the chassis. Attach the mounting bracket to the device by using the mounting screws. Tighten the screws. See .

Figure 44: Attach the 2-Post Brackets
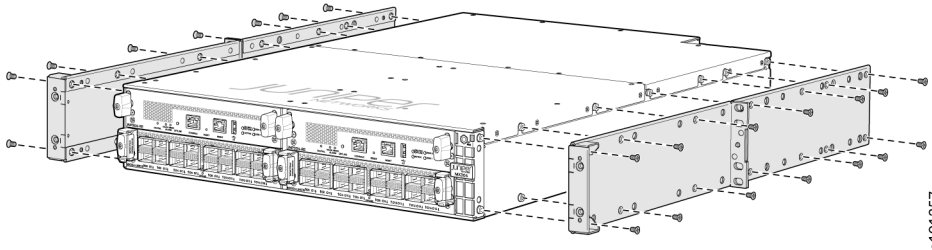
5. Repeat the steps on the opposite side of the device.

6. Install the cable management brackets on each side of the chassis, and secure each bracket with screws at the bottom and top of the bracket.

Figure 45: Attach the Cable Manager
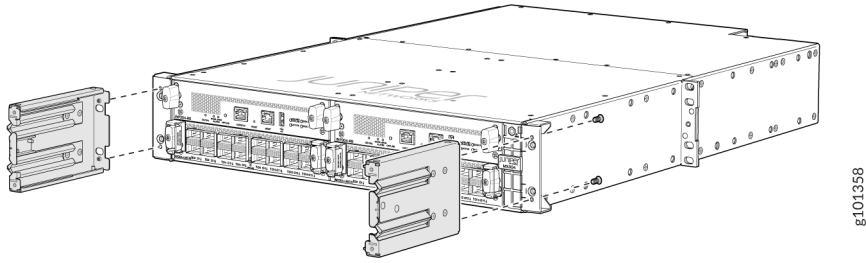
7. Have one person grasp both sides of the device, lift it, and position it in the rack so that the mid-bracket aligns with the rack holes.

8. Have a second person secure the bracket to the rack by using four mounting screws (and cage nuts and washers if your rack requires them. Tighten the screws. See Figure 46 on page 95.

Figure 46: Install the Chassis in the Two-post Rack
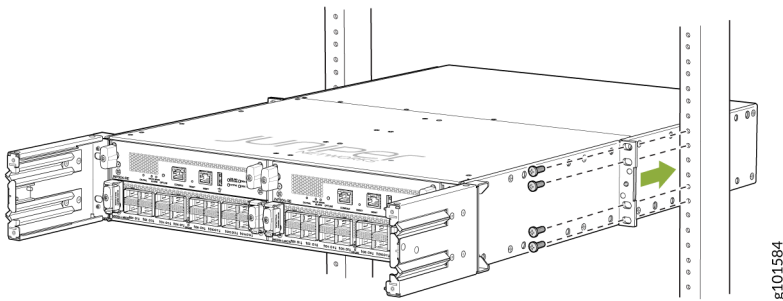
9. (Optional) Attach the front cover with the air filter to the chassis. Tighten the four screws turning them clockwise.

Figure 47: Attach the Front Cover with the Air Filter
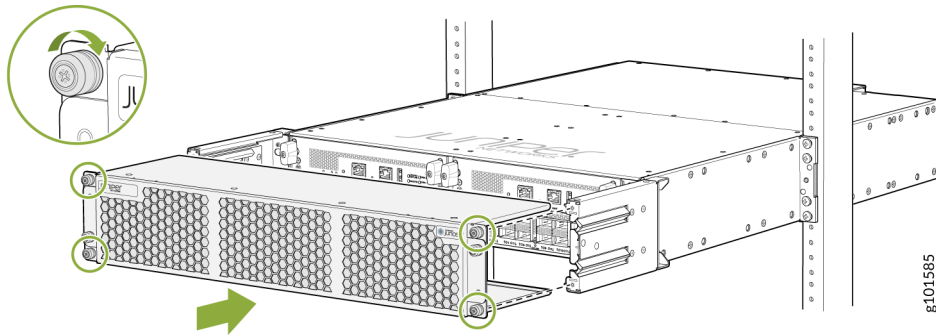
Connect the MX304 to Power

Tools and Parts Required for MX304 Router Grounding and Power Connections

To ground and to provide power to the router, you need the following tools and parts:

- Phillips (+) screwdrivers, numbers 1 and 2

- Socket nutdriver

- 2.5-mm flat-blade (−) screwdriver

- Torque-controlled driver, with a maximum torque capacity of 23 lbf-in. (2.6 Nm) to 25 lbf-in. (2.8 Nm) for tightening screws to terminals on each power supply on a DC-powered router.

> ⚠️ **CAUTION**: The maximum torque rating of the terminal screws on the DC power supply is 23 lbf-in. (2.6 Nm) to 25 lbf-in. (2.8 Nm). If you apply excessive torque, the terminal screws might be damaged. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately sized driver, with a maximum torque capacity of 6 lb-in. or less. Ensure that the driver is undamaged and properly calibrated and that you have been trained in its use. You might want to use a driver that is designed to prevent overtorque when the preset torque level is achieved.

- Wire cutters

- Electrostatic discharge (ESD) grounding wrist strap

Ground the MX304 Router

> **NOTE**: You must install the MX304 in a restricted-access location and ensure that the chassis is always properly grounded. The MX304 has a two-hole protective grounding terminal on the chassis. See Figure 49 on page 99. We recommend that you use this protective grounding terminal for grounding the chassis regardless of the power supply configuration. However, if additional grounding methods are available, you can also use those methods. For example, you can use the grounding wire in the AC power cord or use the grounding terminal or lug on a DC power supply. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

To ground the router, connect a grounding cable to earth ground and then attach it to the chassis grounding points with two M6 pan head screws. Figure 49 on page 99 shows the grounding point location on the chassis. You'll need to provide the grounding cables and the cable lugs. For grounding cable specifications, see "MX304 Router Grounding Specifications" on page 52.

Figure 48: ESD Point on the MX304 Router
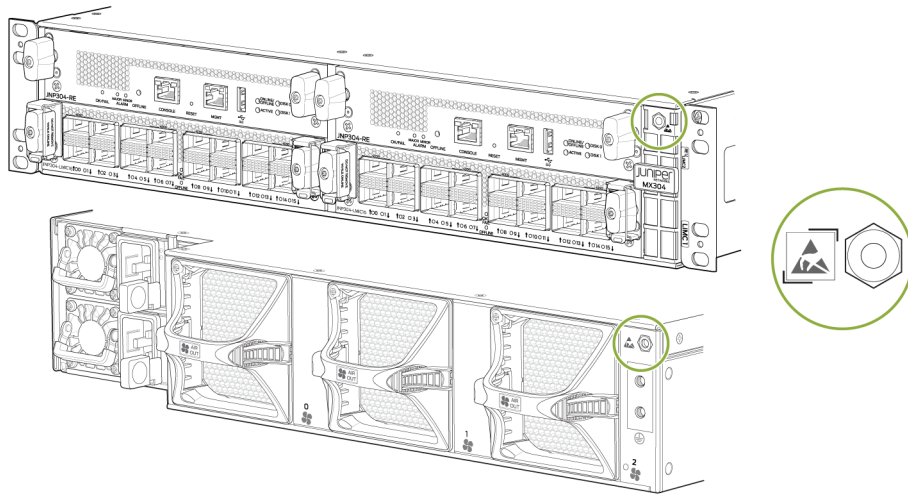
To ground the router:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

3. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.

4. Connect the grounding cable to a proper earth ground.

5. Detach the ESD grounding strap from the site ESD grounding point.

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

7. Place the grounding cable lug over the grounding points on the chassis.

8. Secure the grounding cable lug with the screws. The holes are sized for M6 pan head screws (see).

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

Figure 49: Connecting Grounding Lugs to the MX304 Router
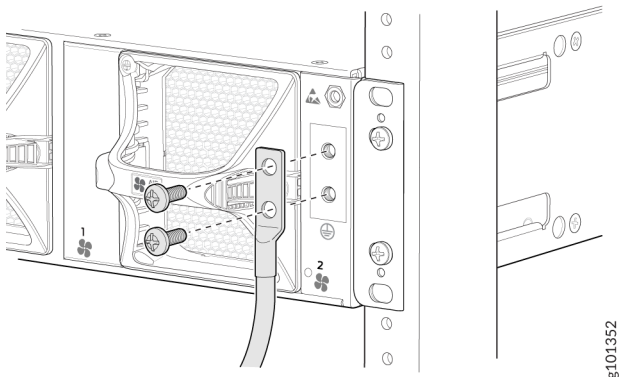
Connect Power to an AC-Powered MX304 Router

⚠️ **CAUTION**: Do not mix AC, DC, or HVAC/DC power supplies within the same router. This might damage the router.

To connect AC power to the router, attach power cords from the AC power sources to the AC appliance sockets on the power supplies. Here's how:

1. Locate power cords (included in your accessory kit) that have a plug appropriate for your geographic location. For more information, see the MX304 Router AC Power Specifications section.

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

3. Power off the AC power supply.

4. Insert the power cord firmly into the AC power socket on the power supply.

5. Push the retainer clip through the loop and tighten it until it fits snug around the power cord. See Figure 50 on page 100.

6. Plug the power cord into an external AC power source outlet.

> **NOTE**: Each power supply must be connected to a dedicated AC power feed and a dedicated customer-site circuit breaker. We recommend that you use a dedicated customer-site circuit breaker rated for 15 A (110 VAC) minimum, or as required by local code.

> ⚡ **WARNING**: The router is a pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for M6 hex screws) 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.

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

8. Power on the power supply.

9. Repeat Step 1 through Step 8 to install the other power supply.

Figure 50: Connecting AC Power to the Router
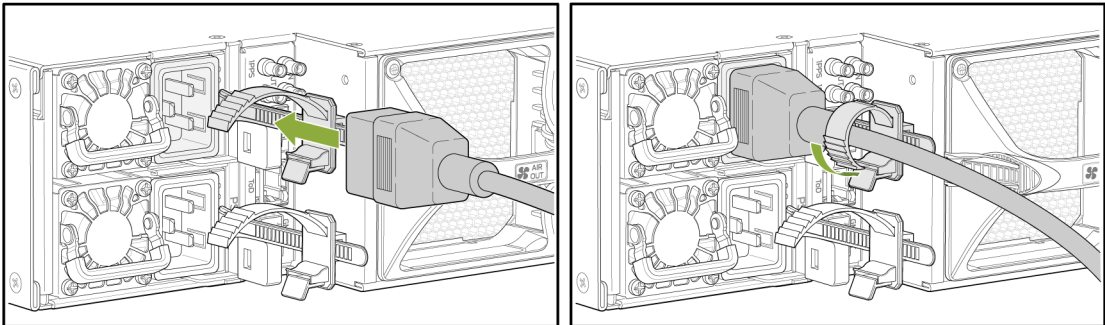
SEE ALSO

Connect Power to a DC-Powered MX304 Router

⚠️ **CAUTION**: Do not mix AC, DC, or HVAC/DC power supplies within the same router. Damage to the router might occur.

⚠️ **WARNING**: Before you perform DC power procedures, ensure there is no power to the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

You connect DC power to the router by attaching power cables from the external DC power sources to the terminal block on the power supply faceplate. You must provide the power cables (the cable lugs are supplied with the router). For power cable specifications, see "DC Power Cable Specifications for the MX304 Router" on page 73.

To connect the DC source power cables to the router for each power supply:

1. Switch off the dedicated customer-site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.

2. Attach an ESD grounding strap to your bare wrist, and connect the other end of the strap to an ESD grounding point.

3. Remove the DC power supplies from the chassis. See Figure 51 on page 101.

Figure 51: Removing the DC Power Supply from the Chassis
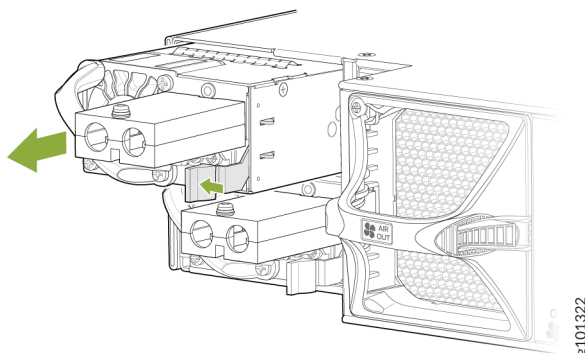
4. The DC power supply has two terminals labeled **-48V/-60V** (negative) and **RTN** (positive) for connecting the DC power cables labeled positive (+) and negative (-). The terminals are covered by a cover on the terminal block.

5. Using a screwdriver (anticlockwise) unscrew the nut on top of the terminal block. See Figure 54 on page 103

Figure 52: Removing the Terminal Block Cover
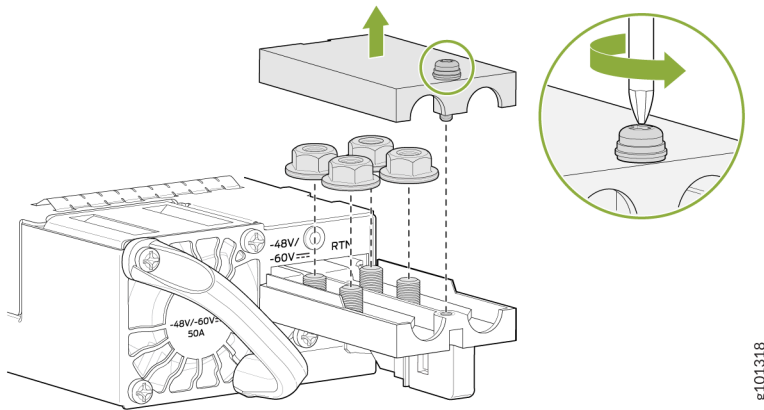
6. Install heat-shrink tubing insulation around the power cables.

   To install heat-shrink tubing:

   a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

   b. Shrink the tubing with a heat gun. Ensure that you heat all sides of the tubing evenly so that it shrinks around the cable tightly.

   Figure 53 on page 103 shows the steps to install heat-shrink tubing.

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

Figure 53: How to Install Heat-Shrink Tubing
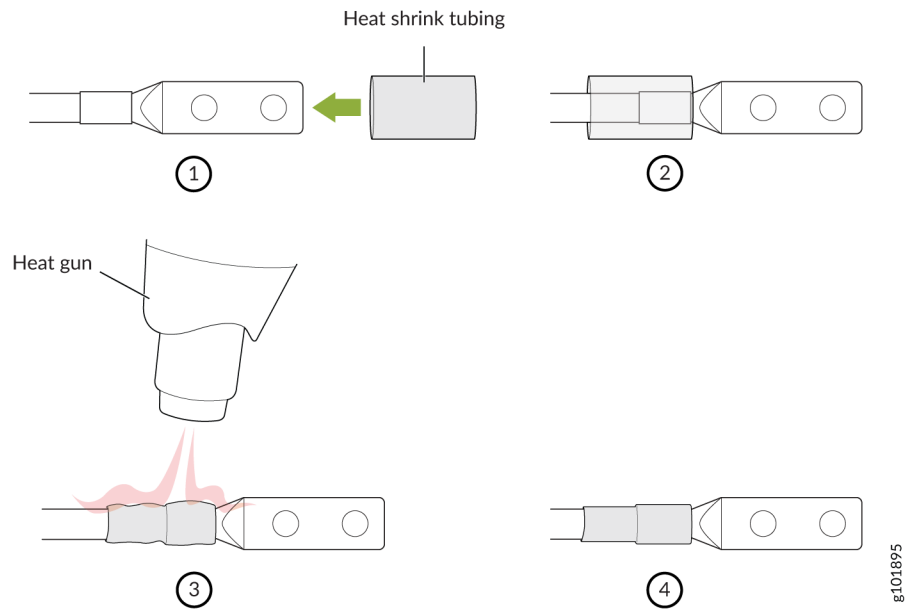
7. Remove the nuts from the four terminals. See .

Figure 54: Removing the Nuts from the Terminals
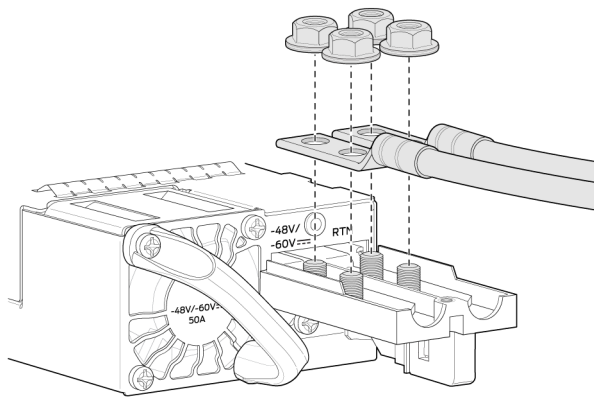
8. Secure each power cable lug to the terminal with the nuts. Tighten the nuts on the power supply terminals until snug by using the screwdriver. Apply between 23 lbf-in. (2.6 Nm) to 25 lbf-in. (2.8 Nm) of torque to the nuts. Do not apply vertical force while tightening the screws. Do not overtighten the nuts. (Use a socket nutdriver.) See .

Figure 55: Connecting the DC Cable

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

b. Secure the negative (−) DC source power cable lug to the **−48V/-60V** (input) terminal.

⚠ **CAUTION**: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded into the terminal. Applying installation torque to the nuts when improperly threaded can result in damage to the terminal.

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

NOTE: For a list of supported DC power cables, see "DC Power Cable Specifications for the MX304 Router" on page 73 the section.

9. Place the terminal block cover on and tighten the screw.

10. Install the power supply in the chassis.

Figure 56: Installing the Power Supply in the Chassis
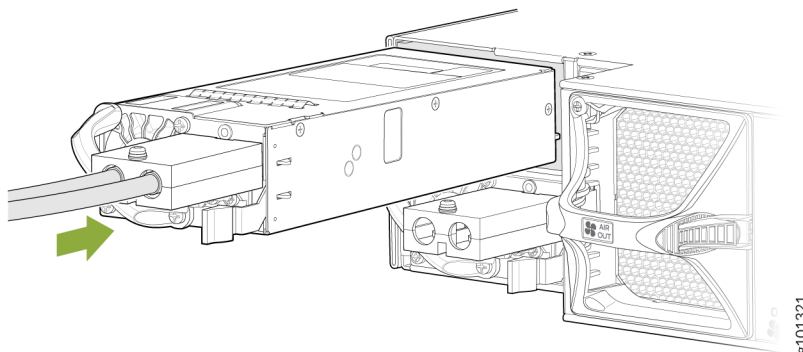
11. Verify that the power cables are connected correctly, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.

12. Repeat Step 1 through Step 10 for installing the other power supply.

13. Close the input circuit breaker.

14. Connect the power supply to the power sources.

SEE ALSO

Connect Power to an HVAC/DC Powered MX304 Router

⚠ **CAUTION**: Do not mix AC, DC, or HVAC/DC power supplies within the same router. Damage to the router might occur.

You connect high-voltage AC/DC power to the router by attaching power cords from the AC/DC power sources to the HVAC/DC appliance inlets located on the power supplies.

To connect the HVAC/DC power cords to the router for each power supply:

1. Locate power cords that have a plug appropriate for your geographic location. For more information, see High-Voltage (AC/DC) Power Cable Specifications for the MX304.

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

3. Power off the AC/DC input appliance inlet on the power supply.

4. Insert the HVAC/DC power cord firmly into the inlet on the power supply (see Figure 57 on page 106).

5. Insert the power cord plug into an external AC/DC power source receptacle.

> **NOTE**: Each power supply must be connected to a dedicated HVAC/HVDC power feed and a dedicated customer-site circuit breaker. We recommend that you use a dedicated customer-site circuit breaker rated for 20 A minimum, or as required by local code.

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

7. Repeat Step 1 through Step 8 for the installing the other power supply.

8. Power on the power supply at source.

Figure 57: Connecting the HVAC/DC Power Cord
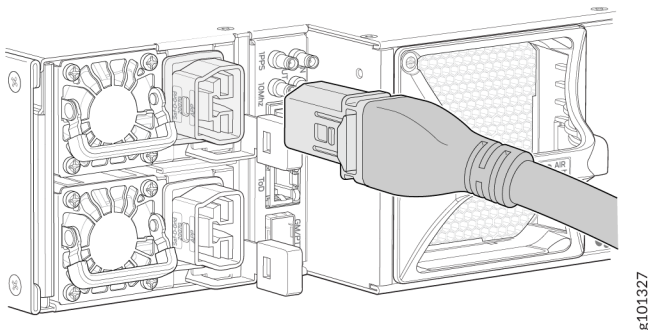
SEE ALSO

General Safety Guidelines and Warnings | 206

Connect the MX304 to the Network

IN THIS SECTION

Tools and Parts Required to Connect the MX304 Router to External Devices

To connect the router to external devices, you need the following tools and parts:

- Electrostatic discharge (ESD) grounding wrist strap (provided in the accessory kit)

Connect the MX304 Router to External Devices and Cables

IN THIS SECTION

shows the front panel of the MX304 Routing Engine. All the connections to the router are made through the Routing Engines. The external devices are connected through the Routing Engine.

Figure 58: Routing Engine Ports
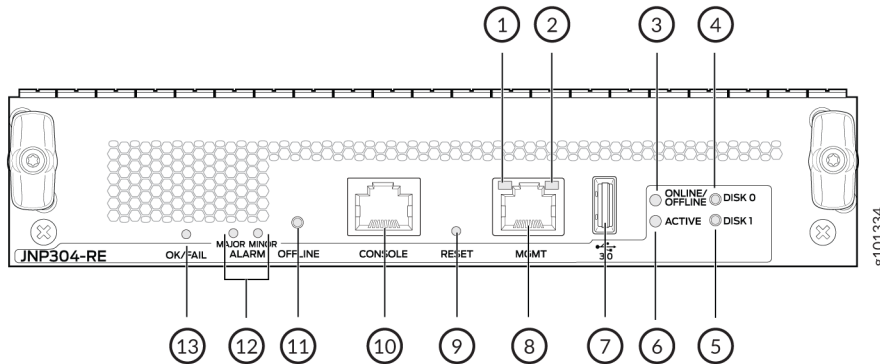
1–	Management (MGMT) port LED (left)	8–	Management (MGMT) port
2–	Management (MGMT) port LED(right)	9–	Reset button
3–	Offline and Online LED	10–	Console port
4–	Disk 0 LED	11–	Offline button
5–	Disk 1 LED	12–	Major and Minor Alarm LED
6–	Active LED	13–	OK/Fail LED
7–	USB port		

Connect the Router to an Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the **MGMT** port on the Routing Engine interface. One Ethernet cable is provided with the router. To connect to the **MGMT** port on the Routing Engine interface:

> **NOTE**: Use shielded CAT5e cable for connecting the **CONSOLE** and **MGMT** ports in Routing Engine for INDIA only.

1. Turn off power to the management device.
2. Plug one end of the Ethernet cable (Figure 2 shows the connector) into the **MGMT** port on the Routing Engine interface.
3. Plug the other end of the cable into the network device.

Figure 59: Out-of-Band Management Cable Connector
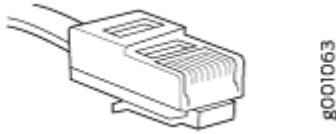
Table 40: Out-of-Band Management Port on the Routing Engine

Label	Description
MGMT	Dedicated management channel for device maintenance. System administrators also use it to monitor and manage the router remotely.

Connect the Router to a Console Device

To configure and to manage the Routing Engine, use a system console to connect to the appropriate **CON** port on the Routing Engine interface. The console port is used to connect a laptop or console terminal to configure the router. See Figure 4 and Figure 5. The console port accepts a cable with an RJ-45 connector.

NOTE: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)

- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

If you want to use RJ-45 to USB-A or RJ-45 to USB-C adapter you must have X64 (64-Bit) Virtual COM port (VCP) driver installed on your PC. See, https://ftdichip.com/drivers/vcp-drivers/ to download the driver.

NOTE: Use shielded CAT5e cable for connecting the **CONSOLE** and **MGMT** ports in Routing Engine for INDIA only.

To connect to a management console:

1. Turn off power to the console device.

2. Plug the RJ-45 end of the serial cable (see Figure 3) into the **CON** port on the Routing Engine interface.

3. Plug the socket DB-9 end into the device's serial port.

> **NOTE**: For console devices, configure the serial port to the following values:
>
> - Baud rate—9600
>
> - Parity—N
>
> - Data bits—8
>
> - Stop bits—1
>
> - Flow control—none

Figure 60: Console and Auxiliary Cable Connector
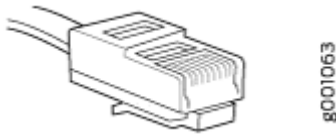
Figure 61: Connect a Router to a Management Console Through a Console Server
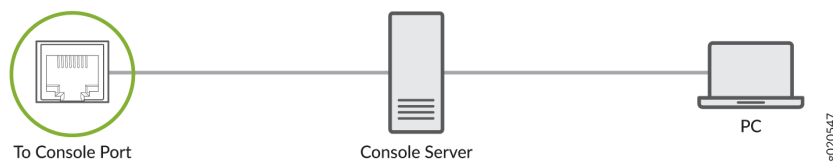
Figure 62: Connect a Router Directly to a Management Console
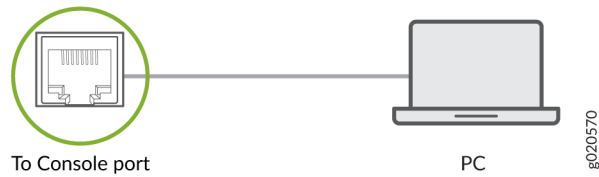
To Console port   PC

Table 41: Console Port on the Routing Engine

Label	Description
CONSOLE	Connect a laptop or console terminal to configure the router.

Connect the MX304 Router to External Clocking and Timing Devices

SUMMARY

IN THIS SECTION

- Connect 1-PPS and 10-MHz Timing Devices to the Router | **112**
- Connect a Time-of-Day Device to the Router | **113**
- Connect a BITS External Clocking Device to the Router | **114**

The router supports external clock synchronization for Synchronous Ethernet, and external inputs.

Figure 63: Timing Interface Ports
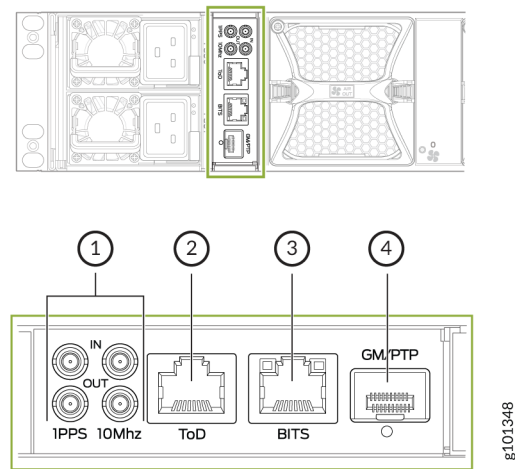
1. 10MHz (one input and one output), 1PPS (one input and one output)

2. ToD—Time-of-day (TOD)

3. BITS—Building-integrated timing supply (BITS)

4. GM/PTP—PTP grandmaster clock port

Connect 1-PPS and 10-MHz Timing Devices to the Router

The router has two 2x1 DIN 1.0/2.3 right angle connectors that support 1-PPS-IN, 1-PPS-OUT, 10-MHz-IN, and 10-MHz-OUT timing ports.

> **NOTE**: MX304 can be configured as a timing primary or a client device. If the MX304 is configured as a timing primary device, the router gets 1-PPS-IN and 10-MHz-IN input (connected to the ports marked **IN**) from the timing source and sends 1-PPS-OUT and 10-MHz-OUT to a client device. If the MX304 is configured as a timing client device, it receives 1-PPS-IN and 10-MHz-IN (connected to ports marked **IN**) as input from the timing source.

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

To connect the DIN cable to the external clocking input port:

1. Connect one end of the DIN cable connectors to the 1-PPS-IN and the 10-MHz-IN ports marked **IN** on the router.

If the MX304 is a timing primary device, use the 1-PPS-OUT and the 10-MHz-OUT ports marked **OUT** to connect to a client router or device.

2. Connect the other end of the DIN cable to the 10-MHz or 1-PPS source network equipment.

> **NOTE**: Ensure that the 10-MHz or 1-PPS source network equipment contains a low voltage complementary metal oxide semiconductor (LVCMOS) of 50 ohms or is compatible with low-voltage transistor-transistor logic (LVTTL) (3.3v).

Table 42: Clocking Port on the Rear Panel

Label	Description
10MHz- IN **1PPS-IN**	1 PPS input port 10 MHz input port
10MHz-OUT **1PPS-OUT**	1 PPS output port 10 MHz output port

Connect a Time-of-Day Device to the Router

A time-of-day port labeled **ToD** on the front panel of the Timing Interface Board enables you to connect external timing devices.

To connect the router to a ToD external timing device:

1. Attach an electrostatic discharge (ESD) grounding strap on your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Plug one end of the RJ-45 cable into the **ToD** port on the front panel of the Timing Interface Board.
3. Plug the other end of the RJ-45 cable into the ToD timing device.
4. Verify that the LEDs for the **ToD** port on the router are lit steadily green.
5. Configure the port. See *Configuring Clock Synchronization Interface on MX Series Routers*.

Table 43: Time-of-Day Port on the Timing Interface Ports

Label	Description
ToD	ToD RJ-45 port.

shows the ToD pinouts.

Table 44: ToD RJ45 Connector Pinout

Pin	Signal	Description
1	No connect	
2	No connect	
3	ToD TX	ToD Transmit
4	GND	
5	GND	
6	ToD RX	ToD Receive
7	No connect	
8	No connect	

Connect a BITS External Clocking Device to the Router

The router has an external building-integrated timing supply (BITS) port labeled **BITS** on the rear panel of the chassis.

To connect the router to a BITS external clocking device:

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

2. Plug one end of the RJ-45 cable into the internal clock port on the rear panel.

3. Plug the other end of the RJ-45 cable into the BITS external clocking device.

4. Verify that the LEDs for the **BITS** port are lit steadily green.

5. Configure the port. See *Configuring Clock Synchronization Interface on MX Series Routers*.

shows the ToD pinouts.

Table 45: BITS Port on the Rear Panel

Label	Description
BITS	Building-integrated Timing Supply (BITS) clock interface port.

Table 46: BITS RJ45 Connector Pinouts

Pin	Signal	Description
1	R RING	Receive Ring
2	R RING	Receive TIP
3	No connect	
4	T RING	Transmit Ring
5	T TIP	Transmit Tip
6	No connect	
7	No connect	
8	No connect	

Power on and off the MX304

IN THIS SECTION

Power on an AC-Powered or High Voltage AC/DC Powered MX304 Router

To power on an AC-powered or HVAC/DC-powered router:

1. Verify that you fully insert the power supplies in the chassis.
2. Verify that you securely insert each AC or HVAC/DC power cord into its appliance inlet.
3. Verify that you connect an external management device to one of the Routing Engine ports (**CON**).
4. Turn on power to the external management device.
5. Switch on the dedicated customer-site circuit breakers for the power supplies. Follow the instructions for your site.
6. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
7. Observe the status LED on each power supply faceplate. If an AC or HVAC/DC power supply is correctly installed and functioning normally, the status LED for each AC or HVAC/DC input switch lights steadily green.

    If the power supply status LED is amber or blinking, the power supply is not functioning normally. Repeat the installation and cabling procedures.

    > **NOTE**: After powering off a power supply, wait at least 120 seconds before turning it back on. After powering on a power supply, wait at least 120 seconds before turning it off.
    >
    > If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, first issue the CLI `request system halt` command.
    >
    > After a power supply powers on, it can take up to 60 seconds for status indicators—such as the status LEDs on the power supply and the `show chassis` command display—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

8. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

Power on a DC-Powered MX304 Router

To power on a DC-powered router:

1. Verify that you connect an external management device to one of the Routing Engine ports (**CON**).

2. Turn on power to the external management device.

3. Verify that you connect the source power cables to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V/-60**).

4. Verify that you fully insert the power supplies in the chassis.

5. Switch on the dedicated customer-site circuit breakers to provide power to the DC power cables.

6. Check that the status LED on the power supply faceplate is lit steadily blue to verify that power is present.

7. If power is not present:

   - Verify that you correctly install the fuse, and turn on the breaker at the battery distribution fuse board or fuse bay.

   - Check the voltage with a meter at the terminals of the power supply for correct voltage level and polarity.

8. Attach an ESD grounding strap to your bare wrist, and connect the other end of the strap to an ESD grounding point.

9. Observe the status LED on each power supply faceplate. If a DC power supply is correctly installed and functioning normally, the status LED lights blue steadily.

   If the status LED on the power supply is blinking Amber on or blinking, the power supply is not functioning normally. Repeat the installation and cabling procedures.

   > **NOTE**: After powering off a power supply, wait at least 120 seconds before turning it back on. After powering on a power supply, wait at least 120 seconds before turning it off.
   >
   > If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, first issue the CLI `request system halt` command.
   >
   > After a power supply powers on, it can take up to 60 seconds for status indicators—such as the status LEDs on the power supply and the `show chassis` command display—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

10. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

Power Off the MX304 Router

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

To power off the router:

1. On the external management device connected to the Routing Engine, issue the `request system halt` command.

```
user@host> request vmhost halt
```

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

3. Attach an ESD grounding strap to your bare wrist, and connect the other end of the strap to an ESD grounding point.

4. Switch off the power supply source.

Perform Initial Configuration on the MX304 Router

The router is shipped with the Junos operating system (OS) preinstalled and ready to be configured when the router is powered on. Two 16-MB internal NAND Flash memory devices are located on the baseboard for BIOS storage. The USB storage device can be inserted into the slot in the Routing Engine panel faceplate. The system also supports two M.2-based solid-state drive (SSD) slots. These two SSD devices act as the primary boot devices (**sda** and **sdb**). When the router boots, it first attempts to start the Junos OS image on the USB Flash memory drive if it detects one. If a USB flash drive is not inserted into the router, or the attempt otherwise fails, the router next tries the primary boot device, and then tries the secondary boot device.

The MX304 router ships with factory-default settings that enable some zero touch provisioning (ZTP) functions. These settings load as soon as you power on the switch. In our case we configure the router manually, so we remove the ZTP settings as part of our initial configuration.

When ZTP is not used you must perform the initial configuration of an MX304 router through the console port (**CON**) using the Junos OS command-line interface (CLI). If your MX304 has dual Routing-Engines, you should perform these steps on each Routing-Engine, being sure to specify a unique management IP address for the management interface on each Routing-Engine. See Configuring Junos OS for the First Time on a Device with Dual Routing Engines for information on how to use configuration groups to share a single configuration file between both Routing-Engines.

Have the following information ready before you begin the initial configuration:

- The router's host and domain name

- IP address and subnet mask for the management and loopback interfaces

- IP address of a default gateway for the management network

- IP address of a DNS server

- The root user's password

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

To configure the software:

1. Verify that the router is powered on.

2.
    > **NOTE**: You may see messages on the console relating to ZTP and DHCP. These messages stop once your remove the ZTP statements from the default configuration.

    Configure your serial port for 9600 bps/8-N-1, and attach the cable to the **CON** port of the desired Routing-Engine. Log in as the "root" user. No password is needed.

    ```
    FreeBSD/amd64 (Amnesiac) (ttyu0)

    login: root
    root@:~ #
    ```

3. Start the CLI.

    ```
    root@:~ # cli
    root>
    ```

4. Enter configuration mode.

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

5. Set the root authentication password by entering either a plain text password, an encrypted password, or an SSH public key string (ECDSA, ED25519 or RSA).

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

    or

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

    or

    ```
    [edit]
    root# set system root-authentication (ssh-ecdsa | ssh-ed25519 | ssh-rsa) public-key
    ```

6. Remove factory default configuration statements that relate to ZTP. After you commit these initial changes the ZTP process is stopped and the related console messages are no longer displayed.

    ```
    [edit]
    root@# delete system commit
    root@# delete chassis auto-image-upgrade
    root@# delete interfaces fxp0
    ```

7. Configure the IP address and prefix length for the router's management Ethernet interface (fxp0). You also configure an IPv4 address on the loopback interface in this step. Having a routible IP address on the loopback interface is a best practice and is generally needed later, when routing protocols are configured.

    ```
    [edit]
    root# set interfaces fxp0 unit 0 family inet address address/prefix-length
    root# set interfaces lo0 unit 0 family inet address address/32
    ```

8. Perform an initial commit to activate the modified configuration.

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

```
commit complete
[edit]
root#
```

9. Configure the router's host name. If the name includes spaces, enclose the name in quotation marks (" ").

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

10. Configure the router's domain name.

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

11. Configure the IP address of a DNS server.

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

12. Configure one or more static routes to remote subnets that have access to the management subnet. Without static routing, access to the management port is limited to devices attached to the management subnet. Static routing is needed to access the management interface from devices attached to remote subnets. For more information about static routes, see Configure Static Routes.

   In our example we define a single default static route to provide management network reachability to all possible remote destinations.

```
[edit]
root# set routing-options static route 0.0.0.0/0 next-hop destination-IP retain no-
readvertise
```

13. Configure the IP address of a backup router. The backup router is only used while the routing protocol is not running. The primary use of the backup router is to provide routing capability for the management port on the backup Routing-Engine. This is because the backup Routing-Engine does not run the routing protocol daemon (rpd).

14. In most cases the backup router is the same IP next hop as used for the management network's static routes. We again use a default route to provide the back up Routing-Engine with reachability for all possible remote destinations.

```
[edit]
root# set system backup-router address
root# set system backup-router destination 0.0.0.0/0
```

15. Configure remote access for the root user over ssh. By default the root user is only able to log-in via the console port. The root-login allow statement permits remote log-in for the root user.

```
[edit]
root# set system services ssh root-login allow
```

16. (Optional) Display the configuration to verify it's correct.

```
[edit]
root# show
system {
    host-name host-name;
    root-authentication {
        authentication-method (encripted-password | public-key);
    }
     services {
        ssh {
            root-login allow;
        }
    }
    domain-name domain-name;
    backup-router address destination 0.0.0.0/0;

    name-server {
        address;
    }
}
interfaces {
    fxp0 {
        unit 0 {
            family inet {
                address address/prefix-length;
            }
```

```
            }
        }
    lo0 {
            unit 0 {
                family inet {
                    address address/32;
                }
            }
        }
    }
    routing-options {
        static {
            route 0.0.0.0/0 next-hop destination-IP;
        }
    }
```

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

```
[edit]
root# commit
commit complete

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

18. When you've finished configuring the router, exit configuration mode.

```
[edit]
root@host-name# exit
Exiting configuration mode

root@host-name>
```

Congratulations. The initial configuration is complete. Remember to also configure the backup Routing Engine if your MX304 is equipped with redundant control planes. At this point you should be able to remotely access both of the Routing-Engines as the root user with ssh.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage | 210

No Link Title

5

CHAPTER

Maintaining Components

Routine Maintenance Procedures for MX304 Routers

Purpose

For optimum router performance, perform preventive maintenance procedures.

Action

- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the router and into the air intake vents.

- Check the status-reporting components on the front panel—system alarms and LEDs.

Maintain MX304 Cooling System Components

Maintain the MX304 Air Filter

IN THIS SECTION

Purpose

For optimum cooling, verify the condition of the air filter.

Action

- Regularly inspect the air filter. A dirty air filter restricts airflow in the unit which negatively affects the router ventilation, The filter degrades over time. You must replace it every 6 months.

  ⚠️ **CAUTION**: Always keep the air filter in place while the device is operating, except during replacement. The fans are very powerful and can pull small bits of wire or other materials into the device if the air filter isn't in place. These materials can damage device components.

- The shelf life of polyurethane filter varies from two years to five years depending on the storage conditions. Store in a cool, dry, and dark environment. Wrap the media in plastic and store in an environment with relative humidity between 40%- 80% and temperature between 40°F (4°C) to 90°F (32° C). Note that if the material flakes, or becomes brittle when rubbed or deformed, it is no longer usable.

Replace the MX304 Air Filter Unit

The air filter unit has three parts. The air filter sits right inside the outer filter cover and the inner cage. The air filter unit is installed into the cable management brackets, and is held tightly by captive screws.

Remove the MX304 Air Filter Unit

NOTE: The air filter unit is designed to prevent dust from being drawn into the chassis.

To remove the air filter unit from the front of the router:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on both sides of the air filter unit.

NOTE: You don't need to remove the cables from the cable manager to access the air filter.

3. Grasp the air filter unit and gently pull it out of the cable management brackets. See Figure 1.

Figure 64: Remove the Air Filter from the Chassis
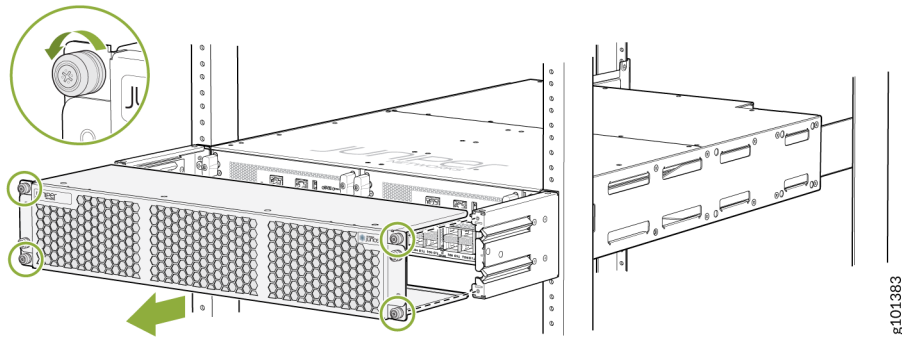
Install the MX304 Air Filter Unit

NOTE: The air filter unit is installed on the cable management brackets. Before installing the air filter unit, ensure that the cable management brackets are already installed on the front of the router.

To install the air filter unit:

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

2. With the air filter unit right side up, slide it into the rails on the cable management brackets until it stops (see Figure 65 on page 129). The air filter unit fits snugly on the cable management brackets.

Figure 65: Install the Air Filter
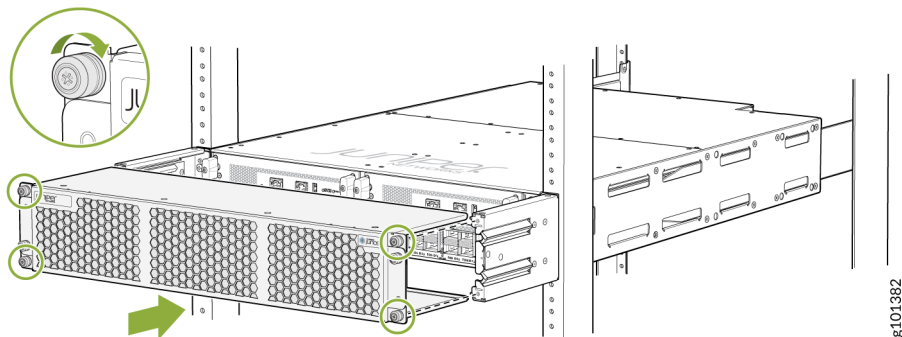
3. Tighten the captive screws to secure the air filter unit to the cable management brackets.

Replace the MX304 Air Filter

IN THIS SECTION

The air filter unit has three parts. The air filter sits right inside the outer filter cover and the inner cage. The air filter unit is installed into the cable management brackets, and is held tightly by captive screws.

> **NOTE**: Regularly inspect the air filter. A dirty air filter restricts airflow in the unit, producing a negative effect on the ventilation of the chassis.

Remove the MX304 Air Filter

> ⚠️ **CAUTION**: Always keep the air filter unit in place while the router is operating, except during replacement. Because the fans are very powerful, they could pull small bits of wire or other materials into the router through the unfiltered air intake. This could damage the router components.

To remove the air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. On the front of the router, loosen the captive screws on each side of the air filter unit.

> **NOTE**: You don't need to remove the cables from the cable manager to access the air filter.

3. Remove the outer air filter cover by grasping the head of the loosened screws, and pulling it out..

    The air filter is located at the center of the air filter unit, and just behind the outer filter cover. See Figure 3.
4. Pull the air filter straight out from the air filter unit.

Figure 66: Remove the Air Filter from the Air Filter Unit
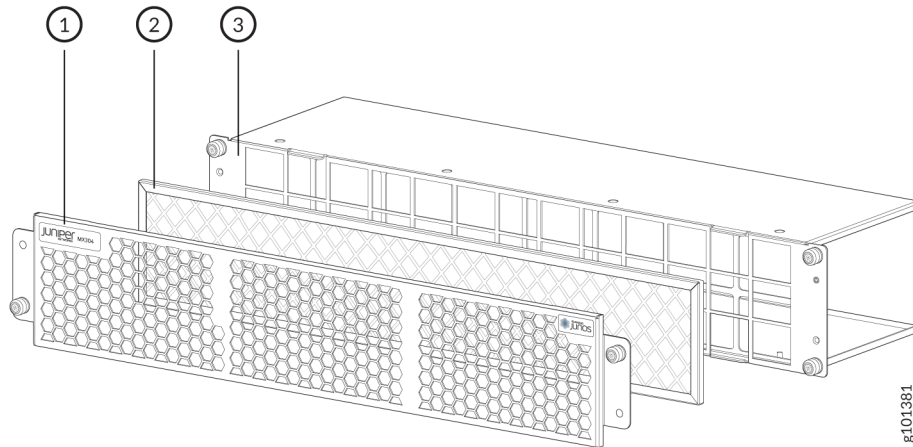
1– Outer filter cover	3– Inner filter cage
2– Air filter	

Install the MX304 Air Filter

NOTE: The air filter unit is installed on the cable management brackets. Before installing the air filter unit, ensure that the cable management brackets are already installed on the front of the router.

To install the air filter:

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

2. On the front of the router, loosen the captive screws on each side of the air filter unit .

   NOTE: You don't need to remove the cables from the cable manager to access the air filter.

   ⚠ **CAUTION**: Do not run the router for more than two minutes without the air filter unit in place.

3. Grasp the head of the loosened screws, and pull out the outer air filter cover.

   The air filter is at the center of the air filter unit, just behind the outer filter cover. See .

4. Slide the air filter straight onto inner filter cage.

Figure 67: Install the Air Filter from the Air Filter Unit
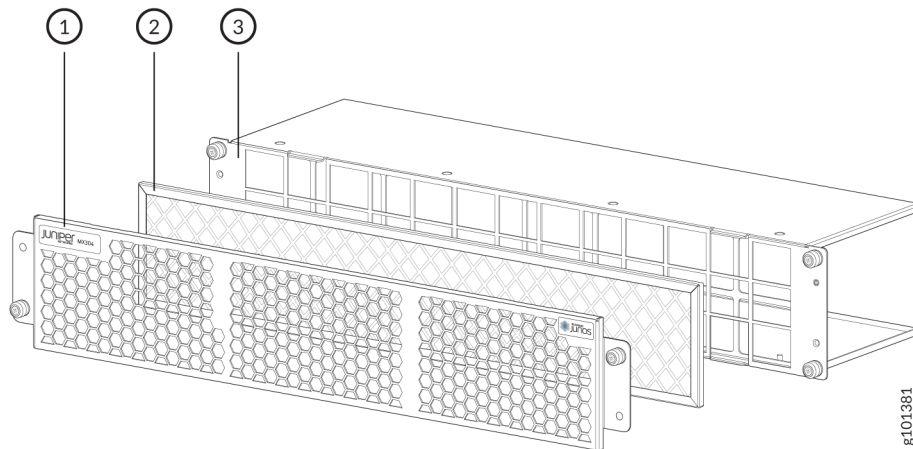
1– Outer filter cover	3– Inner filter cage
2– Air filter	

5. Place the outer air filter cover back into it's place, and tighten the captive screws to secure the air filter unit.

Maintain the MX304 Fan Module

IN THIS SECTION

- Purpose | **132**
- Action | **133**

Purpose

For optimum cooling, verify the condition of the fans.

Action

- Monitor the status of the fans. A fan module contains multiple fans that work in unison to cool the router components. If one fan fails, the router adjusts the speed of the remaining fans to maintain proper cooling. A red alarm is triggered when a fan fails, and when a fan module is removed.

- To display the status of the cooling system, issue the `show chassis environment` command. The output is similar to the following:

```
user@host> show chassis environment
Class Item                        Status    Measurement
      Routing Engine 0 CPU        OK        38 degrees C / 100 degrees F
      RE 0 CPU Core-0 Temp        OK        38 degrees C / 100 degrees F
      RE 0 CPU Core-1 Temp        OK        37 degrees C / 98 degrees F
      RE 0 CPU Core-2 Temp        OK        36 degrees C / 96 degrees F
      RE 0 CPU Core-3 Temp        OK        36 degrees C / 96 degrees F
      RE 0 CPU Core-4 Temp        OK        34 degrees C / 93 degrees F
      RE 0 CPU Core-5 Temp        OK        38 degrees C / 100 degrees F
      RE 0 CPU Core-6 Temp        OK        34 degrees C / 93 degrees F
      RE 0 CPU Core-7 Temp        OK        37 degrees C / 98 degrees F
      RE 0 Exhaust_right          OK        34 degrees C / 93 degrees F
      RE 0 Inlet_Left             OK        26 degrees C / 78 degrees F
      RE 0 Exhaust_Left           OK        32 degrees C / 89 degrees F
      RE 0 Inlet_right            OK        29 degrees C / 84 degrees F
Temp  CB 0 Exhaust_A              OK        41 degrees C / 105 degrees F
      CB 0 Exhaust_B              OK        40 degrees C / 104 degrees F
      CB 0 Exhaust_C              OK        37 degrees C / 98 degrees F
      CB 0 Intake_A               OK        45 degrees C / 113 degrees F
      CB 0 Intake_B               OK        35 degrees C / 95 degrees F
      CB 0 Onboard                OK        37 degrees C / 98 degrees F
      CB 0 PEX Die                OK        29 degrees C / 84 degrees F
      FPC 0 PMB_CPU               OK        28 degrees C / 82 degrees F
      FPC 0 PMB_DIMM-0            OK        36 degrees C / 96 degrees F
      FPC 0 PMB_DIMM-1            OK        41 degrees C / 105 degrees F
      FPC 0 YT0-therm_sensor      OK        60 degrees C / 140 degrees F
      FPC 0 YT1-therm_sensor      OK        66 degrees C / 150 degrees F
      FPC 0 YT2-therm_sensor      OK        70 degrees C / 158 degrees F
      FPC 0 YT0-test_macro        OK        61 degrees C / 141 degrees F
      FPC 0 YT1-test_macro        OK        67 degrees C / 152 degrees F
      FPC 0 YT2-test_macro        OK        71 degrees C / 159 degrees F
      FPC 0 YT0-pgio_slice0       OK        65 degrees C / 149 degrees F
      FPC 0 YT1-pgio_slice0       OK        77 degrees C / 170 degrees F
```

```
        FPC 0 YT2-pgio_slice0       OK          74 degrees C / 165 degrees F
        FPC 0 YT0-core_pll          OK          60 degrees C / 140 degrees F
        FPC 0 YT1-core_pll          OK          66 degrees C / 150 degrees F
        FPC 0 YT2-core_pll          OK          70 degrees C / 158 degrees F
        FPC 0 YT0-fabio_slice0      OK          63 degrees C / 145 degrees F
        FPC 0 YT1-fabio_slice0      OK          64 degrees C / 147 degrees F
        FPC 0 YT2-fabio_slice0      OK          71 degrees C / 159 degrees F
        FPC 0 YT0-pgio_slice1       OK          66 degrees C / 150 degrees F
        FPC 0 YT1-pgio_slice1       OK          70 degrees C / 158 degrees F
        FPC 0 YT2-pgio_slice1       OK          76 degrees C / 168 degrees F
        FPC 0 YT0-fabio_slice1      OK          63 degrees C / 145 degrees F
        FPC 0 YT1-fabio_slice1      OK          63 degrees C / 145 degrees F
        FPC 0 YT2-fabio_slice1      OK          72 degrees C / 161 degrees F
        FPC 0 YT0-hbmio_slice1      OK          61 degrees C / 141 degrees F
        FPC 0 YT1-hbmio_slice1      OK          62 degrees C / 143 degrees F
        FPC 0 YT2-hbmio_slice1      OK          70 degrees C / 158 degrees F
        FPC 0 YT0-wanio_misc        OK          62 degrees C / 143 degrees F
        FPC 0 YT1-wanio_misc        OK          66 degrees C / 150 degrees F
        FPC 0 YT2-wanio_misc        OK          71 degrees C / 159 degrees F
        FPC 0 YT0-HBM0              OK          55 degrees C / 131 degrees F
        FPC 0 YT1-HBM0              OK          56 degrees C / 132 degrees F
        FPC 0 YT2-HBM0              OK          60 degrees C / 140 degrees F
        FPC 0 YT0-HBM1              OK          56 degrees C / 132 degrees F
        FPC 0 YT1-HBM1              OK          56 degrees C / 132 degrees F
        FPC 0 YT2-HBM1              OK          62 degrees C / 143 degrees F
        FPC 0 WAN RT0.0             OK          85 degrees C / 185 degrees F
        FPC 0 WAN RT1.0             OK          89 degrees C / 192 degrees F
        FPC 0 WAN RT2.0             OK          85 degrees C / 185 degrees F
        FPC 0 WAN RT3.0             OK          87 degrees C / 188 degrees F
        FPC 0 WAN RT4.0             OK          85 degrees C / 185 degrees F
        FPC 0 WAN RT5.0             OK          86 degrees C / 186 degrees F
        FPC 0 WAN RT6.0             OK          88 degrees C / 190 degrees F
        FPC 0 WAN RT7.0             OK          90 degrees C / 194 degrees F
        FPC 0 WAN RT8.0             OK          87 degrees C / 188 degrees F
        FPC 0 WAN RT9.0             OK          91 degrees C / 195 degrees F
        FPC 0 WAN RT10.0            OK          86 degrees C / 186 degrees F
        FPC 0 WAN RT11.0            OK          87 degrees C / 188 degrees F
        FPC 0 WAN RT12.0            OK          95 degrees C / 203 degrees F
        FPC 0 WAN RT13.0            OK          95 degrees C / 203 degrees F
        FPC 0 WAN RT14.0            OK          93 degrees C / 199 degrees F
        FPC 0 WAN RT15.0            OK          96 degrees C / 204 degrees F
        FPC 0 WAN RT16.0            OK          96 degrees C / 204 degrees F
        FPC 0 WAN RT17.0            OK          94 degrees C / 201 degrees F
```

```
FPC 0 PIC0-Intake-A Temp Sensor OK           50 degrees C / 122 degrees F
FPC 0 PIC0-Intake-B Temp Sensor OK           51 degrees C / 123 degrees F
FPC 0 PIC0-Exhaust Temp Sensor OK            44 degrees C / 111 degrees F
FPC 0 PIC0-YT Junction Temp Sensor OK        66 degrees C / 150 degrees F
FPC 0 PIC0-MAX20754_YT_VDD0V75_T OK          57 degrees C / 134 degrees F
FPC 0 PIC0-MAX20743_YT_HBM_VDDQ1V2_T OK      57 degrees C / 134 degrees F
FPC 0 PIC0-MAX20743_YT_HBM_VDDC1V2_T OK      58 degrees C / 136 degrees F
FPC 0 PIC0-MAX20743_YT_RTVDD0V75_T OK        63 degrees C / 145 degrees F
FPC 0 PIC0-MAX20796_WAN_VDD0V8_A_T OK        101 degrees C / 213 degrees F
FPC 0 PIC0-MAX20743_WAN_VDD3V3_A_T OK        71 degrees C / 159 degrees F
FPC 0 PIC0-MAX20743_WAN_AVDD1V2_A_T OK       70 degrees C / 158 degrees F
FPC 0 PIC0-MAX20796_WAN_VDD0V8_B_T OK        73 degrees C / 163 degrees F
FPC 0 PIC0-MAX20743_WAN_VDD3V3_B_T OK        101 degrees C / 213 degrees F
FPC 0 PIC0-MAX20743_WAN_AVDD1V2_B_T OK       73 degrees C / 163 degrees F
FPC 0 PIC0-MAX16545_VDD12V0_T  Absent        46 degrees C / 114 degrees F
FPC 0 PIC1-Intake-A Temp Sensor OK           49 degrees C / 120 degrees F
FPC 0 PIC1-Intake-B Temp Sensor OK           48 degrees C / 118 degrees F
FPC 0 PIC1-Exhaust Temp Sensor OK            39 degrees C / 102 degrees F
FPC 0 PIC1-YT Junction Temp Sensor OK        69 degrees C / 156 degrees F
FPC 0 PIC1-MAX20754_YT_VDD0V75_T OK          57 degrees C / 134 degrees F
FPC 0 PIC1-MAX20743_YT_HBM_VDDQ1V2_T OK      54 degrees C / 129 degrees F
FPC 0 PIC1-MAX20743_YT_HBM_VDDC1V2_T OK      53 degrees C / 127 degrees F
FPC 0 PIC1-MAX20743_YT_RTVDD0V75_T OK        59 degrees C / 138 degrees F
FPC 0 PIC1-MAX20796_WAN_VDD0V8_A_T OK        94 degrees C / 201 degrees F
FPC 0 PIC1-MAX20743_WAN_VDD3V3_A_T OK        65 degrees C / 149 degrees F
FPC 0 PIC1-MAX20743_WAN_AVDD1V2_A_T OK       70 degrees C / 158 degrees F
FPC 0 PIC1-MAX20796_WAN_VDD0V8_B_T OK        68 degrees C / 154 degrees F
FPC 0 PIC1-MAX20743_WAN_VDD3V3_B_T OK        100 degrees C / 212 degrees F
FPC 0 PIC1-MAX20743_WAN_AVDD1V2_B_T OK       76 degrees C / 168 degrees F
FPC 0 PIC1-MAX16545_VDD12V0_T  OK            46 degrees C / 114 degrees F
FPC 0 PIC2-Intake-A Temp Sensor OK           54 degrees C / 129 degrees F
FPC 0 PIC2-Intake-B Temp Sensor OK           50 degrees C / 122 degrees F
FPC 0 PIC2-Exhaust Temp Sensor OK            39 degrees C / 102 degrees F
FPC 0 PIC2-YT Junction Temp Sensor OK        71 degrees C / 159 degrees F
FPC 0 PIC2-MAX20754_YT_VDD0V75_T OK          60 degrees C / 140 degrees F
FPC 0 PIC2-MAX20743_YT_HBM_VDDQ1V2_T OK      63 degrees C / 145 degrees F
FPC 0 PIC2-MAX20743_YT_HBM_VDDC1V2_T OK      65 degrees C / 149 degrees F
FPC 0 PIC2-MAX20743_YT_RTVDD0V75_T OK        65 degrees C / 149 degrees F
FPC 0 PIC2-MAX20796_WAN_VDD0V8_A_T OK        108 degrees C / 226 degrees F
FPC 0 PIC2-MAX20743_WAN_VDD3V3_A_T OK        83 degrees C / 181 degrees F
FPC 0 PIC2-MAX20743_WAN_AVDD1V2_A_T OK       76 degrees C / 168 degrees F
FPC 0 PIC2-MAX20796_WAN_VDD0V8_B_T OK        69 degrees C / 156 degrees F
FPC 0 PIC2-MAX20743_WAN_VDD3V3_B_T OK        103 degrees C / 217 degrees F
```

```
       FPC 0 PIC2-MAX20743_WAN_AVDD1V2_B_T OK    79 degrees C / 174 degrees F
       FPC 0 PIC2-MAX16545_VDD12V0_T  OK         51 degrees C / 123 degrees F
       SFB Exhaust_A                  OK         44 degrees C / 111 degrees F
       SFB Exhaust_B                  OK         44 degrees C / 111 degrees F
       SFB Intake_A                   OK         33 degrees C / 91 degrees F
       SFB Intake_B                   OK         42 degrees C / 107 degrees F
       SFB Middle Inlet               OK         41 degrees C / 105 degrees F
       SFB ZF Temp                    OK         59 degrees C / 138 degrees F
Power PEM 0                           OK         28 degrees C / 82 degrees F
      PEM 1                           Absent
Fans  Fan Tray 0 Fan 0               OK          Spinning at normal speed
      Fan Tray 0 Fan 1               OK          Spinning at normal speed
      Fan Tray 1 Fan 0               OK          Spinning at normal speed
      Fan Tray 1 Fan 1               OK          Spinning at normal speed
      Fan Tray 2 Fan 0               OK          Spinning at normal speed
      Fan Tray 2 Fan 1               OK          Spinning at normal speed
```

Replace an MX304 Fan Module

IN THIS SECTION

Remove an MX304 Fan Module

NOTE: To prevent overheating, install the replacement fan module immediately after removing the existing fan module.

To remove the fan module (see Figure 5):

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

2. Loosen the captive screw on the fan module faceplate (use a number-2 Phillips screwdriver).

3. Hold and press the latches located on the sides of the fan module (see Figure 5) to release it from the chassis.

> ![warning icon] **WARNING**: To prevent injury, keep tools and your fingers away from the fans as you slide the fan module out of the device. The fans might still be spinning.

4. Place one hand under the fan module to support it, and then pull the fan module completely out of the chassis.

Figure 68: Remove the Fan Module
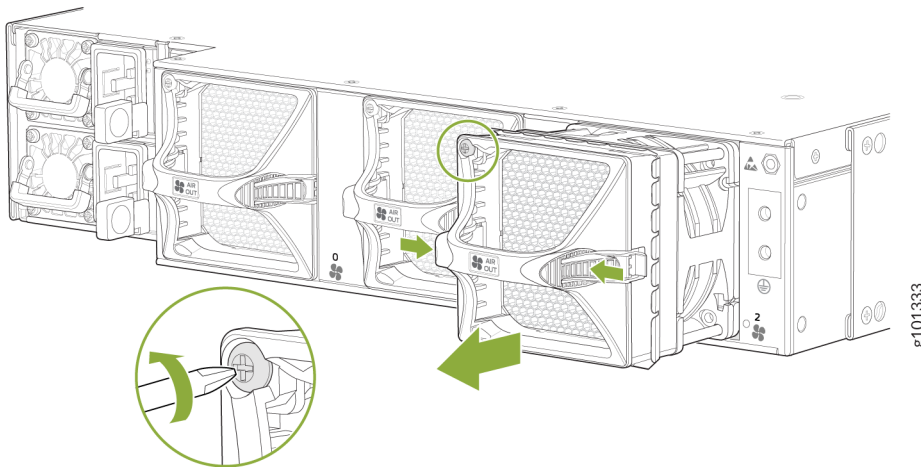
Install an MX304 Fan Module

To install the fan module (see Figure 69 on page 138):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan module by the handle, and place one hand under the fan module for support.
3. Place the fan module on the respective slot, and carefully push the fan module into the chassis until the socket lock snaps into place and holds it.
4. Using a number-2 Phillips screwdriver, turn the locking screw on the fan module faceplate until it is tight and secured.

Figure 69: Install the Fan Module
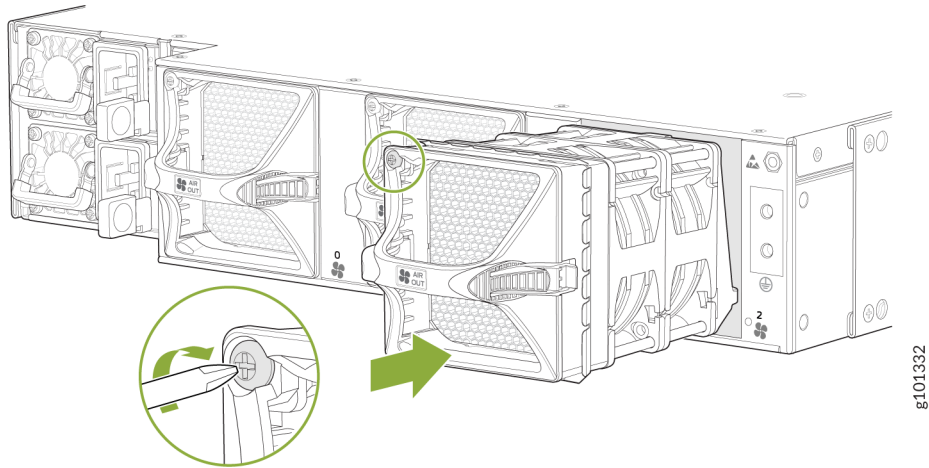
Maintain MX304 Power System Components

IN THIS SECTION

Maintain the Power Supplies

IN THIS SECTION

Purpose

For optimum router performance, verify the condition of the power supplies.

Action

On a regular basis check the power supply status:

- Issue the `show chassis power` CLI command. The output is similar to the following:

```
user@host> show chassis power
PEM 0:
  State:     Empty
  Input:     Absent

PEM 1:
  State:     Online
  Capacity:  2200 W (maximum 2200 W)
  DC output: 972 W (zone 0, 81 A at 12 V, 44% of capacity)

System:
  Zone 0:
      Capacity:          2200 W (maximum 2200 W)
      Allocated power:   1740 W (460 W remaining)
      Actual usage:      972 W
  Total system capacity: 2200 W (maximum 2200 W)
  Total remaining power: 460 W

...
```

- Arrange the power and grounding cables in a way so that they do not obstruct access to other router components.

- Routinely check the status LEDs on the power supply faceplates and the craft interface to determine if the power supplies are functioning normally.

- Check the red and yellow alarm LEDs on the RE interface. If a power supply fails or you remove a power supply, it triggers an alarm that causes one or both LEDs to light. To find out the associated error messages, issue the following command:

```
user@host> show chassis alarms
```

- Periodically inspect the site to ensure that the grounding and power cables connected to the router are securely in place and that there's no moisture accumulating near the router.

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

Replace an MX304 AC Power Supply

IN THIS SECTION

Remove an MX304 AC Power Supply

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

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

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

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

To remove an AC power supply (see Figure 1):

1. Switch off the dedicated customer-site circuit breaker for the power supply, and remove the power cord from the AC power source. Follow the instructions for your site.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Press the release latch on the right side of the AC power supply to disconnect the power supply from the chassis (see Figure 1).

4. Pull the power supply straight out of the chassis.

Figure 70: Remove an AC Power Supply
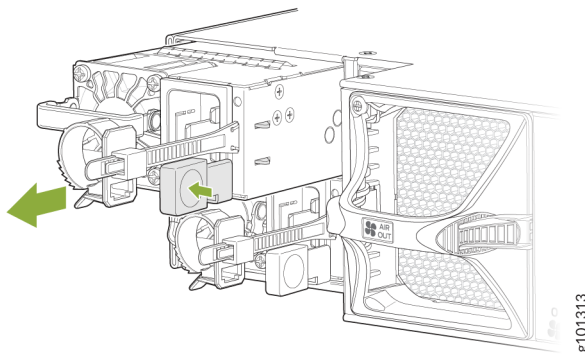
Install an MX304 AC Power Supply

To install an AC power supply (see Figure 71 on page 142):

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

2. Using both hands, hold and slide the AC power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate must be aligned with any adjacent power supply faceplate installed in the power supply slot.

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

4. Attach the power cord to the power supply.

5. Push the retainer clip through the loop and tighten it until it fits snug around the power cord.

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

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

Figure 71: Install an AC Power Supply

Replace an MX304 DC Power Supply

IN THIS SECTION

Remove an MX304 DC Power Supply

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

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

WARNING: Before you perform DC power procedures, ensure there is no power to the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

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

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

To remove a DC power supply:

1. Switch off the dedicated customer-site circuit breaker for the power supply being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the status LED on the power supply is not lit.
4. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
5. Press the latch located on the right side of the DC power supply, to release it from the chassis.
6. Pull the power supply straight out of the chassis. See Figure 3.

Figure 72: Remove the DC power Supply
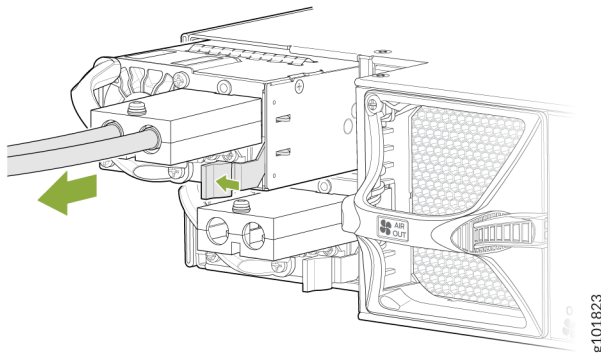
7. Place it on a flat surfacea and using a screwdriver (anticlockwise) unscrew the nut on top of the terminal block. (see Figure 4).

Figure 73: Remove the Terminal Block Cover
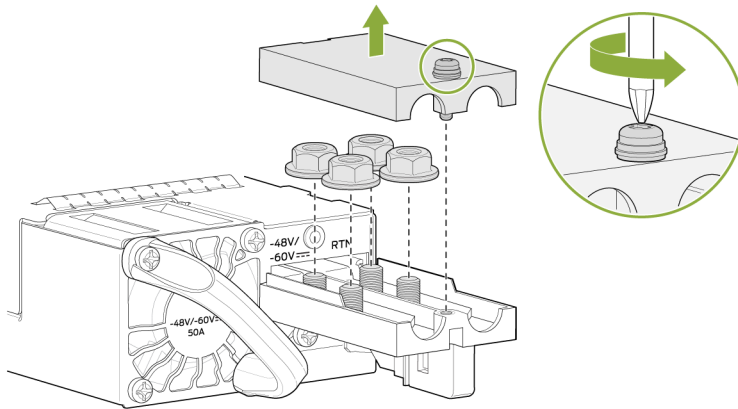
8. Remove the nuts from the four terminals. See Figure 5).

Figure 74: Remove the Nuts from the Terminals
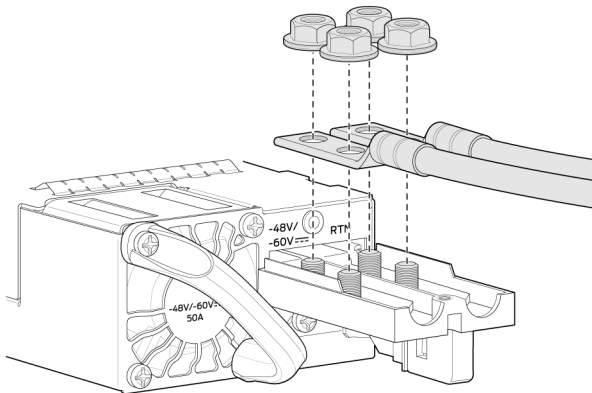
9. Remove the cable lugs from the terminals.
10. Carefully move the power cables out of the way.

Install an MX304 DC Power Supply

> ⚠️ **WARNING**: Before you perform DC power procedures, ensure there is no power to the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board

that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To install a DC power supply (see Figure 78 on page 147):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Using a screwdriver (anticlockwise) unscrew the nut on top of the terminal block. (see Figure 4).

Figure 75: Remove the Terminal Block Cover
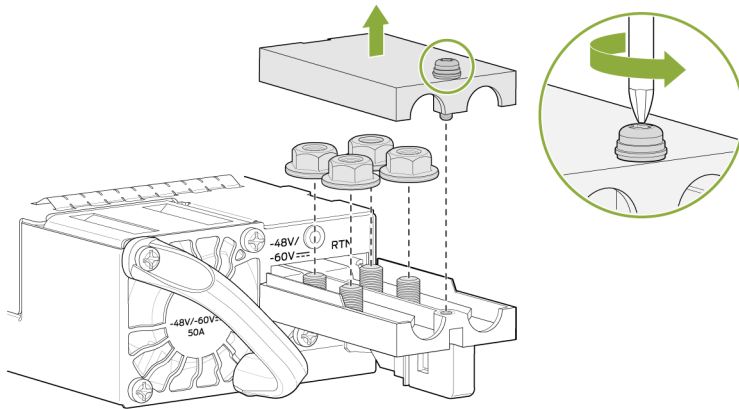
4. Remove the nuts from the four terminals. See Figure 5).

Figure 76: Remove the Nuts from the Terminals
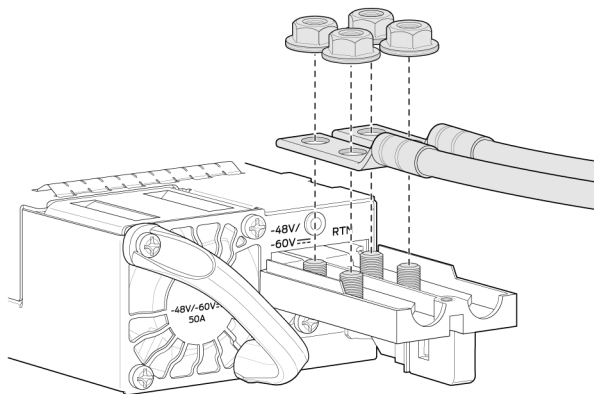
g101319

5. Secure each power cable lug to the terminal with the nuts. Tighten the nuts on the power supply terminals until snug by using the screwdriver. Apply between 23 lbf-in. (2.6 Nm) to 25 lbf-in. (2.8 Nm) of torque to the nuts. Do not overtighten the nuts. (Use a socket nutdriver.)

Figure 77: Connect the DC Cable
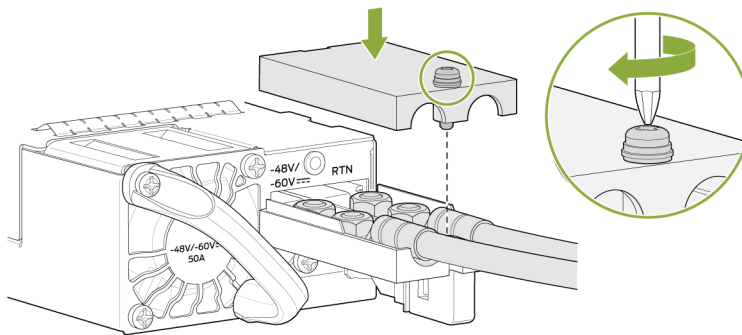
g101320

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

b. Secure the negative (−) DC source power cable lug to the **−48V/-60V** (input) terminal.

> ⚠ **CAUTION**: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded into the terminal. Applying installation torque to the nuts when improperly threaded can result in damage to the terminal.

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

NOTE: For a list of supported DC power cable, see the *DC Power Cord Specifications* section.

6. Place the terminal block cover on and tighten the screw.

7. Verify that the power cables are connected correctly, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.

8. Using both hands, slide the DC power supply straight into the chassis until the power supply is fully seated in the chassis slot. See Figure 78 on page 147. The power supply faceplate must aligned with any adjacent power supply faceplate installed in the power supply slot.

Figure 78: Install a DC Power Supply
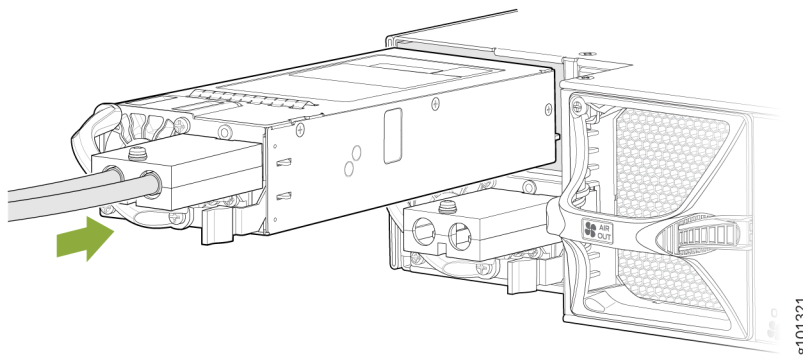
9. Close the input circuit breaker.

10. Connect the power supply to the power source.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage | 210

Replace an MX304 HVAC/DC Power Supply

IN THIS SECTION

Remove an MX304 HVAC/DC Power Supply

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

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

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

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

To remove an HVAC/DC power supply (see Figure 10):

1. Switch off the dedicated customer-site circuit breaker for the power supply, and remove the power cord from the HVAC/DC power source. Follow the instructions for your site.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Press the release latch on the right side of the power supply to disconnect the power supply from the chassis (see "Replace an MX304 HVAC/DC Power Supply" on page 148).
4. Pull the power supply straight out of the chassis.

Figure 79: Remove an HVAC/DC Power Supply

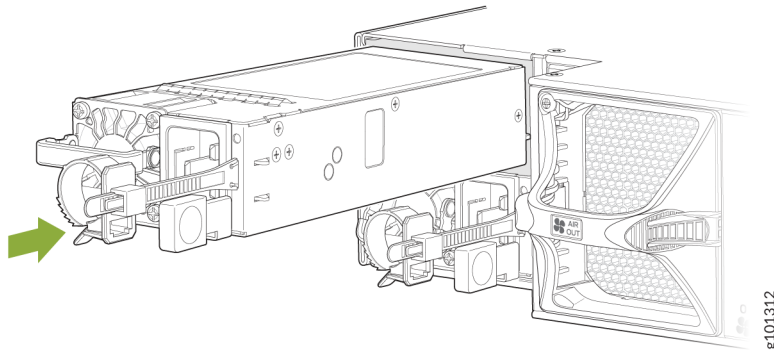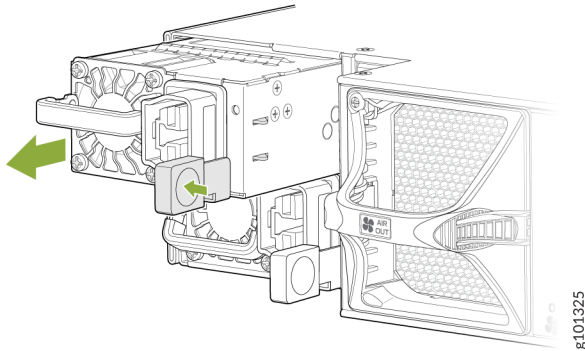## Install an MX304 HVAC/DC Power Supply

To install an HVAC/DC power supply (see):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Using both hands, hold and slide the HVAC/DC power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate must aligned with any adjacent power supply faceplate installed in the power supply slot.
3. Press the latch located on the left side of the power supply to slide it into the chassis.

Figure 80: Install an HVAC/DC Power Supply
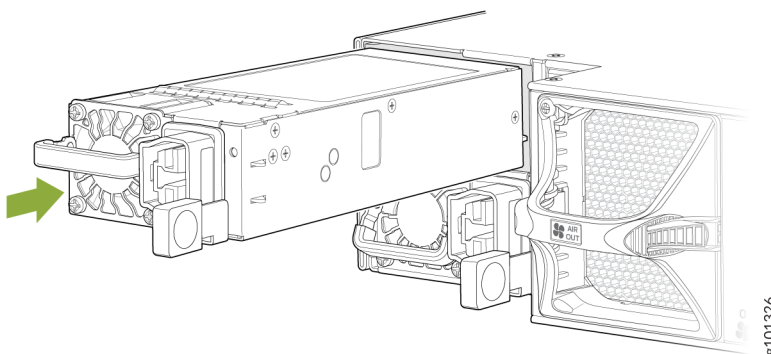
4. Attach the power cord to the power supply.
5. Attach the power cord to the AC or DC power source, and switch on the dedicated customer-site circuit breaker. Follow the instructions for your site.
6. Observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Maintain MX304 Interface Modules

Maintain LMICs

Purpose

The router can have up to three LMICs mounted horizontally in the card cage at the front of the chassis. For optimum router performance, verify the condition of the LMICs.

Action

On a regular basis:

- Check the **OK/FAIL** LED on the LMIC. If the LMIC detects a failure, the LMIC sends an alarm message to the Routing Engine.

- Issue the `show chassis fpc` CLI command to check the status of installed LMICs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the LMIC is functioning normally:

```
user@host> show chassis fpc
                 Temp  CPU Utilization (%)   CPU Utilization (%)  Memory     Utilization
(%)
Slot State       (C)  Total  Interrupt      1min   5min   15min  DRAM (MB) Heap
Buffer
  0  Online        36    6          0         5      5      5     32768       19          0
```

For more detailed output, add the **detail** option. The following example does not specify a slot number, which is optional:

```
user@host> show chassis fpc detail
Slot 0 information:
  State                         Online
  Total CPU DRAM            32768 MB
  Total HBM                 65536 MB
  FIPS Capable                  True
  Temperature                   42 degrees C / 107 degrees F
  Start time                    2022-05-30 08:00:24 IST
  Uptime                        13 minutes, 13 seconds
  Max MPC base power consumption  1105 Watts
  Max MIC0 power consumption      95 Watts
  Max MIC1 power consumption      95 Watts
  Max MIC2 power consumption      95 Watts
  Max MPC total power consumption 1390 Watts

  PFE Information:

  PFE  Power ON/OFF  Bandwidth        SLC
  0     ON              800G
  1     ON              800G
  2     ON              800G
  3     ON              800G
  4     ON              800G
  5     ON              800G
```

- Issue the `show chassis fpc pic-status` CLI command. The LMIC slots are numbered **0** and **1**, left to right:

```
user@host> show chassis fpc pic-status
Slot 0   Online       FPC-BUILTIN
  PIC 0  Online        MRATE LMIC 16x100G/4x400G
  PIC 1  Online        MRATE LMIC 16x100G/4x400G
  PIC 2  Online        MRATE LMIC 16x100G/4x400G
```

For further description of the output from the command, see the CLI Explorer.

Replace an MX304 LMIC

IN THIS SECTION

- Remove an MX304 LMIC | **152**
- Install an MX304 LMIC | **154**

Remove an MX304 LMIC

NOTE: On the MX304 router, all the LMICs are removable. You can have up to three LMICs in the router.

The LMICs are on the front side of the router. A typical LMIC weighs around 6.17 lb (2.8 kg).

To remove a LMIC (see Figure 1):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the LMIC. If the LMIC connects to a fiber-optic cable, have a rubber safety cap for each transceiver and cable ready.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

3. Issue the following CLI command to take the FPC offline:

```
user@host>request chassis fpc slot 0 offline
```

> **NOTE**: All LMICs lose service.

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

4. Label the cables connected to the LMIC so that you can later reconnect each cable to the correct LMIC.

5. Disconnect the cables from the LMIC. If the LMIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

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

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

6. Arrange the cable to prevent it from falling out or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop.

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

7. Hold the knob lock at the touch point and pull outwards to rotate it up. See Figure 1.

8. Grasp the handles on the LMIC faceplate, turn them anti-clockwise and slide the LMIC out of the chassis. Place it in the electrostatic bag or on the antistatic mat.

9. If you are not reinstalling an LMIC into the emptied LMIC slot within a short time, install a blank LMIC panel over the slot to maintain proper airflow in the chassis.

Figure 81: Remove an MX304 LMIC
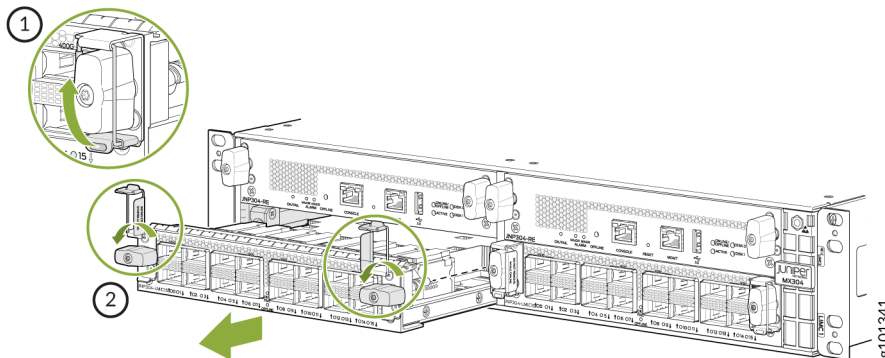
| 1– Hold the knob lock and lift it up. | 2– Turn handles anti-clockwise and remove the LMIC. |

Install an MX304 LMIC

To install an LMIC (see Figure 82 on page 155):

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

2. If the LMIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.

   NOTE: If you are installing one LMIC, we recommend you to plug it in the LMIC0 slot If you are installing two LMICs, we recommend you use slots LMIC0 and LMIC1.

3. Align the rear of the LMIC with the guides located at the corners of the LMIC slot.

4. Grasp and press both the LMIC ejector handles inward, and slide the LMIC until the ejectors latch into the chassis. Turn the ejector handles clock-wise to lock it.

   ⚠ **CAUTION**: Slide the LMIC straight into the slot to avoid damaging the components on the LMIC.

5. Hold the knob lock and pull it downwards. Press it down to lock. See Figure 82 on page 155.

Figure 82: Install an MX304 LMIC
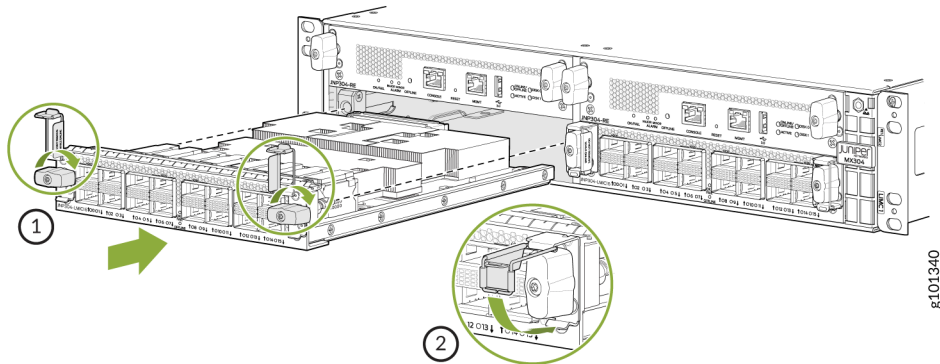
1– Insert the LMIC in the chassis and turn the ejector handles clock-wise.	2– Pull the knob lock down and press to lock in place.

6. Verify that the ejector lever is engaged properly by pushing it toward the LMIC faceplate.

7. If the LMIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

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

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

8. Insert the appropriate cables into the cable connectors on the LMIC.

9. Arrange each cable to prevent the cable from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop.

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

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

10. To bring the LMIC online, issue the following command:

```
user@host>request chassis fpc slot 0 restart
```

> **NOTE**: All LMICs restart.

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

RELATED DOCUMENTATION

Maintain Cables That Connect to LMICs

IN THIS SECTION

- Purpose | **156**
- Action | **157**

Purpose

For optimum router performance, verify the condition of the cables that connect to the LMICs.

Action

On a regular basis:

- Use the cable management brackets to support cables and prevent cables from coming unplugged or developing stress points.

- Place excess cable out of the way in the cable management brackets. Do not allow fastened loops of cable to dangle from the connector or cable management brackets, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.

- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.

- Label both ends of the cables to identify them.

The following guidelines apply specifically to fiber-optic cables:

- When you unplug a fiber-optic cable, always place a rubber safety plug over the transceiver on the faceplate and on the end of the cable.

- Anchor fiber-optic cables to avoid stress on the connectors. Be sure to secure fiber-optic cables so that they do not support their own weight as they hang to the floor. Never let fiber-optic cable hang free from the connector.

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

- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments can cause damage to the instruments and is expensive to repair. Instead, 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 easy and inexpensive to replace.

- Keep fiber-optic cable connections clean. Small microdeposits of oil and dust in the canal of the transceiver or cable connector could cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.

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

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

Replace a Cable on an MX304 LMIC

Remove a Cable on an LMIC

Removing and installing cables on an LMIC does not affect router function.

To remove a cable:

1. Have ready a rubber safety cap for each fiber-optic cable and transceiver.
2. (Recommended) Disable the port in which the transceiver is installed by using the `disable` statement at the `[edit interfaces]` hierarchy level for the specific interface.

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

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

3. Disconnect the cable from the cable connector port. If the component uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.
4. Remove the cable from the cable management brackets.
5. Disconnect the cable from the destination port.

Install a Cable on an LMIC

To install a cable:

1. Have ready a length of the type of cable used by the LMIC.
2. If the cable connector port is covered by a rubber safety plug, remove the plug.

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

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

3. Insert the cable connector into the cable connector port on the component faceplate.

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

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

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

5. Insert the other end of the cable into the destination port.

6. Repeat the previous steps for any additional cables.

RELATED DOCUMENTATION

Replace an SFP, SFP+, or QSFP+ Transceiver

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

Remove a Transceiver

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

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat

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

- A dust cover to cover the port or a replacement transceiver

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

To remove a transceiver:

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

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

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

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

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

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

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

Figure 3 shows how to remove an SFP transceiver. The procedure is the same for SFP+ and QSFP+ transceivers.

Figure 83: Small Form-Factor Pluggable (SFP) Transceiver
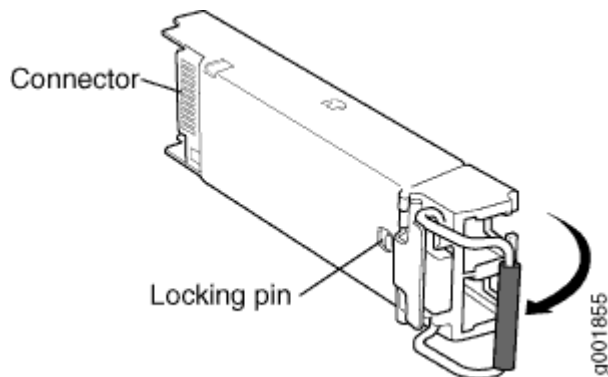
7. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the interface port.

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

9. Place a rubber safety cap over the transceiver.

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

11. Place the dust cover over the empty port or install the replacement transceiver.

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

Install a Transceiver

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

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

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

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

> ⚠️ **CAUTION**: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem running a Juniper device that uses third-party optical modules or cables, JTAC may help you diagnose host-related issues if the observed issue is not, in the opinion of JTAC, related to the use of the third-party optical modules or cables. Your JTAC engineer will likely request that you check the third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.
>
> Use of third-party optical modules with high-power consumption (for example, coherent ZR or ZR+) can potentially cause thermal damage to or reduce the lifespan of the host equipment. Any damage to the host equipment due to the use of third-party optical modules or cables is the users' responsibility. Juniper Networks will accept no liability for any damage caused due to such use.

To install a transceiver:

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

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

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

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

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

Figure 84: Install a Transceiver
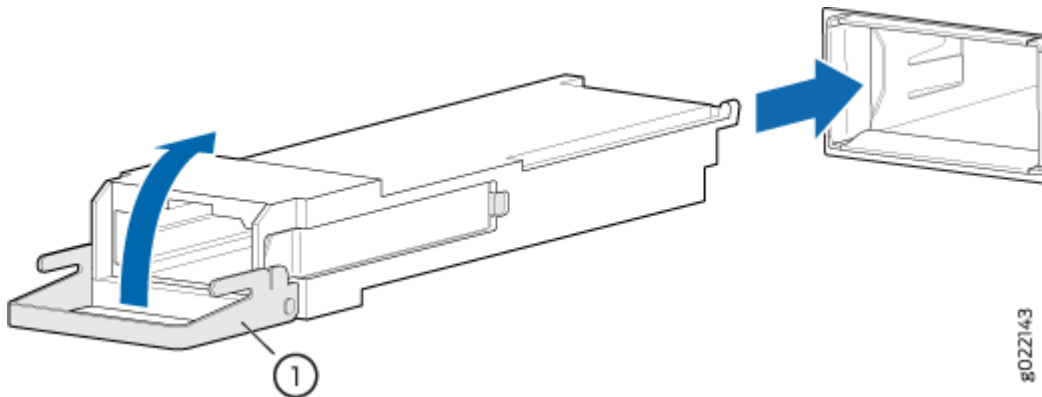
1— Ejector lever

6. Close the ejector handle of the transceiver.

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

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

Replace a QSFP28 Transceiver

IN THIS SECTION

- Remove a QSFP28 Transceiver | 165
- Install a QSFP28 Transceiver | 166

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

Remove a QSFP28 Transceiver

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

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat

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

- A dust cover to cover the port or a replacement transceiver

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

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

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

To remove a QSFP28 transceiver (see Figure 5):

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

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

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

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

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

6. Pull the transceiver's rubber handle straight back.

    The locking pins on the transceiver automatically releases the transceiver.

Figure 85: 28-Gbps Quad Small Form-Factor Pluggable (QSFP28) Transceiver

Locking pin

Ejector tab

g006999

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

Install a QSFP28 Transceiver

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

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

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

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

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

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

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

To install a replacement QSFP28 transceiver (see Figure 86 on page 168):

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.

2. Verify that a rubber safety cap covers the QSFP28 transceiver. If it is not, cover the transceiver with a safety cap.

3. Orient the transceiver in front of the port so that the QSFP28 connector faces the appropriate direction.

Figure 86: Install a QSFP28 Transceiver

Locking pin

Ejector tab

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

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

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

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

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

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

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

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

Replace a QSFP56-DD Transceiver

400-Gbps quad small form-factor pluggable (QSFP56-DD) transceivers are hot-insertable and hot-removable. The transceivers have four optical lanes that operate at 100Gbps PAM4 modulation, providing solutions up to 400 Gbps. They are compliant with the QSFP-DD MSA (DD = Double Density). Removing a QSFP56-DD transceiver does not interrupt router functioning, but the removed QSFP56-DD transceiver no longer receives or transmits data.

Remove a QSFP56-DD Transceiver

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

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat

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

- A dust cover to cover the port or a replacement transceiver

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

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

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

To remove a QSFP56-DD transceiver (see Figure 7):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the QSFP56-DD transceiver. Have ready a rubber safety cap for the QSFP56-DD transceiver and the cable.

2. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.

3. Label the cable connected to the QSFP56-DD transceiver so that you can later reconnect the cable to the correct QSFP56-DD transceiver.

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

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

CAUTION: Do not leave a fiber-optic transceiver uncovered, except when inserting or removing a cable. The safety cap keeps the port clean and protects your eyes from accidental exposure to laser light.
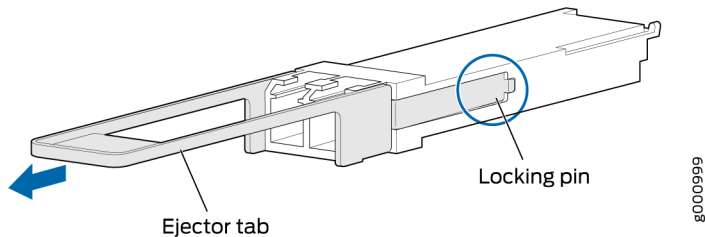
5. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

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

6. Pull the transceiver's rubber handle straight back.

The locking pins on the transceiver automatically releases the transceiver.

Figure 87: 400-Gbps Quad Small Form-Factor Pluggable (QSFP56-DD) Transceiver
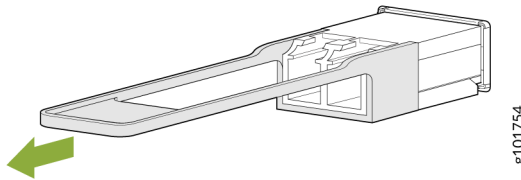
7. Place the transceiver on the antistatic mat or in the electrostatic bag.

8. Place the dust cover over the empty port or install the replacement transceiver.

Install a QSFP56-DD Transceiver

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

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

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

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

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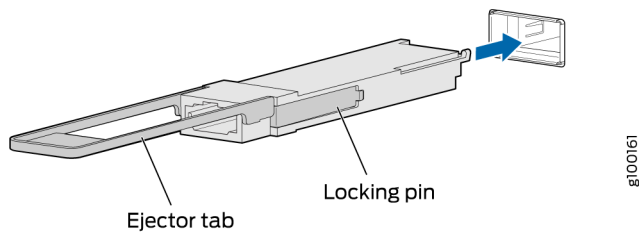
> **CAUTION**: The Juniper Networks Technical Assistance Center (JTAC) provides complete support for Juniper-supplied optical modules and cables. However, JTAC does not provide support for third-party optical modules and cables that are not qualified or supplied by Juniper Networks. If you face a problem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

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

To install a replacement QSFP56-DD transceiver (see Figure 7):

1. Wrap and fasten one end of the ESD grounding strap around your bare wrist, and connect the other end of the strap to an ESD point.

2. Verify that a rubber safety cap covers the QSFP56-DD transceiver. If it is not, cover the transceiver with a safety cap.

3. Orient the transceiver in front of the port so that the QSFP56-DD connector faces the appropriate direction.

Figure 88: 400-Gbps Quad Small Form-Factor Pluggable (QSFP56-DD) Transceiver

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

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

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

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

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

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

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

7. Verify that the status LEDs on the router indicate that the QSFP56-DD transceiver is functioning correctly. You can also verify that the interface port is functioning by running the `show chassis fpc pic-status` command.

Maintain Active Optical Cables

IN THIS SECTION

- Disconnect an Active Optical Cable | **173**
- Connect an Active Optical Cable | **176**

An active optical cable (AOC) is an optical fiber cable that has a transceiver preattached to each end.

Disconnect an Active Optical Cable

Before you disconnect an active optical cable (AOC) from a device, ensure that you have taken the necessary precautions for safe handling of laser (see Laser and LED Safety Guidelines and Warnings).

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat to store the cable, if you are disconnecting the cable from all the ports it is connected to

- Rubber safety caps to cover the ports on the device, or a replacement cable

- Rubber safety caps to cover the transceivers at the ends of the cable

- An electrostatic discharge (ESD) grounding strap—not provided

To disconnect an active optical cable:

1. Disable the port to which the cable is connected by issuing the following command:

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

2. Place the antistatic bag or antistatic mat on a flat, stable surface if you are disconnecting the cable from both the ports it is connected to.

3. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.

4. Label the cable so that you can reconnect it correctly.

   ⚠ **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.

   Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.

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

5. By using your fingers, pull the tab on the transceiver attached to the cable to disengage it.

Figure 89: Disconnect an SFP28 or SFP+ Active Optical Cable
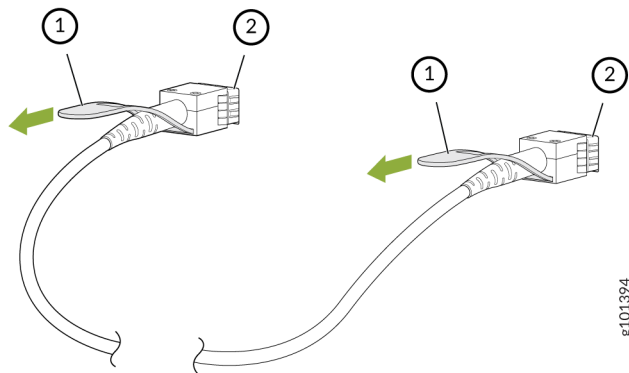
1–	Tab to pull the transceiver	2–	Port on the device

Figure 90: Disconnect a QSFP28 or QSFP+ Active Optical Cable

1–	Tab to pull the transceiver	2–	Port on the device

6. Grasp the transceiver and gently slide it approximately 0.5 in. (1.3 cm) straight out of the port.

> ⚠️ **CAUTION**: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

7. By using your fingers, grasp the body of the transceiver and pull it straight out of the port.

8. Cover the transceiver with a rubber safety cap.

9. If you are disconnecting the cable from both the ports it is connected to, place the cable in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

The procedure to disconnect other types of AOCs, other than direct attach AOCs, is the same as the procedure described in this topic.

Connect an Active Optical Cable

Before you connect an AOC to a device, ensure that you have taken the necessary precautions for safe handling of lasers (see Laser and LED Safety Guidelines and Warnings).

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

Ensure that you have an ESD grounding strap (not provided).

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

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

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

To connect an active optical cable:

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.
2. Remove the cable from its bag.

> ⚠ **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.

3. If the transceiver attached to the cable is covered with a rubber safety cap, remove the cap. Save the cap.

4. If the port on the device is covered with a rubber safety cap, remove the cap. Save the cap. If you are hot-swapping a cable, wait for at least 10 seconds after removing the cable from the port before installing a new cable.

> ⚠ **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 cable unusable.
>
> Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
>
> Do not let the cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

5. By using both hands, carefully insert the transceiver in the empty port. The connectors must face the chassis. Slide the transceiver in gently until it is fully seated.

Figure 91: Connect an SFP28 or SFP+ Active Optical Cable
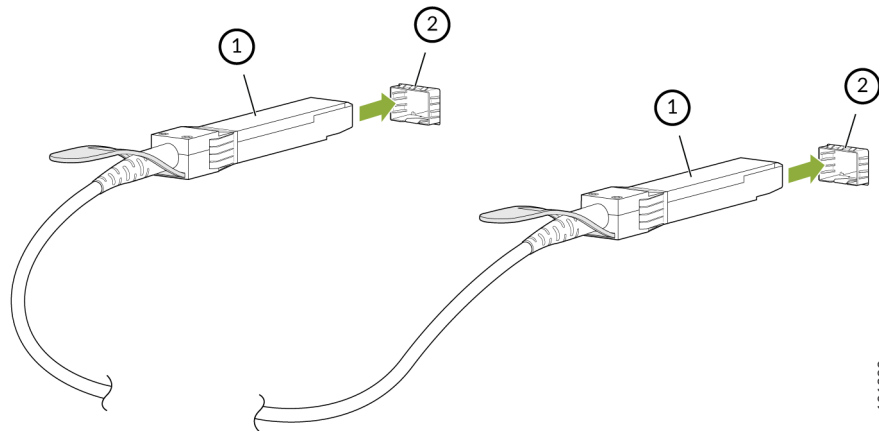
| 1– Transceiver | 2– Port on the device |

Figure 92: Connect a QSFP28 or QSFP+ Active Optical Cable
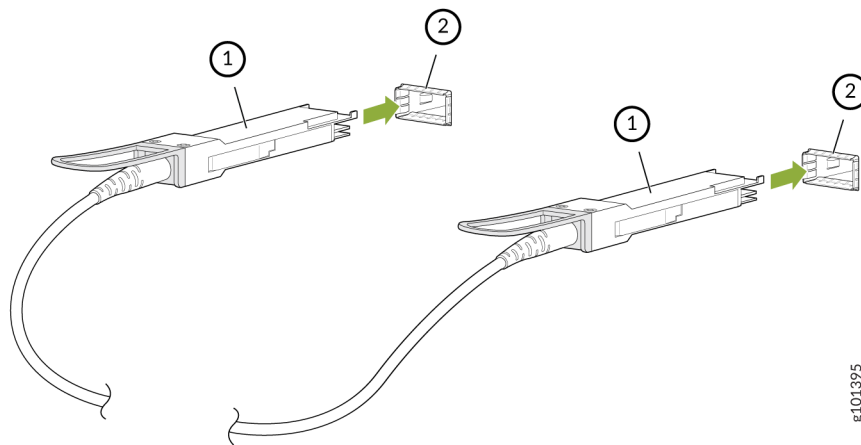
1– Transceiver	2– Port on the device

6. Repeat Step 5 for all ports to which the cable must be connected.

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

The procedure to connect other types of AOCs, other than direct attach AOCs, is the same as the procedure described in this topic.

Maintain Breakout Cables

IN THIS SECTION

- Disconnect a Breakout Cable | **179**
- Connect a Breakout Cable | **180**

Breakout cables have one transceiver preattached to one end and more than one transceiver preattached to the other end. You can use the cables to channelize a port and increase the number of interfaces. For example, you can channelize the QSFP28 ports on the front panel of MX304 by connecting breakout cables and by using CLI configuration when those ports are configured as network ports (see Port Speed on MX304 Router Overview).

Disconnect a Breakout Cable

Before you disconnect a breakout cable from a device, ensure that you have taken the necessary precautions for safe handling of laser (see "Laser and LED Safety Guidelines and Warnings" on page 219).

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat to store the cable, if you are disconnecting the cable from all the ports it is connected to

- Rubber safety caps to cover the ports on the device, or a replacement cable

- Rubber safety caps to cover the transceivers at the ends of the cable

- An electrostatic discharge (ESD) grounding strap—not provided

To disconnect a breakout cable:

1. Disable the port to which the cable is connected by issuing the following command:

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

2. Place the antistatic bag or antistatic mat on a flat, stable surface if you are disconnecting the cable from all the devices it is connected to.

3. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.

4. Label the cable so that you can reconnect it correctly.

> ⚠ **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.
>
> Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
>
> Do not let the cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

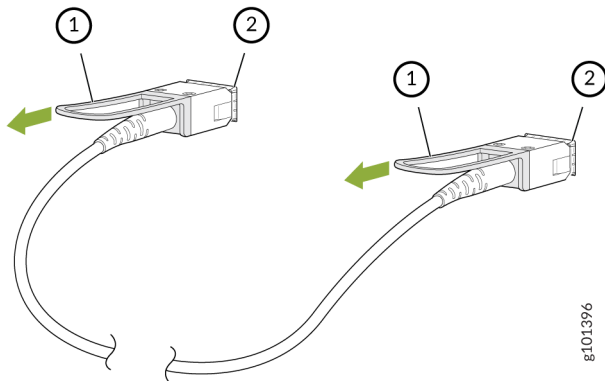5. By using your fingers, pull the tab on the transceiver attached to the cable to disengage it (see Figure 13).

Figure 93: Disconnect a Breakout Cable
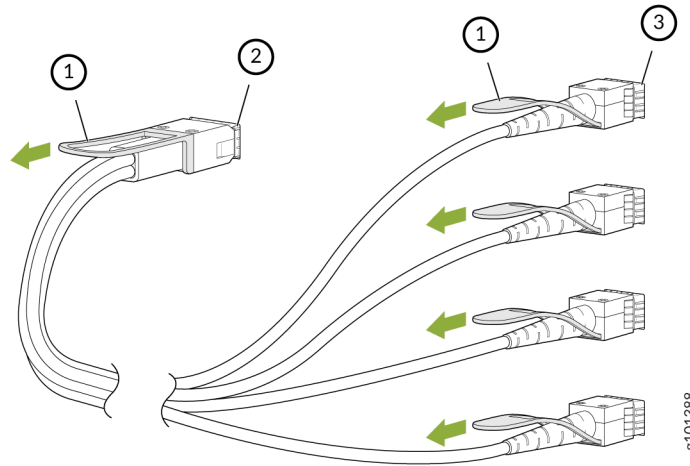
1– Tab to pull the transceiver	3– Port at the other end
2– Channelized port on a device	

6. Grasp the transceiver and gently slide it approximately 0.5 in. (1.3 cm) straight out of the port.

> ⚠️ **CAUTION**: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

7. By using your fingers, grasp the body of the transceiver and pull it straight out of the port.
8. Cover the transceiver with a rubber safety cap.
9. Secure the cable so that it does not support its own weight as it hangs to the floor. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.
10. If you are disconnecting the cable from all the devices it is connected to, place the cable in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

The procedure to disconnect other types of breakout cables is the same as the procedure described in this topic.

Connect a Breakout Cable

> ⚠️ **CAUTION**: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

> If you are connecting an active optic breakout cable to a device, ensure that you have taken the necessary precautions for safe handling of laser (see "Laser and LED Safety Guidelines and Warnings" on page 219).

Ensure that you have an electrostatic discharge (ESD) grounding strap (not provided).

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

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

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

To connect a breakout cable:

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.
2. Remove the cable from its bag.

⚠ **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.

3. If the transceiver attached to the cable is covered with a rubber safety cap, remove the cap. Save the cap.
4. If the port on the device is covered with a rubber safety cap, remove the cap. Save the cap. If you are hot-swapping a cable, wait for at least 10 seconds after removing the cable from the port before installing a new cable.

> ⚠ **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 cable unusable.
>
> Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
>
> Do not let the cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

5. By using both hands, carefully insert the transceiver in the empty port. The connectors must face the chassis. Slide the transceiver in gently until it is fully seated (see Figure 94 on page 182).

Figure 94: Connect a Breakout Cable
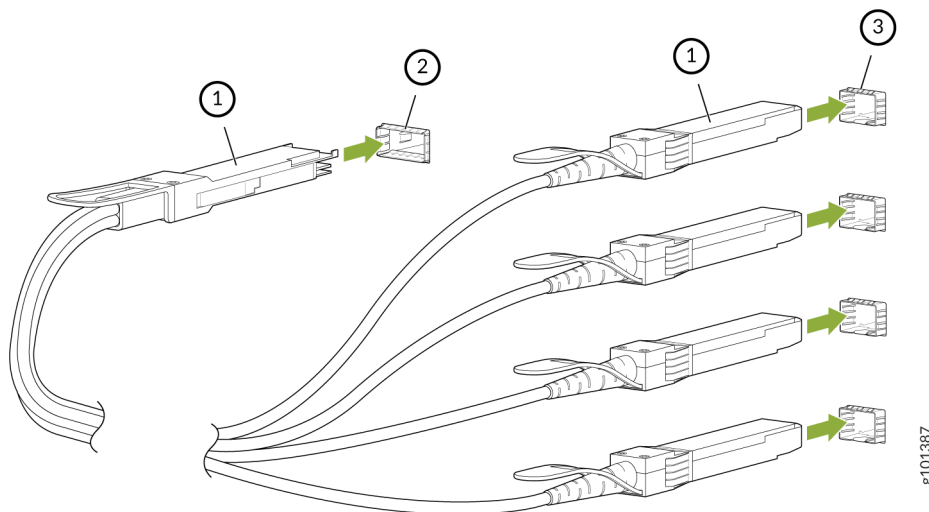
1– Transceiver	3– Ports at the other end
2– Channelized port on a device	

6. Repeat Step 5 for all ports to which the cable must be connected.

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

The procedure to connect other types of breakout cables is the same as the procedure described in this topic.

Maintain Direct Attach Cables

A direct attach cable has a transceiver preattached to each end.

Disconnect a Direct Attach Cable

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat to store the cable, if you are disconnecting the cable from both the ports it is connected to

- Rubber safety caps to cover the ports on the device, or a replacement cable

- Rubber safety caps to cover the transceivers at the ends of the cable

- An electrostatic discharge (ESD) grounding strap—not provided

To disconnect a direct attach cable:

1. Disable the port to which the cable is connected by issuing the following command:

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

2. Place the antistatic bag or antistatic mat on a flat, stable surface if you are disconnecting the cable from both the ports it is connected to.

3. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.

4. Label the cable so that you can reconnect it correctly.

   > **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.

> Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
>
> Do not let the cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

5. By using your fingers, pull the tab on the transceiver attached to the cable to disengage it.

Figure 95: Disconnect an SFP28 or SFP+ Direct Attach Cable
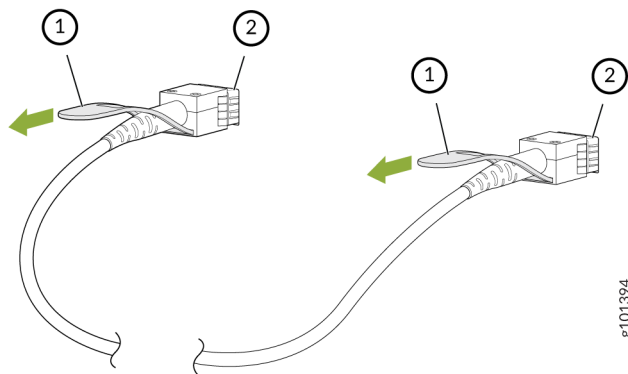
1– Tab to pull the transceiver	2– Port on the device

Figure 96: Disconnect a SFP28, SFP+, or QSFP-DD Direct Attach Cable

1– Tab to pull the transceiver	2– Port on the device

6. Grasp the transceiver and gently slide it approximately 0.5 in. (1.3 cm) straight out of the port.

> ⚠️ **CAUTION**: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

7. By using your fingers, grasp the body of the transceiver and pull it straight out of the port.

8. Cover the transceiver with a rubber safety cap.

9. If you are disconnecting the cable from both the ports it is connected to, place the cable in the antistatic bag or on the antistatic mat placed on a flat, stable surface.

The procedure to disconnect other types of direct attach cables, other than direct attach breakout cables, is the same as the procedure described in this topic.

Connect a Direct Attach Cable

> ⚠️ **CAUTION**: To prevent ESD damage to the transceiver, do not touch the connector pins at the end of the transceiver.

Ensure that you have an ESD grounding strap (not provided).

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

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

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

To connect a direct attach cable:

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to a site ESD point.

2. Remove the cable from its bag.

> ⚠ **CAUTION**: Do not leave the transceivers at the ends of the cable uncovered except when connecting or disconnecting the cable. The rubber safety cap keeps the transceivers clean and protected.

3. If the transceiver attached to the cable is covered with a rubber safety cap, remove the cap. Save the cap.

4. If the port on the device is covered with a rubber safety cap, remove the cap. Save the cap. If you are hot-swapping a cable, wait for at least 10 seconds after removing the cable from the port before installing a new cable.

> ⚠ **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 cable unusable.
>
> Do not bend the cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cables and cause problems that are difficult to diagnose.
>
> Do not let the cables hang free from the connector. Do not allow fastened loops of cables to dangle, which stresses the cables at the fastening point.

5. By using both hands, carefully insert the transceiver in the empty port. The connectors must face the chassis. Slide the transceiver in gently until it is fully seated.

Figure 97: Connect an SFP28 or SFP+ Direct Attach Cable
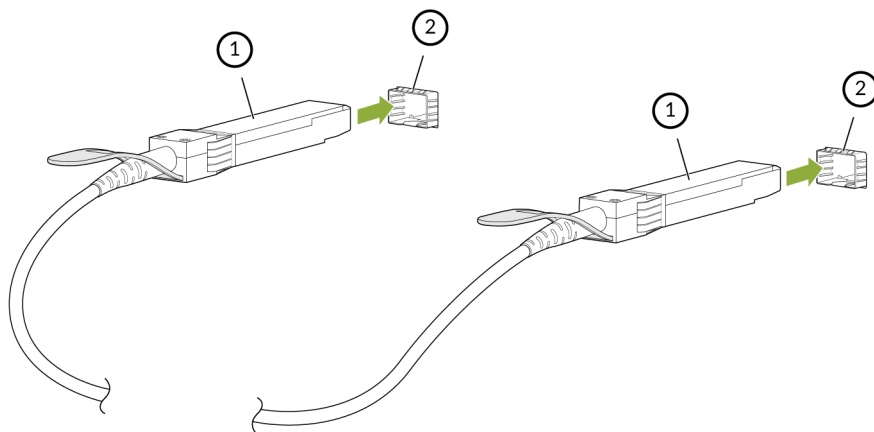
| 1— Transceiver | 2— Port on the device |

Figure 98: Connect a SFP28, SFP+, or QSFP-DD Direct Attach Cable
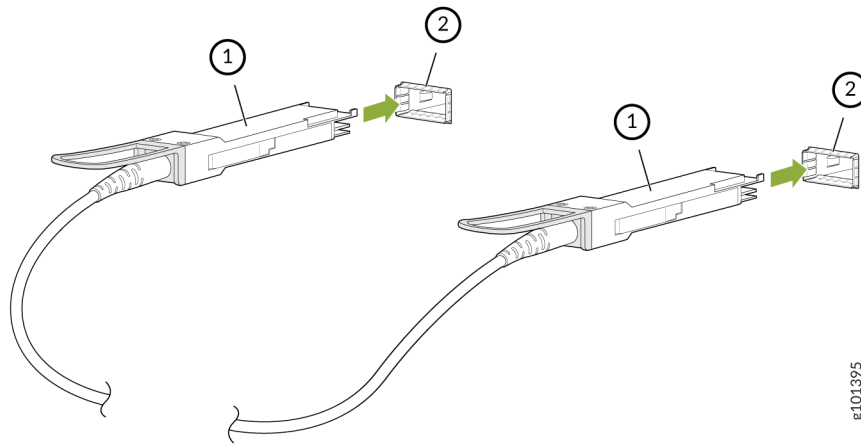
1– Transceiver	2– Port on the device

6. Repeat Step 5 for all ports to which the cable must be connected.

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

The procedure to connect other types of direct attach cables, other than direct attach breakout cables, is the same as the procedure described in this topic.

Maintain the MX304 Routing Engine

IN THIS SECTION

Maintain the Routing Engine

Purpose

For optimum router performance, verify the condition of the Routing Engine on regular basis.

Action

On a regular basis:

- Check the LEDs on the front panel to view information about the status of the Routing Engine.

- To check the status of the Routing Engine, issue the `show chassis routing-engine` command. The output is similar to the following:

```
user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature               33 degrees C / 91 degrees F
    CPU temperature           34 degrees C / 93 degrees F
    DRAM                     98250 MB (98304 MB installed)
    Memory utilization          3 percent
    5 sec CPU utilization:
      User                      0 percent
      Background                0 percent
      Kernel                    0 percent
      Interrupt                 0 percent
      Idle                     99 percent
    1 min CPU utilization:
      User                      0 percent
      Background                0 percent
```

```
      Kernel                   0 percent
      Interrupt                0 percent
      Idle                    99 percent
   5 min CPU utilization:
      User                     0 percent
      Background               0 percent
      Kernel                   0 percent
      Interrupt                0 percent
      Idle                    95 percent
   15 min CPU utilization:
      User                     0 percent
      Background               0 percent
      Kernel                   0 percent
      Interrupt                0 percent
      Idle                    63 percent
   Model                       RE 2700 8C 128G
   Serial ID                   BCDA4069
   Start time                  2022-09-06 11:27:31 IST
   Uptime                      17 minutes, 49 seconds
   Last reboot reason          0x1:power cycle/failure
   Load averages:              1 minute   5 minute   15 minute
                                  0.43       0.35       0.37




...
```

Replace an MX304 Routing Engine

IN THIS SECTION

Remove an MX304 Routing Engine

The MX304 host subsystem has up to two Routing Engines.

To remove a Routing Engine (see Figure 1):

> ⚠️ **CAUTION**: Before removing a Routing Engine, make sure you know how to properly use the ejector handles to avoid damage to the equipment.

> ⚠️ **CAUTION**: Before you replace a Routing Engine, you must take the host subsystem offline. If there's only one host subsystem, the router shuts down when you take it offline.

1. Take the host subsystem offline.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Open the ejector handle outward to unseat the Routing Engine.
5. Grasp the ejector handle, and slide the Routing Engine about halfway out of the chassis. See Figure 1.

Figure 99: Removing an Routing Engine
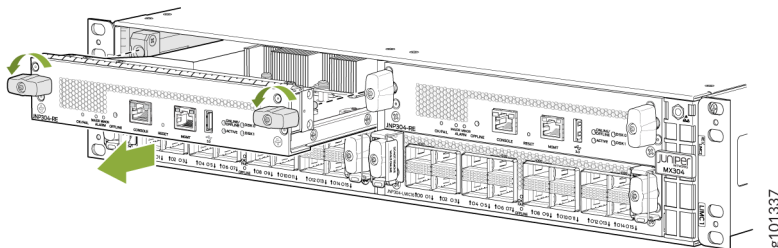
6. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis.
7. Place the Routing Engine on the antistatic mat or into an antistatic bag.

> **NOTE**: If you plan to re-insert the Routing Engine, wait for atleast 1 minute or more and then re-insert back into the chassis.

8. If you are not replacing the Routing Engine immediately, install a blank panel over the empty slot.

Install an MX304 Routing Engine

To install an MX304 Routing Engine (see):

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

2. Remove the Routing Engine from the electrostatic bag.

3. Carefully align the sides of the Routing Engine with the guides inside the chassis.

4. Slide the Routing Engine into the chassis until you feel resistance, carefully ensuring that it's correctly aligned.

5. Grasp the ejector handles, and gently close them simultaneously until the Routing Engine is fully seated. Turn the ejector handles clockwise until they lock.

Figure 100: Installing an MX304 Routing Engine
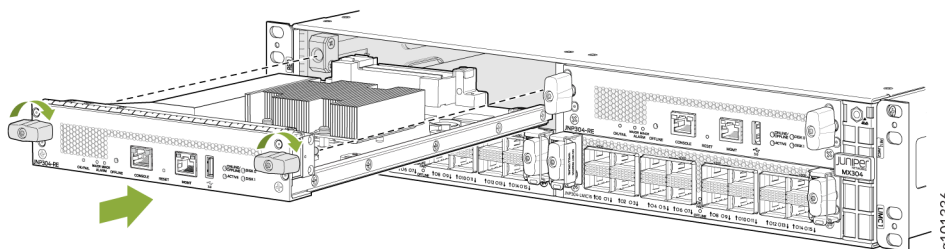
6. Check the LEDs on the Routing Engine faceplate to verify that it's functioning normally:

   - The green **OK/FAIL** LED should light steadily a few minutes after you install the Routing Engine.

   - If the **OK/FAIL** LED is red, remove and install the Routing Engine again. If the **OK/FAIL** LED still lights steadily, the Routing Engine isn't functioning properly. Contact your customer support representative. See *Contact Customer Support*.

7. Check the Routing Engine status by using the `show chassis routing-engine` command:

```
user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                 Master
    Election priority             Master (default)
    Temperature               33 degrees C / 91 degrees F
    CPU temperature           34 degrees C / 93 degrees F
    DRAM                     98250 MB (98304 MB installed)
    Memory utilization          3 percent
    5 sec CPU utilization:
```

```
  User                  0 percent
  Background            0 percent
  Kernel               0 percent
  Interrupt            0 percent
  Idle                 99 percent
1 min CPU utilization:
  User                  0 percent
  Background            0 percent
  Kernel               0 percent
  Interrupt            0 percent
  Idle                 99 percent
5 min CPU utilization:
  User                  0 percent
  Background            0 percent
  Kernel               0 percent
  Interrupt            0 percent
  Idle                 95 percent
15 min CPU utilization:
  User                  0 percent
  Background            0 percent
  Kernel               0 percent
  Interrupt            0 percent
  Idle                 63 percent
Model                    RE 2700 8C 128G
Serial ID                BCDA4069
Start time               2022-09-06 11:27:31 IST
Uptime                   17 minutes, 49 seconds
Last reboot reason       0x1:power cycle/failure
Load averages:           1 minute   5 minute  15 minute
                            0.43        0.35       0.37
```

6
CHAPTER

Contacting Customer Support and Returning the Chassis or Components

Contact Customer Support and Returning the Chassis or Components

Contact Customer Support to Obtain a Return Material Authorization

If you need to return a device or hardware component to Juniper Networks for repair or replacement, obtain an RMA number from JTAC. You must obtain an RMA number before you attempt to return the component.

After locating the serial number of the device or hardware component you want to return, open a service request with the JTAC on the Web or by telephone.

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

- Your existing service request number, if you have one

- Serial number of the component

- Your name, organization name, telephone number, fax number, and shipping address

- Details of the failure or problem

- Type of activity being performed on the device when the problem occurred

- Configuration data displayed by one or more show commands

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

- Service Request Manager: https://support.juniper.net/support

- Telephone: +1-888-314-JTAC (+1-888-314-5822), toll free in U.S., Canada, and Mexico

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

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

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

Locate the Serial Number on an MX304 Router or Component

IN THIS SECTION

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

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

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

List the Chassis and Component Details Using the CLI

To list the MX304 chassis and the 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                                 FY621            JNP304 [MX304]
Routing Engine 0 REV 11   750-123749   BCDA4069         RE 2700 8C 128G
CB 0             REV 30   750-123404   BCDC3824         Control Board
FPC 0                     BUILTIN      BUILTIN          FPC-BUILTIN
  CPU            REV 10   750-122877   BCCX0167         JNP304 PMB
  PIC 0          REV 21   750-122718   BCDC4866         MRATE LMIC 16x100G/4x400G
    Xcvr 0       REV 01   740-065632   1FCS241807E      QSFP28-100G-AOC-5M
    Xcvr 1       REV 01   740-061001   1P1C42A615256    QSFP28-100G-CU3M
    Xcvr 2       REV 01   740-061001   1P1C42A615256    QSFP28-100G-CU3M
    Xcvr 3       REV 01   740-061001   1P1C42A6151M8    QSFP28-100G-CU3M
    Xcvr 4       REV 01   740-061001   1P1C42A6151M8    QSFP28-100G-CU3M
    Xcvr 5       REV 01   740-061001   1P1C42A616MKE    QSFP28-100G-CU3M
    Xcvr 6       REV 01   740-061001   1P1C42A616MKE    QSFP28-100G-CU3M
    Xcvr 7       REV 01   740-061001   1P1C42A61525C    QSFP28-100G-CU3M
    Xcvr 8       REV 01   740-061001   1P1C42A61525C    QSFP28-100G-CU3M
    Xcvr 9       REV 01   740-061001   1P1C42A615253    QSFP28-100G-CU3M
    Xcvr 10      REV 01   740-061001   1P1C42A615253    QSFP28-100G-CU3M
    Xcvr 11      REV 01   740-061002   1P1C43A61525U    QSFP28-100G-CU5M
    Xcvr 12      REV 01   740-061002   1P1C43A61525U    QSFP28-100G-CU5M
    Xcvr 13      REV 01   740-061002   1P1C43A615268    QSFP28-100G-CU5M
    Xcvr 14      REV 01   740-061002   1P1C43A615268    QSFP28-100G-CU5M
    Xcvr 15      REV 01   740-061002   1P1C43A615271    QSFP28-100G-CU5M
  PIC 1          REV 22   750-122718   BCDC4909         MRATE LMIC 16x100G/4x400G
    Xcvr 0       REV 01   740-061002   1P1C43A615271    QSFP28-100G-CU5M
    Xcvr 1       REV 01   740-061002   1P1C43A615270    QSFP28-100G-CU5M
    Xcvr 2       REV 01   740-061002   1P1C43A615270    QSFP28-100G-CU5M
    Xcvr 3       REV 01   740-061002   1P1C43A61526U    QSFP28-100G-CU5M
    Xcvr 4       REV 01   740-061002   1P1C43A61526U    QSFP28-100G-CU5M
```

```
     Xcvr 5       REV 01   740-061001   1R1C42A62600W   QSFP28-100G-CU3M
     Xcvr 6       REV 01   740-061001   1R1C42A62600W   QSFP28-100G-CU3M
     Xcvr 7       REV 01   740-061001   1R1C42A62600U   QSFP28-100G-CU3M
     Xcvr 8       REV 01   740-061001   1R1C42A62600U   QSFP28-100G-CU3M
     Xcvr 9       REV 01   740-061001   1R1C42A62600F   QSFP28-100G-CU3M
     Xcvr 10      REV 01   740-061001   1R1C42A62600F   QSFP28-100G-CU3M
     Xcvr 11      REV 01   740-061001   1R1C42A626018   QSFP28-100G-CU3M
     Xcvr 12      REV 01   740-061001   1R1C42A626018   QSFP28-100G-CU3M
     Xcvr 13      REV 01   740-061001   1R1C42A62600H   QSFP28-100G-CU3M
     Xcvr 14      REV 01   740-061001   1R1C42A62600H   QSFP28-100G-CU3M
     Xcvr 15      REV 01   740-064669   198730          QSFP28-LPBK
PEM 0             Rev 02   740-110419   1F27C030096     AC AFO 2200W Power Supply
PEM 1             Rev 02   740-110419   1F27C030038     AC AFO 2200W Power Supply
Fan Tray 0        REV 04   760-126744   BCDH1418        JNP304 Fan Tray, Front to Back Airflow
Fan Tray 1        REV 04   760-126744   BCDH1411        JNP304 Fan Tray, Front to Back Airflow
Fan Tray 2        REV 04   760-126744   BCDH1409        JNP304 Fan Tray, Front to Back Airflow
SFB 0             REV 08   750-122847   BCCW0192        Switch Fabric Board
TIB               REV 06   750-126514   BCCW7927        Timing Interface Board
```

Locate the Chassis Serial Number ID Label on an MX304

The serial number ID label is located on a label on the top of the chassis. See for the location on a MX304.

Figure 101: MX304 Serial Number Label
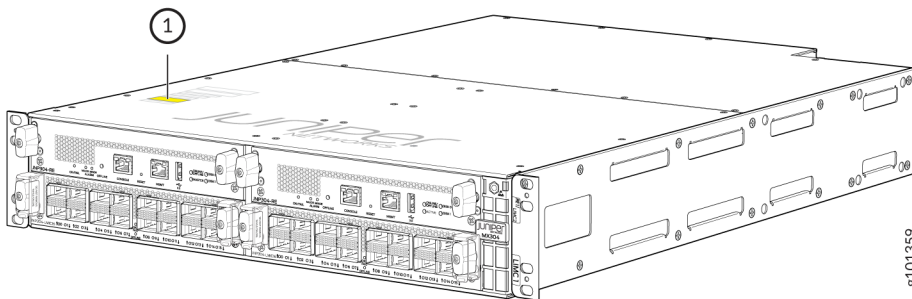
1— Serial number label

Locate the Serial Number ID Labels on MX304 Power Supplies

The power supplies installed in a MX304 are field-replaceable units (furs). For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

- AC power supply—The serial number ID label is on the top of the AC power supply. See Figure 102 on page 198.

Figure 102: MX304 AC Power Supply Serial Number Location
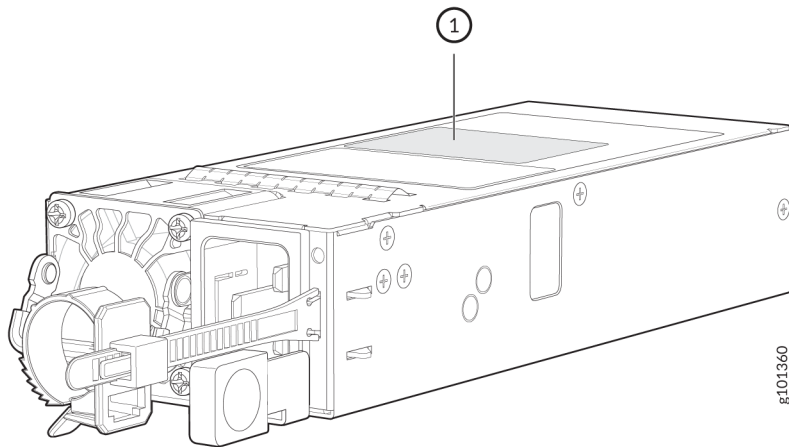
1— Serial number label

- DC power supply—The serial number ID label is on the top of the DC power supply. See Figure 103 on page 199.

Figure 103: MX304 DC Power Supply Serial Number Location
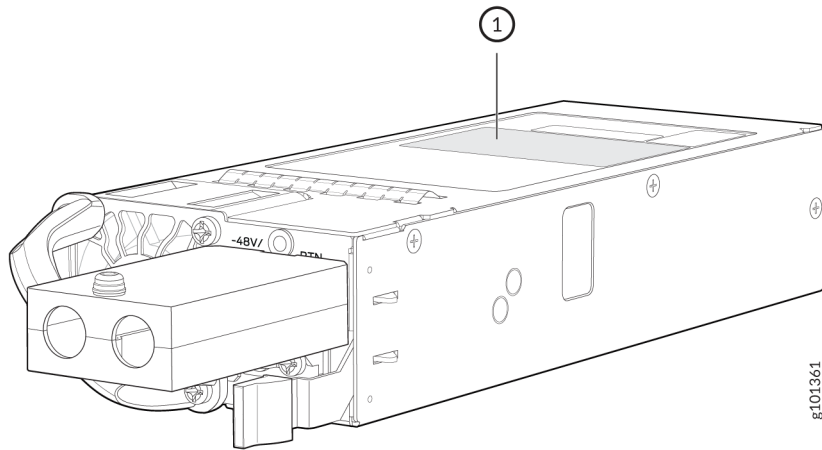
1— Serial number label

- HVAC/DC power supply—The serial number ID label is on the top of the HVAC/DC power supply. See .

Figure 104: MX304 HVAC/HVDC Power Supply Serial Number Location
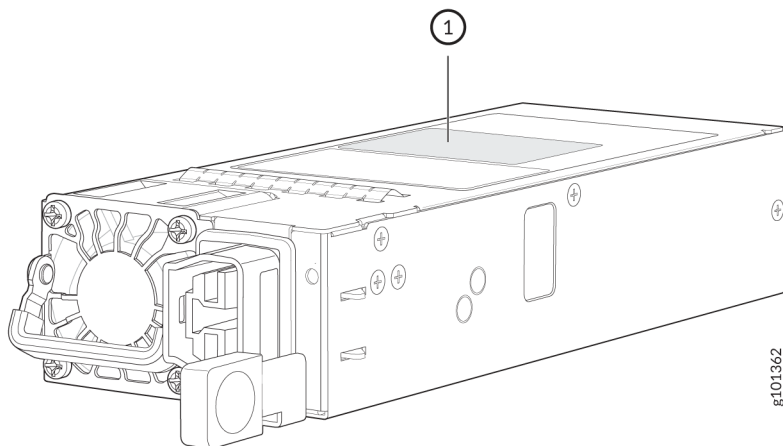
1— Serial number label

Locate the Serial Number ID Label on MX304 Fan Module

The three fan modules installed in a MX304 are field-replaceable units (furs). For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

Fan module–The serial number ID label is located at the base of the fan module. See .

Figure 105: MX304 Fan Module Serial Number Location
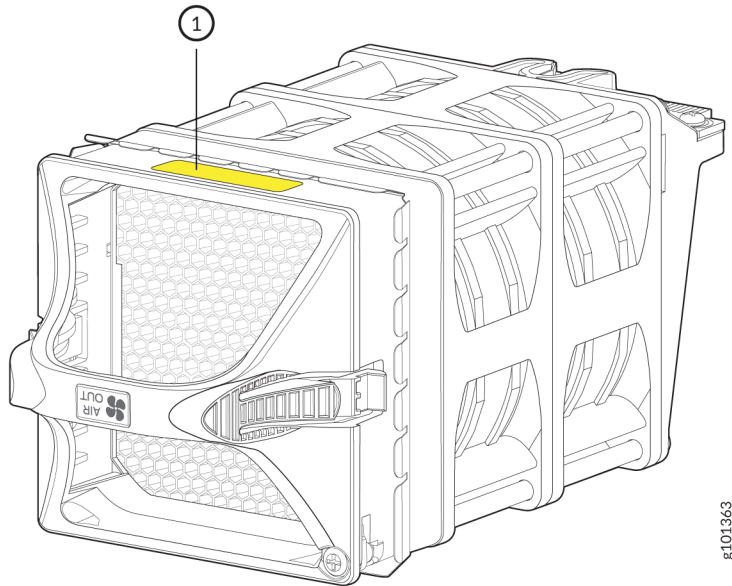
1— Serial number label

Locate the Serial Number ID Labels on MX304 Line Cards

shows the location of the serial number label. For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

Figure 106: MX304 LMIC Serial Number Location
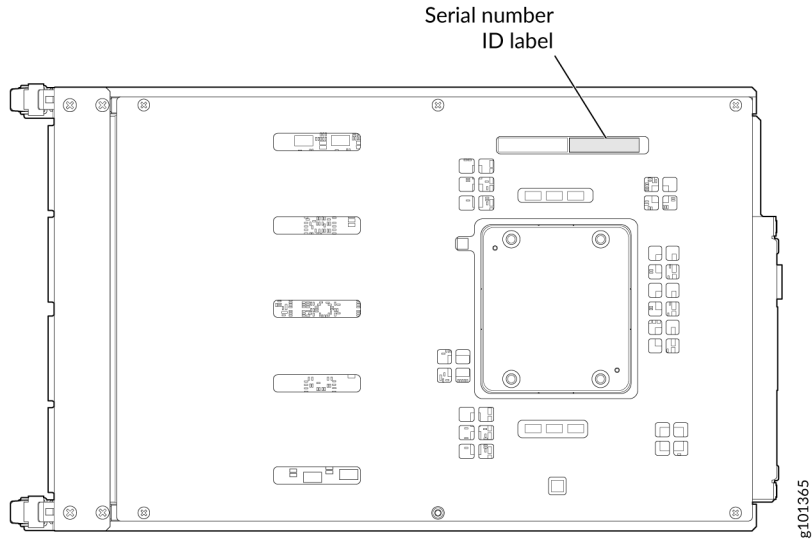
1— Serial number label

Locate the Serial Number ID Labels on MX304 Routing Engine

The serial number ID label for an MX304 Routing Engine is located on the left side. See Figure 107 on page 201. For each FRU, you must remove the FRU from the router chassis to see the FRU serial number ID label.

Figure 107: MX304 Routing Engine Serial Number Location
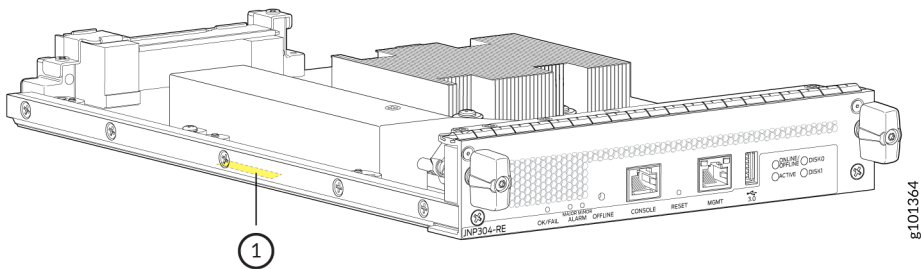
1— Serial number label

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure that they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.

- Use the original shipping materials if they are available.

- Place individual components in antistatic bags.

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

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

7

CHAPTER

Safety and Compliance Information

Definitions of Safety Warning Levels

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

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

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

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

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

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

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

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

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

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

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

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

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du 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.

General Safety Guidelines and Warnings

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

- Perform only the procedures explicitly described in the hardware documentation for this device. Make sure that only authorized service personnel perform other system services.

- Keep the area around the device clear and free from dust before, during, and after installation.

- Keep tools away from areas where people could trip over them while walking.

- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, which could become caught in the device.

- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.

- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.

- Never attempt to lift an object that is too heavy for one person to handle.

- Never install or manipulate wiring during electrical storms.

- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.

- Operate the device only when it is properly grounded.

- Follow the instructions in this guide to properly ground the device to earth.

- Replace fuses only with fuses of the same type and rating.

- Do not open or remove chassis covers or sheet-metal parts unless instructions are provided in the hardware documentation for this device. Such an action could cause severe electrical shock.

- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.

- Avoid spilling liquid onto the chassis or onto any device component. Such an action could cause electrical shock or damage the device.

- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.

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

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

General Safety Warnings for Juniper Networks Devices

Qualified Personnel Warning

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

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

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

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

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

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

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

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

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

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

Restricted-Access Area Warning

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

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

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

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

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

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

Advarsel Denne enheten er laget for installasjon i områder med begrenset adgang. Et område med begrenset adgang gir kun adgang til servicepersonale som bruker et

spesielt verktøy, lås og nøkkel, eller en annen sikkerhetsanordning, og det kontrolleres av den autoriteten som er ansvarlig for området.

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

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

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

RELATED DOCUMENTATION

Installation Safety Warnings for Juniper Networks Devices

Maintenance and Operational Safety Warnings for Juniper Networks Devices

General Electrical Safety Warnings for Juniper Networks Devices

DC Power Electrical Safety Warnings for Juniper Networks Devices

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 108 on page 211) in one hand and touch the exposed, bare metal of the device with the other hand immediately before inserting the component into the device.

> ⚠ **WARNING**: For safety, periodically check the resistance value of the ESD grounding strap. The measurement must be in the range 1 through 10 Mohms.
>
> **Avertissement** Par mesure de sécurité, vérifiez régulièrement la résistance du bracelet antistatique. Cette valeur doit être comprise entre 1 et 10 mégohms (Mohms).

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

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

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

- When removing or installing a component that is subject to ESD damage, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an antistatic bag (see Figure 108 on page 211). If you are returning a component, place it in an antistatic bag before packing it.

Figure 108: Placing a Component into an Antistatic Bag
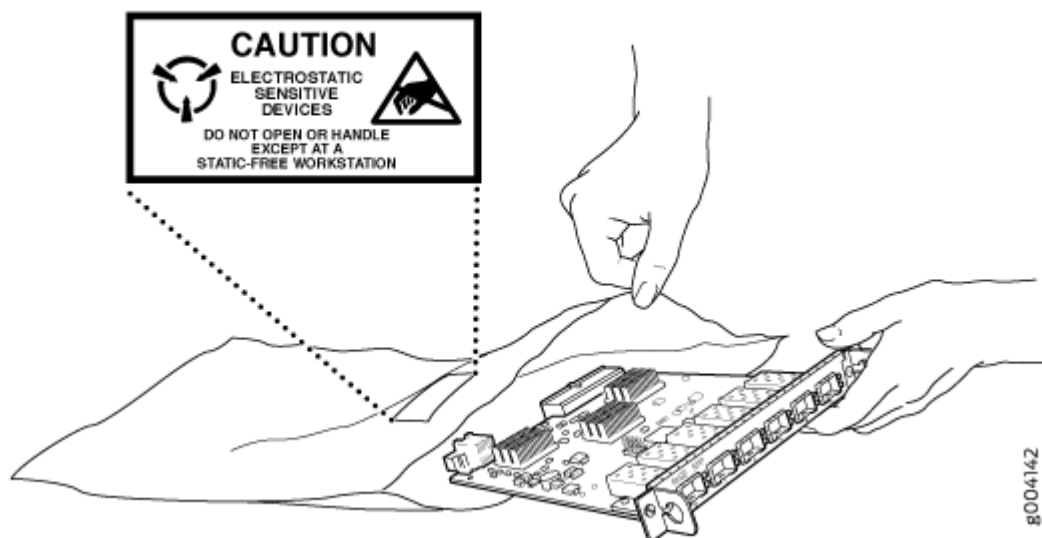
> **⚠ CAUTION**: ANSI/TIA/EIA-568 cables such as Category 5e and Category 6 can get electrostatically charged. To dissipate this charge, always ground the cables to a suitable and safe earth ground before connecting them to the system.
>
> **Attention** Les câbles ANSI/TIA/EIA-568, par exemple Cat 5e et Cat 6, peuvent emmagasiner des charges électrostatiques. Pour évacuer ces charges, reliez toujours les câbles à une prise de terre adaptée avant de les raccorder au système.

Fire Safety Requirements

IN THIS SECTION

-
-

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

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

Fire Suppression

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

Fire Suppression Equipment

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

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

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

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

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

Installation Instructions Warning

> **WARNING**: Read the installation instructions before you connect the device to a power source.
>
> **Waarschuwing** Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.
>
> **Varoitus** Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.
>
> **Avertissement** Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.
>
> **Warnung** Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

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

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

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

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

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

Chassis and Component Lifting Guidelines

- Before moving the device to a site, ensure that the site meets the power, environmental, and clearance requirements.

- Before lifting or moving the device, disconnect all external cables and wires.

- As when lifting any heavy object, ensure that your legs bear most of the weight rather than your back. Keep your knees bent and your back relatively straight. Do not twist your body as you lift. Balance the load evenly and be sure that your footing is firm.

- Use the following lifting guidelines to lift devices and components:

  - Up to 39.7 lb (18 kg): One person.

  - From 39.7 lb (18 kg) to 70.5 lb (32 kg): Two or more people.

  - From 70.5 lb (32 kg) to 121.2 lb (55 kg): Three or more people.

  - Above 121.2 lb (55 kg): Use material handling systems (such as levers, slings, lifts, and so on). When this is not practical, engage specially trained persons or systems (such as riggers or movers).

Ramp Warning

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

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

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

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

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

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

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

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

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

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

Rack-Mounting and Cabinet-Mounting Warnings

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

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

- Install the device in a rack that is secured to the building structure.

- Mount the device at the bottom of the rack if it is the only unit in the rack.

- When mounting the device on a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.

- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

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

- De Juniper Networks switch moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.

- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.

- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.

- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

Varoitus Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta 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.

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

- Le rack sur lequel est monté le Juniper Networks switch doit être fixé à la structure du bâtiment.

- Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.

- Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l'élément le plus lourd dans le bas.

- Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l'unité en casier.

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

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.

- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.

- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.

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

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

- Il Juniper Networks switch deve essere installato in un telaio, il quale deve essere fissato alla struttura dell'edificio.

- Questa unità deve venire montata sul fondo del supporto, se si tratta dell'unica unità da montare nel supporto.

- Quando questa unità viene montata in un supporto parzialmente pieno, caricare il supporto dal basso all'alto, con il componente più pesante sistemato sul fondo del supporto.

- Se il supporto è dotato di dispositivi stabilizzanti, installare tali dispositivi prima di montare o di procedere alla manutenzione dell'unità nel supporto.

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

- Juniper Networks switch må installeres i et stativ som er forankret til bygningsstrukturen.

- Denne enheten bør monteres nederst i kabinettet hvis dette er den eneste enheten i kabinettet.

- Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.

- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

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

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

- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.

- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.

- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

¡Atención! Para evitar lesiones durante el montaje de este equipo sobre un bastidor, 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.

Laser and LED Safety Guidelines and Warnings

IN THIS SECTION

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

Observe the following guidelines and warnings:

General Laser Safety Guidelines

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

- Do not look into unterminated ports or at fibers that connect to unknown sources.

- Do not examine unterminated optical ports with optical instruments.

- Avoid direct exposure to the beam.

> **LASER WARNING**: Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.
>
> **Avertissement** Les connecteurs à fibre optique sans terminaison peuvent émettre un rayonnement laser invisible. Le cristallin de l'œil humain faisant converger toute la puissance du laser sur la rétine, toute focalisation directe de l'œil sur une source laser, —même de faible puissance—, peut entraîner des lésions oculaires irréversibles.

Class 1 Laser Product Warning

> **LASER WARNING**: Class 1 laser product.
> **Waarschuwing** Klasse-1 laser produkt.
>
> **Varoitus** Luokan 1 lasertuote.
>
> **Avertissement** Produit laser de classe I.
>
> **Warnung** Laserprodukt der Klasse 1.
>
> **Avvertenza** Prodotto laser di Classe 1.
>
> **Advarsel** Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

LASER WARNING: Class 1 LED product.
Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Avertissement Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

LASER WARNING: Do not stare into the laser beam or view it directly with optical instruments.
Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

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

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

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

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

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

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

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

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

Radiation from Open Port Apertures Warning

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

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

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

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

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

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

Advarsel Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan 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 an EXposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

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

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

Maintenance and Operational Safety Guidelines and Warnings

IN THIS SECTION

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

Battery Handling Warning

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

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

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

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

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

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

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

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

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

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

Jewelry Removal Warning

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

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

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

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

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

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Lightning Activity Warning

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Avertissement Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning

WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

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

Avertissement Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this device must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Avertissement La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

General Electrical Safety Guidelines and Warnings

⚡ **WARNING**: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS (Network Equipment-Building System) requirements and protect against lightning surges and commercial power disturbances, the intrabuilding ports *must not* be 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.

Avertissement Certains ports de l'appareil sont destinés à un usage en intérieur uniquement (ports Type 2 ou Type 4 tels que décrits dans le document *GR-1089-CORE*) et doivent être isolés du câblage de l'installation extérieure exposée. Pour respecter les exigences NEBS et assurer une protection contre la foudre et les perturbations de tension secteur, les ports pour intérieur *ne doivent pas* être raccordés physiquement aux interfaces prévues pour la connexion à l'installation extérieure ou à son câblage. Les ports pour intérieur de l'appareil sont réservés au raccordement de câbles pour intérieur ou non exposés uniquement. L'ajout de protections ne constitue pas une précaution suffisante pour raccorder physiquement ces interfaces au câblage de l'installation extérieure.

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

Attention Avant de retirer ou d'installer des composants d'un appareil, raccordez un bracelet antistatique à un point de décharge électrostatique et fixez le bracelet à votre poignet nu. L'absence de port d'un bracelet antistatique pourrait provoquer des dégâts sur l'appareil.

- Install the device in compliance with the following local, national, and international electrical codes:

  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.

  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.

  - Evaluated to the TN power system.

- Canada—Canadian Electrical Code, Part 1, CSA C22.1.

- Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.

  Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.

- Locate the emergency power-off switch for the room in which you are working so that if an electrical accident occurs, you can quickly turn off the power.

- Make sure that you clean grounding surface and give them a bright finish before making grounding connections.

- Do not work alone if potentially hazardous conditions exist anywhere in your workspace.

- Never assume that power is disconnected from a circuit. Always check the circuit before starting to work.

- Carefully look for possible hazards in your work area, such as moist floors, ungrounded power extension cords, and missing safety grounds.

- Operate the device within marked electrical ratings and product usage instructions.

- To ensure that the device and peripheral equipment function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

You can remove and replace many device components without powering off or disconnecting power to the device, as detailed elsewhere in the hardware documentation for this device. Never install equipment that appears to be damaged.

Site Electrical Wiring Guidelines

describes the factors you must consider while planning the electrical wiring at your site.

> ⚠️ **WARNING**: You must provide a properly grounded and shielded environment and use electrical surge-suppression devices.
>
> **Avertissement** Vous devez établir un environnement protégé et convenablement mis à la terre et utiliser des dispositifs de parasurtension.

Table 47: 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: • Radio frequency interference (RFI) because of improperly installed wires • Damage from lightning strikes occuring when wires exceed recommended distances or pass between buildings • Electromagnetic pulses (EMPs) caused by lightning damaging 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. • To 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. Strong sources of electromagnetic interference (EMI) can cause: • Destruction of the signal drivers and receivers in the device. • Electrical hazards as a result of power surges conducted over the lines into the equipment.

AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to AC-powered devices:

• Note the following warnings printed on the device:

   "**CAUTION:** THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK."

"**ATTENTION:** CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE."

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.

- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.

- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.

- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

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

注意

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

AC Power Disconnection Warning

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

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

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

Avertissement Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

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

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

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

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

DC Power Disconnection Warning

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

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

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta

huolehtivassa kojetaulussa sijaitseva suojakytkin, käännä suojakytkin KATKAISTU-asentoon ja teippaa suojakytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

Avertissement Avant de pratiquer l'une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n'est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l'aide d'un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

Warnung Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

Avvertenza Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

Advarsel Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.

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

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

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

DC Power Grounding Requirements and Warning

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

> **WARNING**: When you install the device, the ground connection must always be made first and disconnected last.
>
> **Waarschuwing** Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.
>
> **Varoitus** Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.
>
> **Avertissement** Lors de l'installation de l'appareil, la mise à la terre doit toujours être connectée en premier et déconnectée en dernier.
>
> **Warnung** Der Erdanschluß muß bei der Installation der Einheit immer zuerst hergestellt und zuletzt abgetrennt werden.
>
> **Avvertenza** In fase di installazione dell'unità, eseguire sempre per primo il collegamento a massa e disconnetterlo per ultimo.
>
> **Advarsel** Når enheten installeres, må jordledningen alltid tilkobles først og frakobles sist.
>
> **Aviso** Ao instalar a unidade, a ligação à terra deverá ser sempre a primeira a ser ligada, e a última a ser desligada.
>
> **¡Atención!** Al instalar el equipo, conectar la tierra la primera y desconectarla la última.
>
> **Varning!** Vid installation av enheten måste jordledningen alltid anslutas först och kopplas bort sist.

DC Power Wiring Sequence Warning

> **WARNING**: Wire the DC power supply using the appropriate lugs. When connecting power, the proper wiring sequence is ground to ground, +RTN to +RTN, then –48 V to –

48 V. When disconnecting power, the proper wiring sequence is −48 V to −48 V, +RTN to +RTN, then ground to ground. Note that the ground wire must always be connected first and disconnected last.

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

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

Avertissement Câblez l'approvisionnement d'alimentation CC En utilisant les crochets appropriés à l'extrémité de câblage. En reliant la puissance, l'ordre approprié de câblage est rectifié pour rectifier, +RTN à +RTN, puis −48 V à −48 V. En débranchant la puissance, l'ordre approprié de câblage est −48 V à −48 V, +RTN à +RTN, a alors rectifié pour rectifier. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois. Notez que le fil de masse devrait toujours être relié d'abord et débranché pour la dernière fois.

Warnung Die Stromzufuhr ist nur mit geeigneten Ringösen an das DC Netzteil anzuschliessen. Die richtige Anschlusssequenz ist: Erdanschluss zu Erdanschluss, +RTN zu +RTN und dann -48V zu -48V. Die richtige Sequenz zum Abtrennen der Stromversorgung ist -48V zu -48V, +RTN zu +RTN und dann Erdanschluss zu Erdanschluss. Es ist zu beachten dass der Erdanschluss immer zuerst angeschlossen und als letztes abgetrennt wird.

Avvertenza Mostra la morsettiera dell alimentatore CC. Cablare l'alimentatore CC usando i connettori adatti all'estremità del cablaggio, come illustrato. La corretta sequenza di cablaggio è da massa a massa, da positivo a positivo (da linea ad L) e da negativo a negativo (da neutro a N). Tenere presente che il filo di massa deve sempre venire collegato per primo e scollegato per ultimo.

Advarsel Riktig tilkoples tilkoplingssekvens er jord til jord, +RTN til +RTN, −48 V til − 48 V. Riktig frakoples tilkoplingssekvens er −48 V til − 48 V, +RTN til +RTN, jord til jord.

Aviso Ate con alambre la fuente de potencia cc Usando los terminales apropiados en el extremo del cableado. Al conectar potencia, la secuencia apropiada del cableado se muele para moler, +RTN a +RTN, entonces −48 V a −48 V. Al desconectar potencia, la secuencia apropiada del cableado es −48 V a −48 V, +RTN a +RTN, entonces molió para moler. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último. Observe que el alambre de tierra se debe conectar siempre primero y desconectar por último.

¡Atención! Wire a fonte de alimentação de DC Usando os talões apropriados nan EXtremidade da fiação. Ao conectar a potência, a seqüência apropriada da fiação é moída para moer, +RTN a +RTN, então −48 V a −48 V. Ao desconectar a potência, a seqüência apropriada da fiação é −48 V a −48 V, +RTN a +RTN, moeu então para moer. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último. Anote que o fio à terra deve sempre ser conectado primeiramente e desconectado por último.

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

DC Power Wiring Terminations Warning

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

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

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

Avertissement Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

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

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

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

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

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislante como el conductor.

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

Multiple Power Supplies Disconnection Warning

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

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

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

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

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

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

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

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

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

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

TN Power Warning

WARNING: The device is designed to work with a TN power system.
Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Avertissement Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Action to Take After an Electrical Accident

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

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.

2. Disconnect power from the device.

3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, and then call for help.

Agency Approvals for MX304 Router

IN THIS SECTION

Safety and EMC Standards

The router is designed to comply with the following standards:

- Safety:

  - IEC 60950-1:2005, AMD 1:2009, AMD 2:2013 Information Technology Equipment

  - UL 60950-1:2007 R10.14 Information Technology Equipment

- CAN/CSA-C22.2 No. 60950-1-07, AMD 1:2011, AMD 2:2014 Information Technology Equipment

- IEC 60825-1 Safety of Laser Products - Part 1: Equipment Classification

- IEC 62368-1 2014 (2nd Edition) Audio/Video, Information and Communication Technology Equipment.

- IEC 62368-1 2018 (3rd Edition) Audio/Video, Information and Communication Technology Equipment.

- EN 62368-1 :2014+A11 :2017 Audio/Video, Information and Communication Technology Equipment.

- UL/CSA 62368-1 :2014 (2nd Edition) Audio/Video, Information and Communication Technology Equipment.

- UL/CSA 62368-1 :2019 (3rd Edition) Audio/Video, Information and Communication Technology Equipment.

- EMC Emissions Tests:

  - EN 55032:2015, Class A

  - CISPR 32:2015, Class A

  - EN 55022:2010, Class A

  - CISPR 22:2008, Class A

  - Australian Communications and Media Authority (ACMA) AS/NZS CISPR 32: 2015 Class A

  - FCC Part 15, Subpart B, for Class A digital devices

  - Innovation, Science and Economic Development Canada ICES 003, dated October 2016, Class A

  - VCCI-CISPR32:2016 Regulations For Voluntary Control Measures of radio interference generated by Information Technology Equipment, V-3 dated April 2015 and V-4 dated April 2012 (Class A).

  - VCCI-CISPR32:2016 Regulations For Voluntary Control Measures of radio interference generated by Information Technology Equipment, VCCI-CISPR32: 2016 (Class A).

  - EN 300 386, V1.6.1 (2012-09), Class A

  - EN 300386 V2.1.1 (2016-07), Class A

  - TEC/SD/DD/EMC-221/05/OCT-16, Class A

- QCVN 118:2018/BTTTT "Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement" Class A

- Deutsche Telekom EMC specification 1 TR 9, Edition 03 2016

- Immunity Tests:

  - EN 300 386, V1.6.1 (2012-09)

  - EN 300386 V2.1.1 (2016-07)

  - TEC/SD/DD/EMC-221/05/OCT-16

  - EN 55035:2017 + A11:2020

  - CISPR 24:2010

  - CISPR 35:2016

  - TCVN 7317:2003

  - Electromagnetic Compatibility Standard GS7 (Issue: V1-Oct. 2017)

  - Deutsche Telekom EMC specification 1 TR 9, Edition 03 2016

  - GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment

- EMI

  - GR-3160-Data Center Equipment

Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

Compliance Statements for Data Center

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).

- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.

- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.

- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.
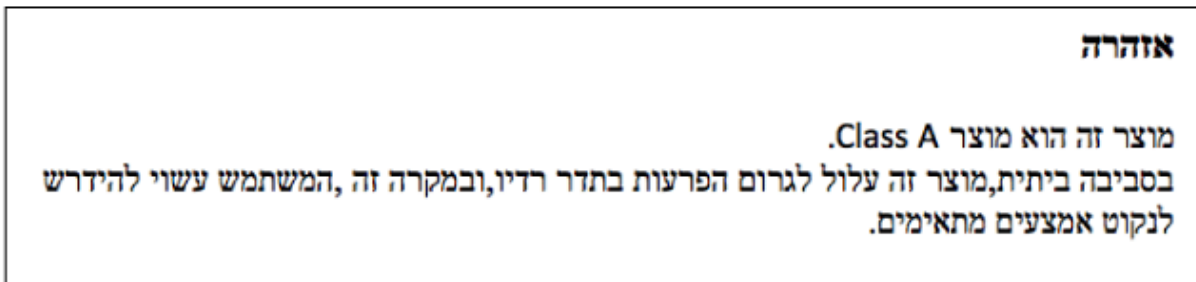
Compliance Statements for EMC Requirements

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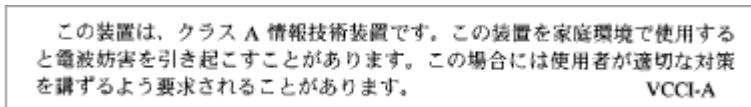
CAN ICES-3 (A)/NMB-3(A)

European Community

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

Israel

אזהרה

מוצר זה הוא מוצר Class A.
בסביבה ביתית,מוצר זה עלול לגרום הפרעות בתדר רדיו,ובמקרה זה, המשתמש עשוי להידרש לנקוט אמצעים מתאימים.

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

Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。　　　VCCI-A

The preceding translates as follows:

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

United States

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Compliance Statements for Environmental Requirements

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

Statements of Volatility for Juniper Network Devices

A *statement of volatility (SoV)*—sometimes known as *letter of volatility (LoV)*—identifies the volatile and non-volatile storage components in Juniper Networks devices, and describes how to remove non-volatile storage components from the device.

> **NOTE**: Individual FRUs do not have separate SoV or LoV documents. They are covered in the SoV or LoV of the Juniper Networks device in which they are installed.

> **NOTE**: Statements of volatility are not available for all Juniper Networks devices.

CTP Series:

- CTP150

- CTP2000

EX Series:

- EX2200 and EX2200-C

- EX2300-24P, EX2300-24T, and EX2300-24T-DC

- EX2300-48P and EX2300-48T

- EX2300-C

- EX3300

- EX3400-24P, EX3400-24T, EX3400-24T-DC

- EX3400-48P, EX3400-48T, EX3400-48T-AFI

- EX4200

- EX4300

- EX4300-48MP

- EX4400

  1. EX4400-24T

  2. EX4400-24P

  3. EX4400-24MP

  4. EX4400-48T

  5. EX4400-48P

  6. EX4400-48MP

  7. EX4400-48F

- EX4500

- EX4550

- EX4600

- EX8200

- EX9251

- EX9253

- XRE200 External Routing Engine

LN Series:

- LN1000–CC

MX Series:

- M7i

- M7i Compact Forwarding Engine Board (CFEB)

- M40e and M10i

- M320

- MX5, MX10, MX40, and MX80

- MX104

- MX204

- MX304

- MX240, MX480, and MX960

- MX10003

- RE-A-2000 Route Engine

- RE-S-X6-64G Routing Engine

NFX Series:

- NFX250

QFX Series:

- QFX3008-I

- QFX3100

- QFX3500

- QFX3600

- QFX5100-24Q

- QFX5100-48S

- QFX5100-48T

- QFX5110-32Q

- QFX5110-48S

- QFX5120

  1. QFX5120-32C

  2. QFX5120-48T

  3. QFX5120-48Y

4. QFX5120-48YM

- QFX5200

- QFX5200-32C

- QFX10008 and QFX10016

SRX Series:

- SRX100

- SRX110

- SRX210B

- SRX210H-POE

- SRX210H-P-MGW

- SRX220

- SRX240H

- SRX240H-POE

- SRX300

- SRX320

- SRX340 and SRX345

- SRX380

- SRX550

- SRX650

- SRX1400

- SRX1500

- SRX3400 and SRX3600

- SRX4200

- SRX4600

- SRX5400, SRX5600, and SRX5800

- SRX-MP-1SERIAL

- SSG-520M

T Series:

- RE-A-2000 Route Engine