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PTX10002-60C Packet Transport Router Hardware Guide

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The information in this document is current as of the date on the title page.

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.

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Table of Contents

7

Safety and Compliance Information

About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the PTX10002-60C Packet Transport Router. After completing the installation and performing the basic configuration procedures covered in this guide, refer to the Junos OS documentation for information about further software configuration.

RELATED DOCUMENTATION

- PTX10002-60C Quick Start Guide
- Junos OS for PTX Series Packet Transport Routers

CHAPTER 1

Overview

PTX10002-60C System Overview

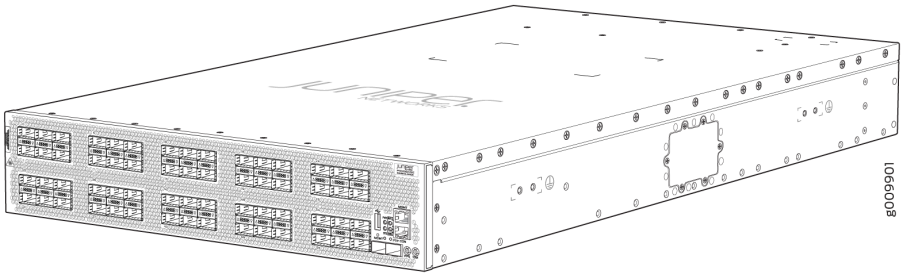
IN THIS SECTION

The Juniper Networks PTX10002-60C Packet Transport Router is a second-generation PTX Series fixed-configuration core router which provides up to 6 Tbps of throughput and 4 Bpps of forwarding capacity. It features a compact, 2 U form factor that is easy to deploy in space-constrained internet exchange locations, remote central offices, and embedded peering points throughout the network, including cloud-hosted services.

The PTX10002-60C supports flexible interface configuration options, offering 60 physical quad small form-factor pluggable 28 (QSFP28) 100GbE ports, 60 QSFP+ 40GbE ports, and 192 10GbE ports via QSFP+ breakout cables. Each port can be configured as 100GbE, 40 GbE, or 4x10 GbE. The

PTX10002-60C ships with four 1600 W AC or DC power supplies and three fan modules. See Figure 1 on page 3.

Figure 1: PTX10002-60C



TIP: For information about features supported on PTX Series routers, see Feature Explorer.

Benefits of the PTX10002-60C

- By offering the industry's highest 100GbE port density—up to 60 ports in a 2 U form factor—the PTX10002-60C enables you to seamlessly scale your core network from 10GbE and 40GbE architectures to 100GbE. The PTX10002-60C gives you a practical solution for keeping pace with evolving distributed core architecture requirements.
- The PTX10002-60C is engineered with hardware redundancy for cooling, power supplies, and forwarding. High Availability (HA) is critical for service providers to maintain an always-on infrastructure base and meet stringent SLAs across the core.
- Exceptional packet processing capabilities help alleviate the challenge of scaling the network as traffic levels increase while optimizing IP/MPLS transit functionality around superior performance and elegant deployability.

PTX10002-60C System Architecture

The system architecture cleanly separates control operations from packet forwarding operations. This design eliminates processing and traffic bottlenecks, permitting the PTX10002-60C to achieve high performance.

- Control operations are performed by the Routing Engine, which runs the Juniper Networks Junos operating system (Junos OS). The Routing Engine handles routing protocols, traffic engineering, policy, policing, monitoring, and configuration management. Junos OS is installed on the PTX10002-60C internal solid-state drives (SSDs). The PTX10002-60C has 2 x 64-GB SSDs. The Routing Engine is enhanced by a 2.5-GHz quad core Intel CPU and 32 GB of SDRAM.
- Forwarding operations are performed by the Packet Forwarding Engines, which include custom ASICs designed by Juniper Networks. The *Q5* ASICs enable the PTX10002-60C to provide up to 6 terabits per second (Tbps) of throughput. The Q5 ASICs are connected to Hybrid Memory Cubes (HMCs). These high-efficiency memory modules provide packet buffering, virtual output queue (VOQ) memory, and improved logical system scale.

Cooling and Power

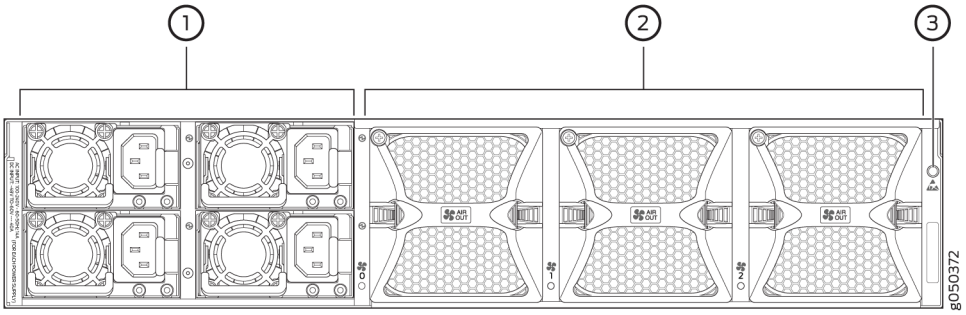
The cooling system in a PTX10002-60C consists of three 80-W fan modules that operate at 150 cubic feet per minute (CFM) at full speed as well as fans housed in the power supplies. Each fan module has dual counter-rotating fans. These fan modules can be hot-swapped and hot-inserted, meaning that you do not need to power off the router or disrupt the routing function to replace a module.

In the PTX10002-60C cooling system, cool air enters through the vents in the port panel and hot air exhausts through the field-replaceable unit (FRU) panel. This type of airflow is known as *airflow out* or *port-to-FRU airflow*.

The four AC or DC 1600-W power supplies are installed by the factory. See Figure 2 on page 5 for an example of the PTX10002-60C FRU panel. Each power supply provides 12-VDC output with a standby

voltage of 12-VDC. The AC or DC power supplies in a PTX10002-60C are hot-removable and hot-insertable FRUs.

Figure 2: PTX10002-60C FRU Panel



System Software

PTX Series devices use the Junos operating system (OS), which provides Layer 2 and Layer 3 switching, routing, and security services. Junos OS is installed on the PTX10002-60C 25-gigabyte (GB) internal NAND solid state flash drive. The same Junos OS code base that runs on PTX10002-60C also runs on all Juniper Networks EX Series switches, and M Series, MX Series, and T Series routers.

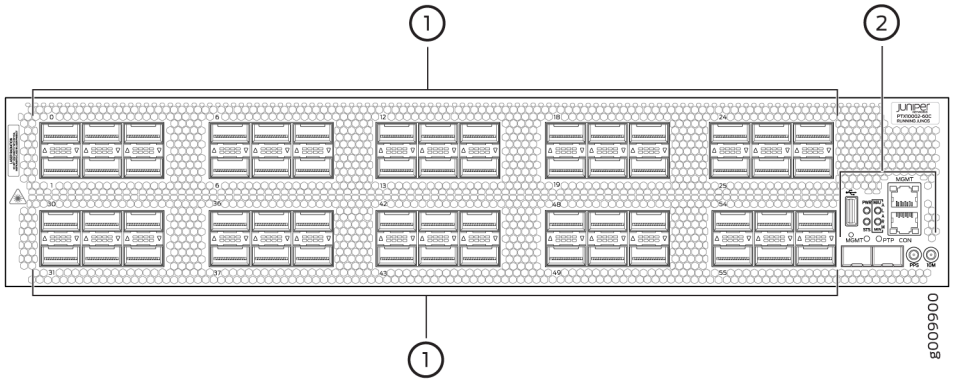
For more information about which features are supported on PTX Series devices, see Feature Explorer.

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

Port Panel and Management Panel

The PTX10002-60C port panel has 60 network ports and port LEDs. The management panel contains console and management ports, a reset button, system status LEDs, clocking ports, and a USB port. Figure 3 on page 6 shows the PTX10002-60C port panel and management panel.

Figure 3: PTX10002-60 Port Panel and Management Panel



1– Port panel	2– Management panel

Each of the 60 network ports support quad small-form factor pluggable (QSFP+ and QSFP28) transceivers. The interfaces on a PTX10002-60C can be configured to support 10-Gbps, 40-Gbps, and 100-Gbps port speeds. Table 1 on page 6 lists the maximum number of ports for each interface type supported by the PTX10002-60C.

Table 1: Maximum Supported Ports at Each Interface Speed

Interface Type	Maximum Supported Ports
10-Gigabit Ethernet	192
40-Gigabit Ethernet	60
100-Gigabit Ethernet	60

You manage the PTX10002-60C by using the Junos OS CLI, which is accessible through the console and out-of-band management ports on the management panel. In addition, the management panel has system status LEDs that alert you to minor or major alarms or other issues with the router, external clock synchronization ports, and a USB port to support software installation and recovery.

SEE ALSO

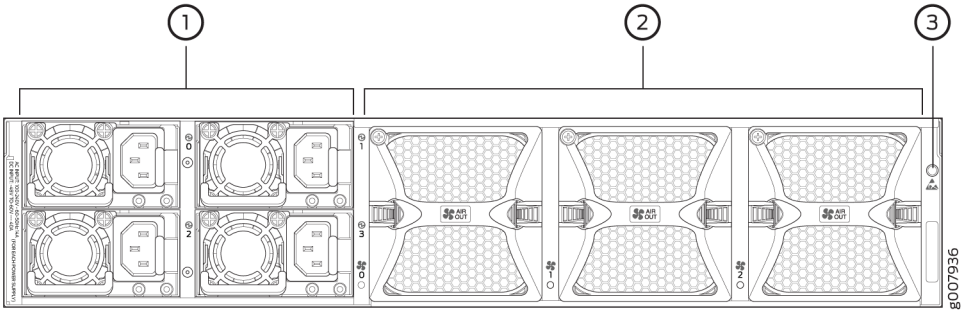
PTX10002-60C Port Panel | 10

PTX10002-60C Management Panel | 16

Field-Replaceable Units Panel

The field-replaceable units (FRU) panel of the PTX10002-60C contains the fan modules, power supplies, and ESD grounding point for the PTX10002-60C. The PTX10002-60C FRUs are hot-removable and hot-insertable—you can remove and replace them without powering off the PTX10002-60C or disrupting the routing function. Figure 4 on page 7 shows the PTX10002-60C FRU panel.

Figure 4: PTX10002-60C FRU Panel



1– Power supplies (4)	3– ESD point
2– Fan modules (3)	

Table 2 on page 7 lists the model numbers and CLI output for PTX10002-60C FRUs.

Table 2: PTX10002-60C FRUs and Spares

Component	Spare Juniper Model Number	CLI Output
Chassis	PTX10002-CHAS-S	`PTX10002-60C`
Fan module	PTX10002-FAN-S	`PTX10002-60C Fan Tray, Front to Back Airflow - AFO`
Power supplies	JPSU-1600W-AC-AFO	`AC AFO 1600W PSU`

Table 2: PTX10002-60C FRUs and Spares *(Continued)*

Component	Spare Juniper Model Number	CLI Output
	JPSU-1600W-DC-AFO	DC AFO 1600W PSU

For more information about the components on the FRU panel, see "PTX10002-60C Cooling System Description and Airflow" on page 23 and "PTX10002-60C Power System" on page 28.

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

SEE ALSO

request vmhost snapshot

show vmhost hardware

PTX10002-60C Component Redundancy

The following hardware components provide redundancy on the PTX10002-60C:

- Cooling system—The PTX10002-60C has three fan modules. Each fan module is a redundant unit containing two fans. If a fan module fails and the remaining fan modules are unable to keep the PTX10002-60C within the desired temperature thresholds, chassis alarms are raised and the PTX10002-60C might shut down.
- Power supplies

  As shown in Table 3 on page 9, the PTX10002-60C can operate with a single DC input power supply or a single AC input power supply for 220VAC operation. A minimum of two AC power supplies are required to operate the PTX10002-60C at 110VAC.

CAUTION: When running the switch in non-redundant mode, install a power supply cover (PTX10002-PWR-BLNK) in any unused power bays for safety, cooling, and emissions control.

The recommended configuration is to run the switch with twice as much power as needed, also called *2N*, for full power redundancy. To provide additional power for switch redundancy or feed-redundancy, see Table 3 on page 9.

Table 3: Available Power Redundancy Options

Model	Power	Non-redundant (N)	2N or Dual Feed
PTX10002-60C	220 VAC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply cover.
	110 VAC	2	4 For power feed redundancy, connect power source feed A to power supplies **0** and **1** and connect power source feed B to power supplies **2** and **3.**
PTX10002-60C-DC	DC	1	2 For power feed redundancy, connect power source feed A to power supplies **0** or **1** and connect power source feed B to power supplies **2** or **3.** The remaining slots should be covered with a power supply blank cover.

SEE ALSO

PTX10002-60C Cooling System Description and Airflow | **23**

PTX10002-60C Power System | **28**

PTX10002-60C Optics and Cables

The PTX10002-60C supports the following types of optics and cables:

- 100-Gigabit Ethernet using 28-Gbps QSFP28 optical transceivers and 100-Gbps active optical cables (AOCs).
- 40-Gigabit Ethernet using QSFP+ optical transceivers, 40-Gbps AOCs, or 40-Gbps direct attach copper (DAC) cables.
- 10-Gigabit Ethernet using DAC breakout cables (DACBO). When configured for channelization, a breakout cable converts the 40-Gigabit Ethernet port into 4 independent 10-Gigabit Ethernet ports.

For a detailed list of supported optical transceivers and electrical cables, see The Hardware Compatibility Tool.

SEE ALSO

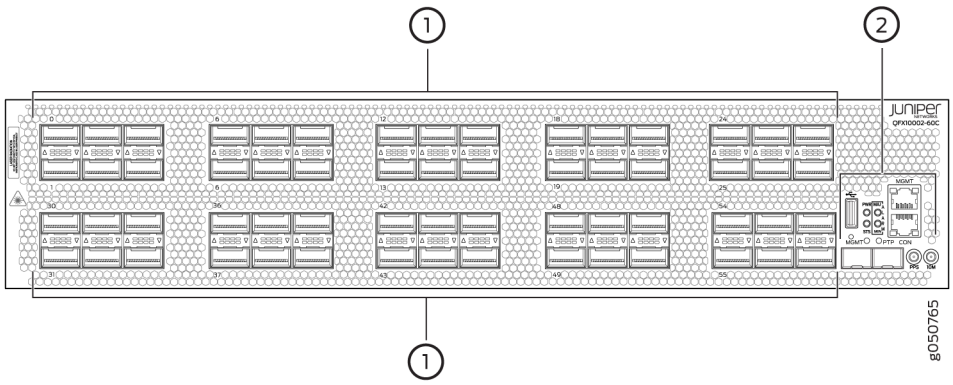
Maintaining Transceivers and Fiber-Optic Cables on PTX10002-60C | **109**

PTX10002-60C Port Panel

IN THIS SECTION

The PTX10002-60C port panel has 60 high-density 100-Gigabit Ethernet QSFP28 ports and a management panel. See Figure 5 on page 11.

Figure 5: PTX10002-60C Port Panel



1– Port panel with QSFP28 access interface or uplink ports (60)	2– Management panel

Each port supports a QSFP28 or QSFP+ transceiver and can be configured as a 100-Gigabit Ethernet, 40-Gigabit Ethernet, or 4x10 Gigabit Ethernet interface. The ports auto-sense whether there is a 100-Gbps QSFP28 or 40-Gbps QSFP+ transceiver, and then set the port speed accordingly. You can configure any of the 60 ports, **0** through **59**, as either uplink or access ports.

Table 4 on page 11 lists details about the multi-port speed support on the PTX10002-60C.

Table 4: PTX10002-60 Multi-Port Speed Support

Interface Speed	Supported Optical Transceiver	Supported Electrical Cables	Maximum Number of Non-channelized Ports	Maximum Number of Channelized Ports
4 x 10-Gbps	QSFP+	10-Gbps	12	192 (48 of 4x10GbE)
40-Gbps	QSFP+	40-Gbps	0	60
100-Gbps	QSFP28	100-Gbps	0	60

For a detailed list of supported optical transceivers and electrical cables, see The Hardware Compatibility Tool.

Channelization

You can channelize selected physical ports to four independent 10-Gigabit Ethernet interfaces using 4x10GbE SR or 4x10GbE LR breakout cables (depending on the type of transceiver). Port behavior is tied to the Packet Forwarding Engine (PFE) associated with the port. Each PFE controls five physical ports. When a port is channelized, one of the dedicated ports within the port group is disabled.

To channelize a port for 10-Gigabit Ethernet, use the Junos OS operational command **set chassis fpc *slot-number* pic 0 port *port number* speed *10g***.

Figure 6 on page 12 illustrates the physical ports controlled by each PFE. Table 5 on page 12 lists the ports that can be channelized. Figure 7 on page 13 show the ports that are disabled when a port or ports controlled by a given PFE are channelized.

Figure 6: Port Assignments Per PFE for the PTX10002-60C

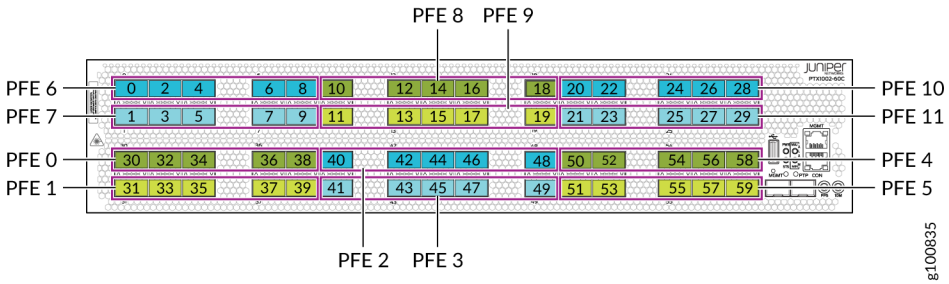


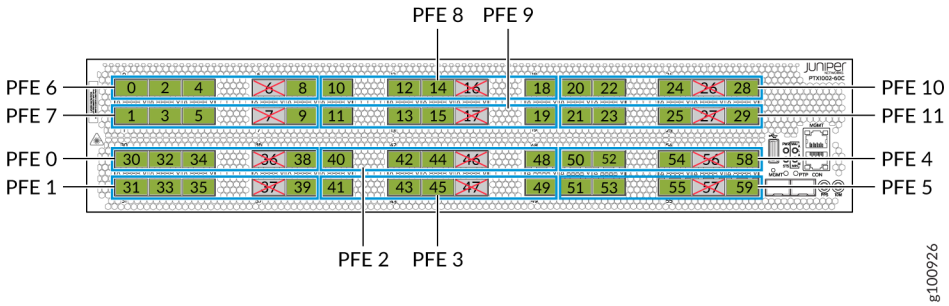
Table 5: Port Mapping for Channelization

ASIC	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE0	30, 32, 34, 38	36
PE1	31, 33, 35, 39	37
PE2	40, 42, 44, 48	46
PE3	41, 43, 45, 49	47
PE4	50, 52, 54, 58	56

Table 5: Port Mapping for Channelization *(Continued)*

ASIC	Physical Ports Available for Channelization	Physical Ports that Become Disabled
PE5	51, 53, 55, 59	57
PE6	0, 2, 4, 8	6
PE7	1, 3, 5, 9	7
PE8	10,12,14,18	16
PE9	11,13,15,19	17
PE10	20,22,24,28	26
PE11	21, 23, 25, 29	27

Figure 7: Ports Disabled for Channelization

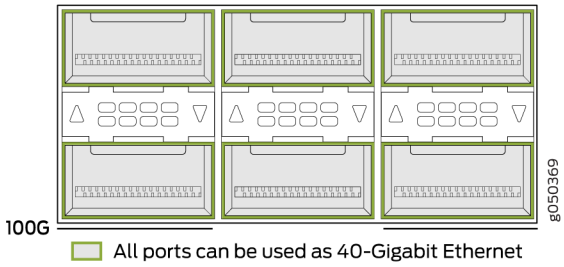


The remaining three ports support 40-Gbps or 100-Gbps speeds.

PTX10002-60C Network Port LEDs

Each PTX10002-60C QSFP+ port uses a single bi-colored LED to indicate link status and activity. See Figure 8 on page 14 for an example of these triangle shaped LEDs.

Figure 8: Port LEDs



The same single bi-colored LED also indicates when the interface is configured and connected using an optical split cable or a copper DACBO cable to a 10-Gigabit Ethernet port.

There's some slight differences in the amber LED behavior depending on the firmware level of the complex programmable logic device (CPLD) in your router and the Junos OS release level running on the router. Issue the `show version` command to the Junos OS release. Issue the `show chassis firmware` command to determine the firmware version for the CPLD. For example:

```
root@> show chassis firmware
Part                    Type       Version
FPC 0                   U-Boot      ***
                        loader           FreeBSD/i386 bootstrap loader 1.2
                        BIOS       V0018.2U
                        EC FPGA    2.3
                        MAIN_CPLD  1.10
                        MEZZ_CPLD  1.10
                        RE FPGA    2.4
root@>
```

See Table 6 on page 15 for how to interpret the QSFP+ LEDs.

Table 6: Network Port LEDs on QSFP+ Ports on a PTX10002-60C

Color	State	Description
Unlit	Off	The port is administratively disabled, there is no power, the link is down, or a transceiver is not present. All sub-channels are disabled.
Green	On steadily	A link is established. When channelized, all sub-channels are up. When not channelized, it indicates no activity.
	Slow blinking (250 ms on and 1750 ms off)	The beacon function was enabled on the port.
	Blinking (500 ms on and 500 ms off)	When channelized, all four channels are up and active. When not channelized, it indicates the port is up and active in either 40-Gigabit or 100-Gigabit mode.
Amber	On steadily	**For Junos Release 15.1X53-D21 or later and CPLD version V1.16 or later:** One or more breakout connections (sub-channels) are up. However not all sub-channels are up and there is no port activity.
		For Junos Release 15.1X53-D10 to 15.1X53-D20 and CPLD version V1.10: Solid yellow LED is not available.
	Blinking	One or more breakout connections (sub-channels) are up. At least one sub-channel has activity, but not all connections are active.

SEE ALSO

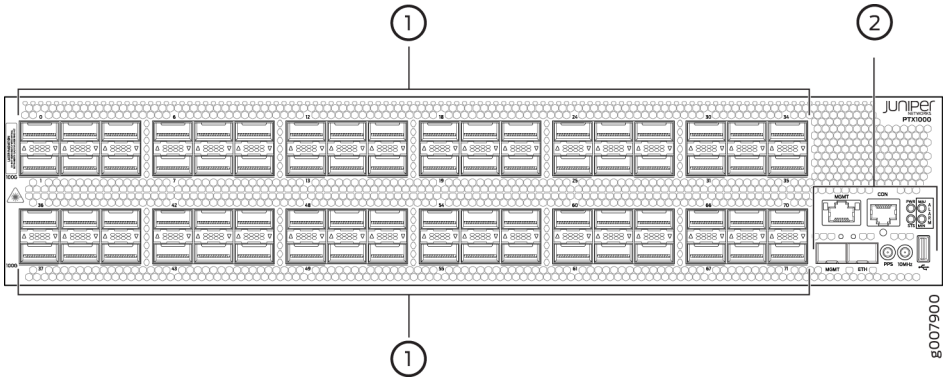
PTX10002-60C Management Panel | 16

PTX10002-60C Management Panel

IN THIS SECTION

The PTX10002-60C management panel is found next to the port panel (see Figure 9 on page 16).

Figure 9: PTX10002-60C Port Panel and Management Panel



1– Port panel

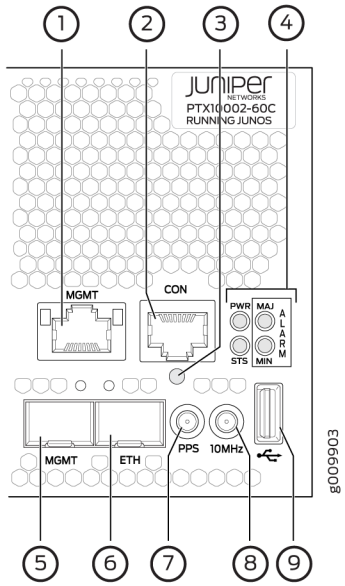
2– Management panel

PTX10002-60C Management Panel Components

You manage the PTX10002-60C by using the Junos OS CLI, which is accessible through the console and out-of-band management ports on the management panel. The management panel has system status LEDs that alert you to minor or major alarms or other issues with the router, external clock

synchronization ports, and a USB port to support software installation and recovery. Figure 10 on page 17 shows the management panel in detail.

Figure 10: PTX10002-60C Management Panel Components



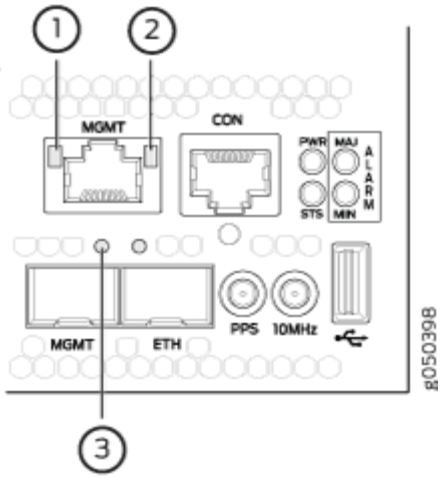
1– em0–RJ-45 (1000BASE-T) management Ethernet port (**MGMT**).	6– PTP Ethernet–SFP (1000BASE-T) port (**ETH**)
2– RJ-45 console port (**CON**) to support RS-232 serial ports. The LED below the port indicates link status and link activity.	7– 10 Hz pulses-per-second (**PPS**) SubMiniature B (SMB) connector for input and output measuring of the timing drift to and from a grandmaster clock
3– Reset button. Press and hold 5 seconds to reset the hardware. Clock functions and FPGA status registers are not reset.	8– 10 MHz SMB timing connector (**10MHz**)
4– Status LEDs–Power (**PWR**), status (**STA**), major alarm (**MJR**), and minor alarm (**MIN**).	9– USB port
5– SFP management Ethernet port (**MGMT**).	

PTX10002-60C Management Port LEDs

There are two management ports on the PTX10002-60C. Both are labeled **MGMT**. The RJ-45 management port is for 10/100/1000BASE-T connections and the small form-factor pluggable (SFP) management port is for 10/100/1000BASE-T and 1000BASE-X connections.

The RJ-45 port has separate LEDs for status and activity. The copper, RJ-45, port has separate LEDs for status and activity. The fiber, SFP, port has a combination link and activity LED. Figure 11 on page 18 shows the location of the LEDs.

Figure 11: Management Port LEDs on a PTX10002-60C Switch



1– Status LED (RJ-45)	3– Green indicates the link is up; blinking indicates activity (SFP)
2– Activity LED (RJ-45)	

Table 7 on page 18 describes the RJ-45 management port LEDs.

Table 7: PTX10002-60C RJ-45 Management Port LEDs

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

Table 8 on page 19 describes the SFP management port LED.

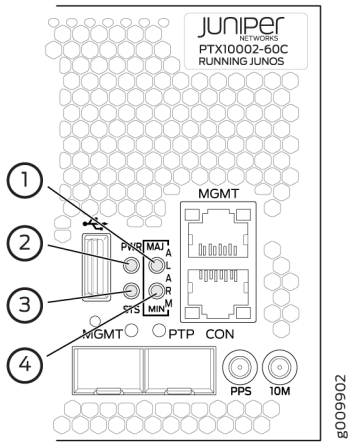
Table 8: PTX10002-60C SFP Management Port LED

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

PTX10002-60C Chassis Status LEDs

The PTX10002-60C has four status LEDs on the port side of the chassis, next to the access ports (see Figure 12 on page 19).

Figure 12: Chassis Status LEDs



1– PWR	3– STS
2– MJR	4– MIN

Table 9 on page 20 describes the chassis status LEDs on a PTX10002-60C.

Table 9: PTX10002-60C Chassis Status LEDs

Name	Color	State	Description
PWR–Alarm	Unlit	Off	The router is powered off; no power to the device.
	Green	On steadily	Power is working correctly.
	Yellow	Blinking	There is a problem with chassis power. Power off the PTX10002-60C by setting the AC power source outlet to the OFF (O) position, or unplugging the AC power cords. Correct any voltage issues. Power on the PTX10002-60C and monitor the power supply and fan LEDs to help determine where the error is occurring. If there is any CPU power failure, the system will not boot.
STA–Status	Unlit	Off	The router is powered off or halted.
	Green	On steadily	Junos OS for PTX Series is loaded on the router.
	Green	Blinking	The beacon feature is enabled on the router. This feature is enabled using the `request chassis beacon` command.
	Yellow	Blinking	The router detects a fault.
MJR–Major alarm	Unlit	Off	There are no major alarms.
	Red	On steadily	A major hardware fault has occurred, such as a temperature alarm or power failure, and the router has halted.
MIN–Minor alarm	Unlit	Off	There are no minor alarms.
	Yellow	On steadily	A minor alarm has occurred, such as a software error.

For power and temperature alarms, you can use the `show chassis environment fpc` operational mode command to get detailed information on the internal state of the chassis. For example:

```
user@device> show chassis environment fpc

FPC 0 status:
  State                       Online
  Temperature                 51 degrees C / 123 degrees F
  Voltage:
    PE0 VDD Core 0.9V           949 mV
    PE0 AVDD 1.0V              1000 mV
    PE0 HMC VDD 0.9V            897 mV
    PE0 HMC AVDD 1.2V          1197 mV
    PE01 HMC VDD 1.2V          1197 mV
    PE1 VDD Core 0.9V           949 mV
    PE1 AVDD Core 1.0V          999 mV
    PE1 HMC VDD 0.9V            899 mV
    PE1 HMC AVDD 1.2V          1197 mV
    PE2 VDD Core 0.9V           950 mV
    PE2 AVDD Core 1.0V          999 mV
    PE2 HMC VDD 0.9V            897 mV
    PE2 HMC AVDD 1.2V          1197 mV
    PE23 HMC AVDD 1.2V         1197 mV
    PE3 VDD Core 0.9V           949 mV
    PE3 AVDD Core 1.0V          999 mV
    PE3 HMC VDD 0.9V            899 mV
    PE3 HMC AVDD 1.2V          1200 mV
    PE4 VDD Core 0.9V           949 mV
    PE4 AVDD Core 1.0V          999 mV
    PE4 HMC VDD 0.9V            899 mV
    PE4 HMC AVDD 1.2V          1197 mV
    PE45 HMC AVDD 1.2V         1197 mV
    PE5 VDD Core 0.9V           949 mV
    PE5 AVDD Core 1.0V         1000 mV
    PE5 HMC VDD 0.9V            899 mV
    PE5 HMC AVDD 1.2V          1200 mV
    XMB VDD 3.3V               3316 mV
    MAIN VDD 3.3V              3298 mV
    RT VDD 1.0V                 999 mV
    MAIN VDD 2.5V              2502 mV
    MAIN PFE 1.5V              1502 mV
    PE6 VDD Core 0.9V           949 mV
```

```
PE6 AVDD 1.0V              1000 mV
PE6 HMC VDD 0.9V            897 mV
PE6 HMC AVDD 1.2V          1204 mV
PE67 HMC VDD 1.2V          1197 mV
PE7 VDD Core 0.9V           949 mV
PE7 AVDD Core 1.0V          999 mV
PE7 HMC VDD 0.9V            897 mV
PE7 HMC AVDD 1.2V          1197 mV
PE8 VDD Core 0.9V           949 mV
PE8 AVDD Core 1.0V          999 mV
PE8 HMC VDD 0.9V            897 mV
PE8 HMC AVDD 1.2V          1200 mV
PE78 HMC AVDD 1.2V         1197 mV
PE9 VDD Core 0.9V           950 mV
PE9 AVDD Core 1.0V          999 mV
PE9 HMC VDD 0.9V            897 mV
PE9 HMC AVDD 1.2V          1200 mV
PE10 VDD Core 0.9V          949 mV
PE10 AVDD Core 1.0V         999 mV
PE10 HMC VDD 0.9V           899 mV
PE10 HMC AVDD 1.2V         1200 mV
PE910 HMC AVDD 1.2V        1200 mV
PE11 VDD Core 0.9V          950 mV
PE11 AVDD Core 1.0V         999 mV
PE11 HMC VDD 0.9V           899 mV
PE11 HMC AVDD 1.2V         1200 mV
PF0 VDD Core 0.9V           950 mV
PF0 AVDD Core 1.0V          999 mV
PF1 VDD Core 0.9V           950 mV
PF1 AVDD Core 1.0V          999 mV
XDB VDD 3.3V               3298 mV
XDB RT VDD 1.0V             999 mV
MEZZ VDD 2.5V              2502 mV
MEZZ PFE 1.5V              1502 mV
MEZZ GEX 1.0V               999 mV
VCC 1.0V                   1009 mV
VCC 0.85V                   862 mV
VDD RAIL 12.0V                0 mV
VCC 1.8V                   1793 mV
VDD 1.2V                   1215 mV
PCH VCC 1.0V                999 mV
CPU VCC 1.8V               1803 mV
BIAS 1 3.3V                3312 mV
```

```
AUX VCC 5.0V                4165 mV
DDR VDD 1.5V                1499 mV
VTT SA CPU 0.8V              803 mV
VTT CPU 1.05V               1048 mV
CORE CPU 1.0V                940 mV
PCH VCC 1.5V                1509 mV
PCH VCC 1.05V               1058 mV
VDD 2.5V                    2508 mV
```

SEE ALSO

show chassis alarms

PTX10002-60C Cooling System Description and Airflow

IN THIS SECTION

The cooling system in a PTX10002-60C consists of three 80-W fan modules in a fan tray and two counter-rotating fans housed in each of the power supplies.

The PTX10002-60C brings air into the vents in the port panel and exhausts warmed air through the field-replaceable units (FRU) panel. This type of airflow is known as *airflow out* or *port-to-FRU* airflow.

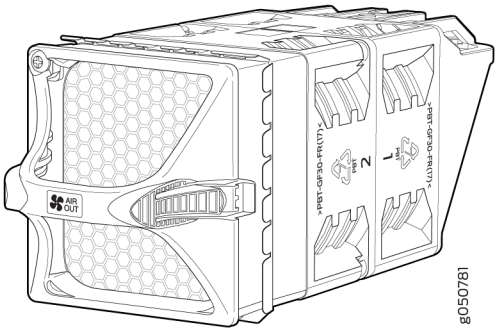
This topic describes:

Fan Modules

The fan modules in a PTX10002-60C are hot-removable and hot-insertable FRUs designed for port-to-FRU airflow. The fan modules numbered **0** through **2** are installed in the fan tray located next to the power supplies. Each fan module slot has a fan icon next to it.

Figure 13 on page 24 shows the 2 U fan module for the PTX10002-60C.

Figure 13: PTX10002-60C Fan Module



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

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

Table 10 on page 25.

Table 10: PTX10002-60C Fan Module Description

Fan Module	Label on the Fan Module	Color of Fan Module Handle	Direction of Airflow in the Fan Module	Power Supplies
PTX10002-FAN	**AIR OUT**	Juniper Gold	Port-to-FRU airflow is where air enters on the end with the ports and exits on the end with fans (also known as *airflow out*).	All models only use power supplies that have gold-colored handles with **AIR OUT** labels.

SEE ALSO

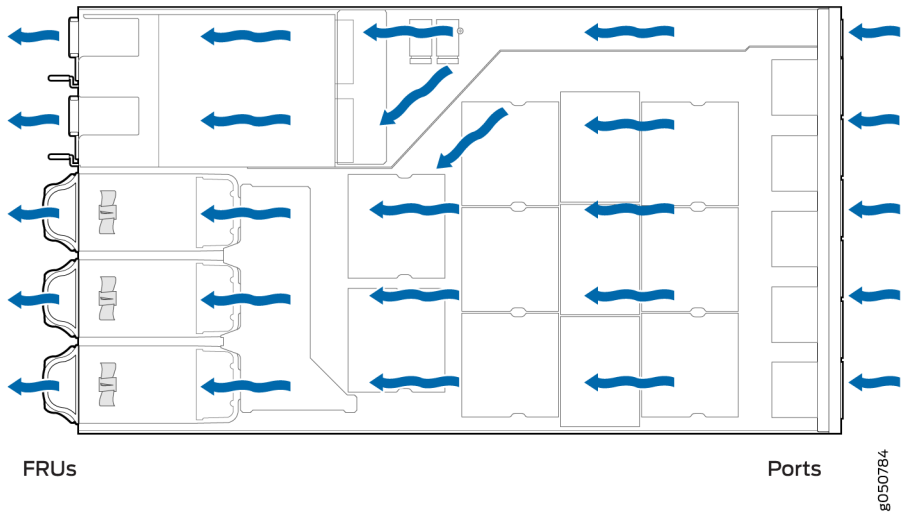
PTX10002-60C System Overview | **2**

Maintaining the PTX10002-60C Fan Modules | **102**

PTX10002-60C Chassis Airflow

In data center deployments, position the router in such a manner that the **AIR OUT** labels on router components are next to the hot aisle. Figure 14 on page 26 shows the airflow through the chassis.

Figure 14: Air Out Airflow Through the PTX10002-60C Chassis



Fan Module Status

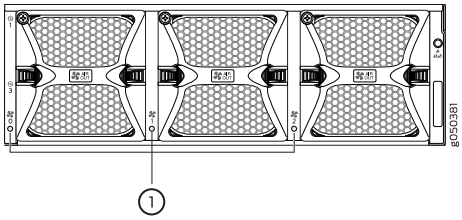
You can check the status of fan modules through the `show system alarms` or `show chassis fan`commands or by looking at the LEDs next to each fan module. For example:

```
user@device> show chassis fan
Item                      Status   RPM     Measurement
      Tray 0 Fan 0              Absent
      Tray 0 Fan 1              Absent
      Tray 1 Fan 0              OK       5000    Spinning at normal speed
      Tray 1 Fan 1              OK       4400    Spinning at normal speed
      Tray 2 Fan 0              OK       5000    Spinning at normal speed
      Tray 2 Fan 1              OK       4400    Spinning at normal speed
```

Each router has a status LED (labeled **ST**) for each fan module on the left side of the corresponding fan module slot. It indicates the status of all the fan modules.

Figure 15 on page 27 shows the location of the LED next to the PTX10002-60C fan module.

Figure 15: PTX10002-60C Fan Module LED



1– Fan LED

Table 11 on page 27

Table 11: PTX10002-60C Fan Module LED

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

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

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

PTX10002-60C Power System

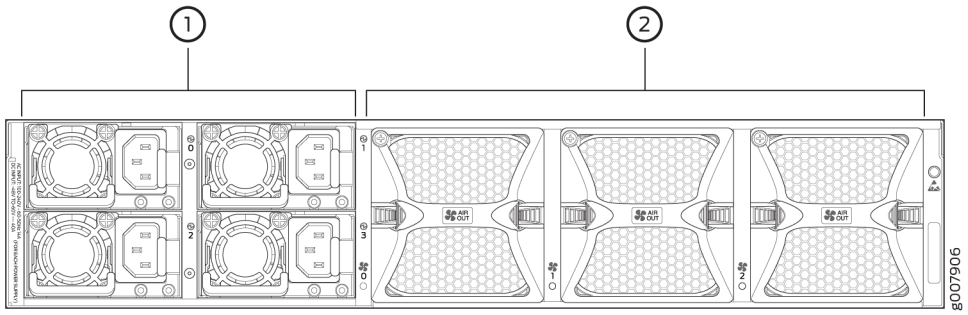
IN THIS SECTION

PTX10002-60C AC Power Supply Description

The AC power supplies in the PTX10002-60C (see Figure 16 on page 28 and Figure 17 on page 29) are hot-removable, and hot-insertable field-replaceable units (FRUs) that you can install without powering off the router or disrupting the routing function. The PTX10002-60C has four power supplies. All the power supplies are initially installed at the factory.

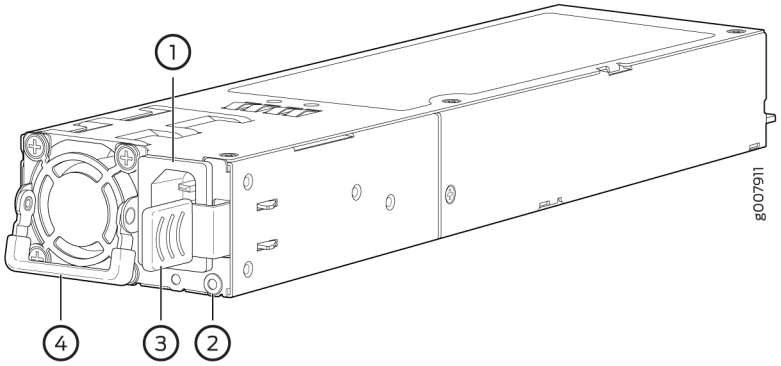
CAUTION: Do not mix AC and DC power supplies in the same chassis.

Figure 16: PTX10002-60C FRU Panel



1– Power supplies (4)	2– Fan modules (3)

Figure 17: PTX10002-60C AC Power Supply



1– plug power connector	3– Ejector lever
2– Status LED	4– Handle

Each of the 1600-W power supplies has a single AC input. The power supply provides 12-VDC output with a standby voltage of 12 VDC. A PTX10002-60C provides for twice the number of power supplies needed to power all of the components in the device, which is known as *2N redundancy*. When the PTX10002-60C has all four power supplies installed and connected to power, the router has full power redundancy. If a power supply fails or is removed, another power supply balances the electrical load without interruption.

NOTE: For more information about power system redundancy, see "PTX10002-60C Component Redundancy" on page 8.

The fan in the power supply provides port-to-FRU airflow, which is also known as *airflow out (AFO)*. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Table 12 on page 29 shows the characteristics of the power supply.

Table 12: PTX10002-60C AC Power Supply

Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
1600-W	JPSU-1600W-AC-AFO	Port-to-FRU	Juniper Gold

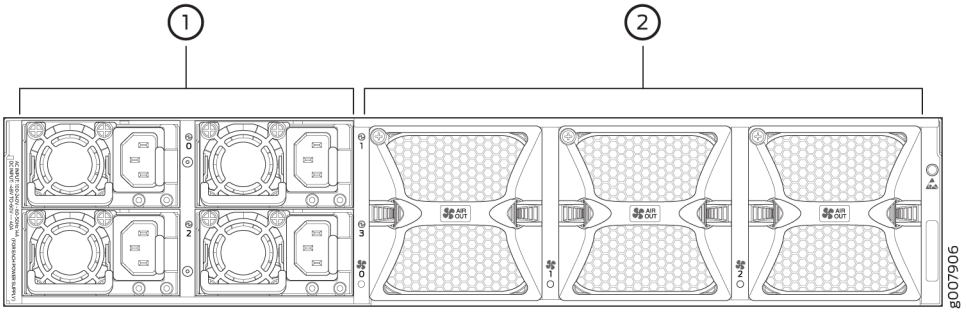
CAUTION: To avoid electrical injury, carefully follow the instructions in "Maintaining the PTX10002-60C Power Supplies" on page 105.

PTX10002-60C DC Power Supply Description

The DC power supplies in the PTX10002-60C (see Figure 18 on page 30 and Figure 19 on page 31) are hot-removable and hot-insertable field-replaceable units (FRUs) that you can install without powering off the router or disrupting the routing function. The PTX10002-60C has four power supplies. All the power supplies are initially installed at the factory.

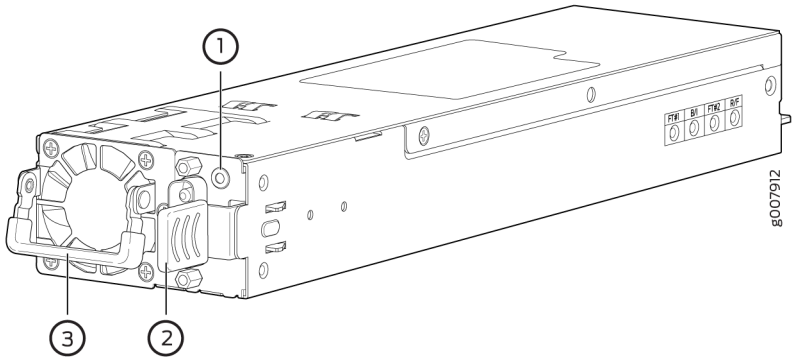
CAUTION: Do not mix AC and DC power supplies in the same chassis.

Figure 18: PTX10002-60C FRU Panel



1– Power supplies (4)	2– Fan modules (3)

Figure 19: DC Power Supply in a PTX10002-60C



1– Status LED	3– Handle
2– Ejector lever	

Each of the four 1600-W power supplies has a single DC input. The power supply provides 12-VDC output with a standby voltage of 12 VDC. A PTX10002-60C provides for twice the number of power supplies needed to power all of the components in the router, which is known as *2N redundancy*. When the PTX10002-60C has all four power supplies installed and connected to power, the router has full power redundancy. If a power supply fails or is removed, another power supply balances the electrical load without interruption.

NOTE: For more information about power system redundancy, see "PTX10002-60C Component Redundancy" on page 8.

The fan in the power supply provides port-to-FRU airflow, which is also known as *airflow out (AFO)*. A power supply with the label **AFO** or a gold-colored handle denotes port-to-FRU airflow.

Table 13 on page 31 shows the characteristics of the DC power supply.

Table 13: PTX10002-60C DC Power Supply

Wattage	Product Number	Direction of Airflow	Color of Power Supply Handle
1600-W	JPSU-1600W-DC-AFO	Port-to-FRU	Juniper Gold

CAUTION: To avoid electrical injury, carefully follow instructions in "Maintaining the PTX10002-60C Power Supplies" on page 105.

NOTE: We recommend that the 48-VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

SEE ALSO

PTX10002-60C System Overview | 2

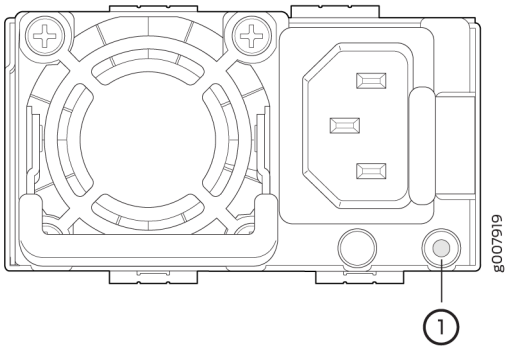
Prevention of Electrostatic Discharge Damage | 164

Maintaining the PTX10002-60C Power Supplies | 105

PTX10002-60C Power Supply LED

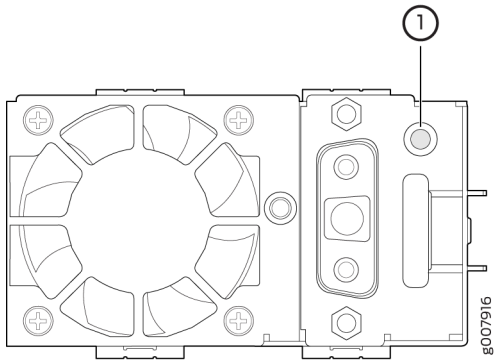
Each PTX10002-60C power supply has a status LED on the power supply faceplate. Figure 20 on page 32 shows the location of the LED on a PTX10002-60C AC power supply and Figure 21 on page 33 shows the location of the LED on a PTX10002-60C DC power supply.

Figure 20: AC Power Supply LED on a PTX10002-60C



1– Status LED	

Figure 21: DC Power Supply LED on a PTX10002-60C



1– Status LED	

Use Table 14 on page 33 to interpret the state of the power supply LED.

Table 14: PTX10002-60C Power Supply LED

Color	State	Description
Green Amber	On steadily Off	The power supply is on and operating correctly.
Green Amber	Slow blinking (1 Hz) Off	The power supply is in cold standby mode; only the 12 V DC input is present.
Green Amber	Blinking (2 Hz) Off	The power supply is uploading firmware.
Green Amber	Off Blinking	Warning events are being detected; the power supply continues to operate. Often these events are because of rising temperatures. Check the fans and ensure there is proper airflow through the chassis.

Table 14: PTX10002-60C Power Supply LED *(Continued)*

Color	State	Description
Green Amber	Off On steadily	Either the power cord is unplugged or a major error is detected in the power supply. Examples of a major error are: power supply failure, an over voltage protection error, an over current protection error, or a fan failure. • If the power cord is unplugged or missing, reattach the power cord appropriate for your country. • If a major error is occurring, Replace the power supply as soon as possible. To maintain proper airflow through the chassis, leave the power supply installed in the chassis until you are ready to replace it.
Green Amber	Off Off	There is no AC power to any of the power supplies.

You can get additional information about the status of the power modules using the `show chassis power command`. For example:

```
user@device> show chassis power

PEM 0:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 372 W (zone 0, 31 A at 12 V, 23% of capacity)

PEM 1:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 324 W (zone 0, 27 A at 12 V, 20% of capacity)

PEM 2:
  State:     Online
  Capacity:  1600 W (maximum 1600 W)
  DC output: 312 W (zone 0, 26 A at 12 V, 19% of capacity)

PEM 3:
  State:     Online
```

```
  Capacity:  1600 W (maximum 1600 W)
  DC output: 312 W (zone 0, 26 A at 12 V, 19% of capacity)

System:
  Zone 0:
      Capacity:          6400 W (maximum 6400 W)
      Allocated power:   1320 W (5080 W remaining)
      Actual usage:      1320 W
  Total system capacity: 6400 W (maximum 6400 W)
  Total remaining power: 5080 W
```

PTX10002-60C AC Power Specifications

Table 15 on page 35 describes the AC power specifications for a PTX10002-60C.

Table 15: PTX10002-60C AC Power Specifications

Item	Specifications
AC input voltage	Operating range: 100–240 VAC
AC input line frequency	50–60 Hz
AC input current rating	11.5 A at 100–120 VAC
AC input current rating	14 A at 100–120 VAC
Typical power consumption	1728 W
Maximum power consumption	1824 W

PTX10002-60C AC Power Cord Specifications

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

NOTE: In North America, AC power cords must not exceed 14.75 feet (approximately 4.5 meters) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52 and Canadian Electrical Code (CEC) Section 4-010(3). The cords that can be ordered for the PTX10002-60C are in compliance.

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

Table 16: PTX10002-60C AC Power Cord Specifications

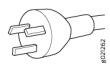
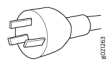
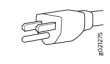
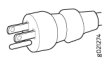
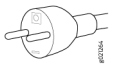
Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
Australia	250 VAC, 10 A, 50 Hz	AS/NZ 3109-1996	CG_CBL-C13-06-AU	CBL-EX-PWR-C13-AU	
China	250 VAC, 10 A, 50 Hz	GB 1002-1996	CG_CBL-C13-06-CH	CBL-EX-PWR-C13-CH	
Europe (except Italy, Switzerland, and United Kingdom)	250 VAC, 10 A, 50 Hz	CEE (7) VII	CG_CBL-C13-06-EU	CBL-EX-PWR-C13-EU	
Italy	250 VAC, 10 A, 50 Hz	CEI 23-16/VII	CG_CBL-C13-06-IT	CBL-EX-PWR-C13-IT	
Japan	125 VAC, 12 A, 50 Hz or 60 Hz	JIS C8303	CG_CBL-C13-06-JP	CBL-EX-PWR-C13-JP	

Table 16: PTX10002-60C AC Power Cord Specifications *(Continued)*

Country/ Region	Electrical Specifications	Plug Standards	Shipped Juniper Model Number	Spare Juniper Model Number	Graphic
North America	250 VAC, 13 A, 60 Hz 250 VAC, 13 A, 60 Hz	CAN/CSA No. 49-92 NEMA L6-15 NEMA 6-15	CG_CBL-C13-06-US	CBL-EX-PWR-C13-US CBL-PW-C13-250-US CBL-PWR-C13-250-US	
South Korea	250 VAC, 10 A, 60 Hz 250 VAC, 13 A, 60 Hz	KSC 8305; K60884-1	CG_CBL-C13-06-KR	CBL-EX-PWR-C13-KR	
Switzerland	250 VAC, 10 A, 50 Hz	SEV 1011 SEV 1991; EN 60320 C13	CG_CBL-C13-06-SZ	CBL-EX-PWR-C13-SZ	
United Kingdom	250 VAC, 10 A, 50 Hz	BS 1363/A	CG_CBL-C13-06-UK	CBL-EX-PWR-C13-UK	

PTX10002-60C DC Power Specifications

Table 17 on page 38 describes the DC power specifications for a PTX10002-60C.

NOTE: We recommend that the 48-VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

Table 17: PTX10002-60C DC Power Specifications

Item	Specifications
DC input voltage	• Rated operating voltage: –48 VDC through –60 VDC • Operating voltage range: –40 VDC through –72 VDC
DC input current rating	57.4 A maximum
Typical power consumption	1642 W
Maximum power consumption	1857 W

PTX10002-60C DC Power Cable Specifications

PTX10002-60C DC power supplies require a D-Sub 3W3- type connector. The three pins on the connector provide –48 VDC input (–), return (+), and ground connections to the power supply.

DC power cables, each approximately 13.1 ft (4 m) long, are supplied with the PTX10002-60C. The provided cables include the three-pin connector on one end and insulated wires at the opposite end, for connection to the site's DC power distribution system.

Table 18 on page 38 lists the specifications for the PTX10002-60C DC power cables.

Table 18: PTX10002-60C DC Power Cable Specifications

Juniper Model Number	Wire Function	Insulation Color	Wire Size
CBL-JNP-PWR-DSUB (straight cable)	–48 VDC input (–)	Blue	8 AWG (8.4 mm^2), 90° C
	Return (+)	Black	8 AWG (8.4 mm^2), 90° C
	Ground	Green and yellow	8 AWG (8.4 mm^2), 90° C

Table 18: PTX10002-60C DC Power Cable Specifications *(Continued)*

Juniper Model Number	Wire Function	Insulation Color	Wire Size
CBL-JNP-PWR-DSUB2 (optional) right-angle cable	–48 VDC input (–)	Blue	8 AWG (8.4 mm^2), 90° C
	Return (+)	Black	8 AWG (8.4 mm^2), 90° C
CBL-JNP-PWR-DSUB3 (Optional) FT4 vertical-flame rated, right-angle cable	–48 VDC input (–)	Gray	8 AWG (8.4 mm^2), 90° C
	Return (+)	Gray	8 AWG (8.4 mm^2), 90° C

NOTE: The optional right-angle DC power cables, CBL-JNP-PWR-DSUB2 and CBL-JNP-PWR-DSUB3, do not include a ground connection wire.

Regardless which DC power cable you use, you must connect the PTX10002-60C to earth ground before you connect it to power, using the procedure described in "Connecting the PTX10002-60C to Ground" on page 83.

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

WARNING: Power cables must not block access to PTX10002-60C components or drape where people could trip over them.

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 might be different from the color coding for the leads on the DC power cable provided with the chassis.

CHAPTER 2

Site Planning, Preparation, and Specifications

PTX10002-60C Site Preparation Checklist

The checklist in Table 19 on page 41 summarizes the tasks you need to perform when preparing a site for a PTX10002-60C installation.

Table 19: Site Preparation Checklist

Item or Task	For More Information	Performed by	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"PTX10002-60C Environmental Requirements and Specifications" on page 43		
Power			
Measure the distance between external power sources and the router installation site.			
Calculate the power consumption and requirements.	• "PTX10002-60C AC Power Specifications" on page 35 • "PTX10002-60C DC Power Specifications" on page 37		
Rack			
Verify that your rack meets the minimum requirements for the installation of the router.	"PTX10002-60C Rack Requirements" on page 48		
Plan rack location, including required space clearances.	Figure 22 on page 46		
Secure the rack to the floor and building structure.			
Cables			

Table 19: Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed by	Date
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	See The Hardware Compatibility Tool.		
Plan the cable routing and management.			

RELATED DOCUMENTATION

- Installation Instructions Warning | **144**
- Chassis and Component Lifting Guidelines | **145**
- Restricted Access Warning | **145**
- Ramp Warning | **147**
- Rack-Mounting and Cabinet-Mounting Warnings | **147**
- Grounded Equipment Warning | **151**

PTX10002-60C Site Guidelines and Requirements

IN THIS SECTION

PTX10002-60C Environmental Requirements and Specifications

The PTX10002-60C must be installed in a rack. It must be housed in a dry, clean, well-ventilated, and temperature-controlled environment.

Follow these environmental guidelines:

- The site must be as dust-free as possible, because dust can clog air intake vents and filters, reducing the efficiency of the PTX10002-60C cooling system.
- Maintain ambient airflow for normal PTX10002-60C operation. If the airflow is blocked or restricted, or if the intake air is too warm, the chassis might overheat, leading to the PTX10002-60C temperature monitor shutting down the router to protect the hardware components.

Table 20 on page 43 provides the required environmental conditions for normal PTX10002-60C operation.

Table 20: PTX10002-60C Environmental Tolerances

Description	Tolerance
Altitude	No performance degradation up to 6000 feet (1828.8 meters).
Relative humidity	• Normal operation ensured in relative humidity range of 5% through 90%, noncondensing. • Short-term operation ensured in relative humidity range of 5% through 93%, noncondensing. **NOTE**: As defined in NEBS GR-63-CORE, Issue 3, short-term events can be up to 96 hours in duration but not more than 15 days per year.

Table 20: PTX10002-60C Environmental Tolerances *(Continued)*

Description	Tolerance
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 through 158° F (–40° C through 70° C).
Seismic	Designed to comply with Zone 4 earthquake requirements per NEBS GR-63-CORE, Issue 3.

NOTE: Install the PTX10002-60C 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.

General Site Guidelines

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

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

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

PTX10002-60C Chassis Grounding Cable and Lug Specifications

For installations that require a separate grounding conductor to the chassis, the PTX10002-60C must be adequately grounded before power is connected to ensure proper operation and to meet safety and electromagnetic interference (EMI) requirements. To ground a PTX10002-60C, connect a grounding cable to earth ground and then attach it to the chassis grounding points.

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

WARNING: To comply with GR-1089 requirements, all intrabuilding copper cabling used for SFP+, QSFP+, and QSFP28 ports must be shielded and grounded at both ends.

CAUTION: Before device installation begins, a licensed electrician must attach a cable lug to the grounding cables that you supply. See "Connecting the PTX10002-60C to Ground" on page 83. A cable with an incorrectly attached lug can damage the PTX10002-60C.

Before connecting the PTX10002-60C to earth ground, review the following information:

- A protective earthing terminal bracket is required for connecting the PTX10002-60C to earth ground. This two-holed bracket attaches through the mounting bracket, providing a protective earthing terminal for the router. Screws are provided in the accessory kit to attach the protective earthing terminal bracket.
- The grounding lug required is a Panduit LCD6-14BH-L or equivalent (provided). The grounding lug accommodates 6 AWG (13.3 mm^2) stranded wire.
- The grounding cable that you provide must be of the same size or heavier than the input wire of each power supply. the minimum recommendation is 8 AWG (8.4 mm^2) stranded wire, 60° C wire, or as permitted by local code.

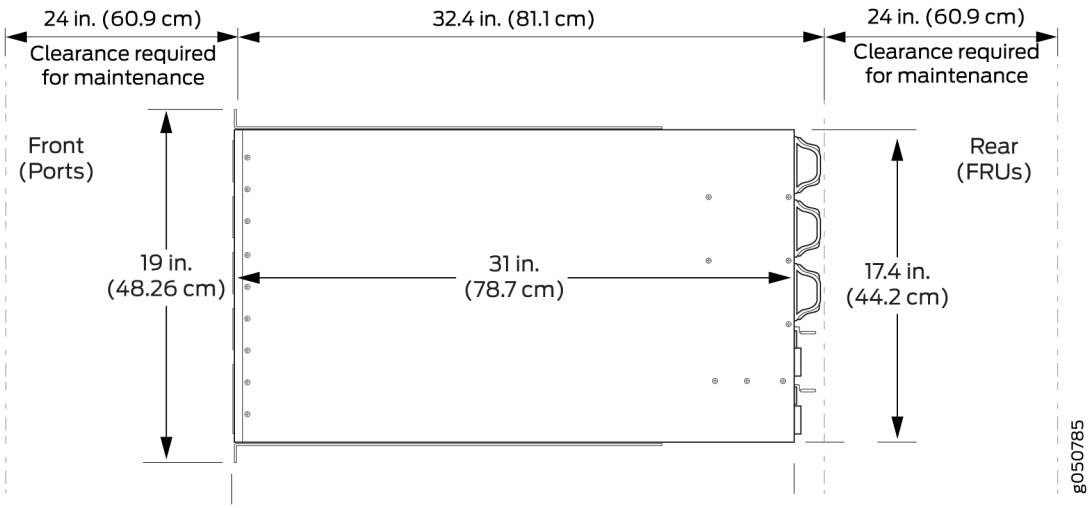
SEE ALSO

Connect the PTX10002-60C to Power | 83

PTX10002-60C Clearance Requirements for Airflow and Hardware Maintenance

When planning the site for a PTX10002-60C installation, you must allow sufficient clearance around the installed chassis (see Figure 22 on page 46).

Figure 22: Clearance Requirements for Airflow and Hardware Maintenance for the PTX10002-60C



Follow these guidelines:

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. See "PTX10002-60C Cooling System Description and Airflow" on page 23 for more information about the airflow through the chassis.
- If you are mounting a PTX10002-60C in a rack with other equipment, ensure that the exhaust from other equipment does not blow into the intake vents of the chassis.
- You must leave at least 24 in. (61 cm) both in front of and behind the PTX10002-60C for service personnel to remove and install hardware components, you must leave adequate space at the front and back of the PTX10002-60C. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack or cabinet and 24 in. (61 cm) behind the rack.

PTX10002-60C Chassis Physical Specifications

Table 21 on page 47 lists the physical specifications for the PTX10002-60C chassis.

Table 21: Physical Specifications for the PTX10002-60C

Description	Weight	Height	Width	Depth
AC-powered chassis with three fans and four power supplies installed	90.39 lbs (41 kg)	3.46 in. (8.8 cm)	17.36 in. (44.1 cm)	31 in. (78.7 cm) without handles for fans or power supplies.
DC-powered chassis with three fans and four power supplies installed	67.8 lb (30.8 kg)			

Site Electrical Wiring Guidelines

Table 22 on page 48 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 22: Site Electrical Wiring Guidelines

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

PTX10002-60C Rack Requirements

The PTX10002-60C chassis is designed to be installed in four-post racks.

Rack requirements consist of:

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

- Rack connection to the building structure

Table 23 on page 49 provides the rack requirements and specifications for the PTX10002-60C.

Table 23: Rack Requirements for the PTX10002-60C

Rack Requirement	Guidelines
Rack type: four-post	Use a four-post rack that provides bracket holes or hole patterns spaced at 1-U (1.75 in. or 4.45 cm) increments and that meets the size and strength requirements to support the weight. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/).
Mounting bracket hole spacing	The holes in the mounting brackets are spaced at 1 U (1.75 in. or 4.45 cm), so that the PTX10002-60C can be mounted in any rack that provides holes spaced at that distance.
Rack size and strength	• Ensure that the rack complies with the standards for a 19-in. or 23-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association (http://www.ecianow.org/). • Use a 600-mm rack as defined in the four-part *Equipment Engineering (EE); European telecommunications standard for equipment practice* (document numbers ETS 300 119-1 through 119-4) published by the European Telecommunications Standards Institute (http://www.etsi.org). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the router's mounting brackets, which measure 19 in. (48.26 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required. • Ensure that the rack rails are spaced widely enough to accommodate the PTX10002-60C chassis' external dimensions. The outer edges of the front-mounting rails extend the width to 19 in. (48.26 cm). • Ensure that the front and rear rack rails are spaced between 28 in. (71.1 cm) and 36 in. (91.4 cm) front-to-back. • Ensure that the rack is strong enough to support the weight of the PTX10002-60C. • Ensure that the spacing of rails and adjacent racks allows for proper clearance around the PTX10002-60C and rack.

Table 23: Rack Requirements for the PTX10002-60C *(Continued)*

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

PTX10002-60C Network Cable and Transceiver Planning

IN THIS SECTION

Determining Transceiver Support for the PTX10002-60C

The PTX10002-60C has quad small form-factor pluggable plus (QSFP+) ports for use as uplinks, downlinks, or as access ports. These 40-Gigabit Ethernet ports support QSFP+ transceivers, QSFP28 transceivers, QSFP+ direct-attach copper (DAC) cables, and DAC breakout cables (DACBO). Each QSFP+ port can be configured to operate as a 10-Gigabit Ethernet interface by using a breakout cable or as a single 40-Gigabit Ethernet interface.

The PTX10002-60C also supports using small form-factor pluggable (SFP) and small form-factor pluggable plus (QSFP+) transceivers to connect the management ports. These transceivers are not supported for use in the uplinks, downlinks, or access ports.

You can find information about the optical transceivers supported on your Juniper device by using the Hardware Compatibility Tool. In addition to transceiver and connection type, the optical and cable characteristics–where applicable–are documented for each transceiver. The Hardware Compatibility Tool enables you to search by product, displaying all the transceivers supported on that device, or category, by interface speed or type. The list of supported transceivers for PTX10002-60C routers is located at https://apps.juniper.net/hct/product/#prd=PTX10002.

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.

Cable and Connector Specifications for MX and PTX Series Devices

IN THIS SECTION

The transceivers that are supported on MX Series and PTX Series devices use fiber-optic cables and connectors. The type of connector and the type of fiber depends on the transceiver type.

You can determine the type of cable and connector required for your specific transceiver by using the Hardware Compatibility Tool.

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

NOTE: The terms multifiber push-on (MPO) and multifiber termination push-on (MTP) describe the same connector type. The rest of this topic uses MPO to mean MPO or MTP.

12-Fiber MPO Connectors

There are two types of cables used with 12-fiber MPO connectors on Juniper Networks devices—patch cables with MPO connectors on both ends, and breakout cables with an MPO connector on one end and four LC duplex connectors on the opposite end. Depending on the application, the cables might use single-mode fiber (SMF) or multimode fiber (MMF). Juniper Networks sells cables that meet the supported transceiver requirements, but it is not required to purchase cables from Juniper Networks.

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

Also, ensure that the fiber end in the connector is finished correctly. Physical contact (PC) refers to fiber that has been polished flat. Angled physical contact (APC) refers to fiber that has been polished at an angle. Ultra physical contact (UPC) refers to fiber that has been polished flat, to a finer finish. The required fiber end is listed with the connector type in the Hardware Compatibility Tool.

12-Fiber Ribbon Patch Cables with MPO Connectors

You can use 12-fiber ribbon patch cables with socket MPO connectors to connect two transceivers of the same type—for example, 40GBASE-SR4-to-40GBASESR4 or 100GBASE-SR4-to-100GBASE-SR4. You can also connect 4x10GBASE-LR or 4x10GBASE-SR transceivers by using patch cables—for example, 4x10GBASE-LR-to-4x10GBASE-LR or 4x10GBASE-SR-to-4x10GBASE-SR—instead of breaking the signal out into four separate signals.

Table 24 on page 53 describes the signals on each fiber. Table 25 on page 53 shows the pin-to-pin connections for proper polarity.

Table 24: Cable Signals for 12-Fiber Ribbon Patch Cables

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

Table 25: Cable Pinouts for 12-Fiber Ribbon Patch Cables

MPO Pin	MPO Pin
1	12

Table 25: Cable Pinouts for 12-Fiber Ribbon Patch Cables *(Continued)*

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

12-Fiber Ribbon Breakout Cables with MPO-to-LC Duplex Connectors

You can use 12-ribbon breakout cables with MPO-to-LC duplex connectors to connect a QSFP+ transceiver to four separate SFP+ transceivers—for example, 4x10GBASE-LR-to-10GBASE-LR or 4x10GBASE-SR-to-10GBASE-SR SFP+ transceivers. The breakout cable is constructed out of a 12-fiber ribbon fiber-optic cable. The ribbon cable splits from a single cable with a socket MPO connector on one end, into four cable pairs with four LC duplex connectors on the opposite end.

Figure 23 on page 55 shows an example of a typical 12-ribbon breakout cable with MPO-to-LC duplex connectors (depending on the manufacture, your cable may look different).

Figure 23: 12-Ribbon Breakout Cable

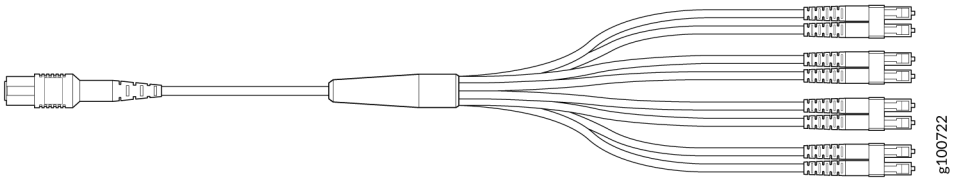


Table 26 on page 55 describes the way the fibers are connected between the MPO and LC duplex connectors. The cable signals are the same as those described in Table 24 on page 53.

Table 26: Cable Pinouts for 12-Fiber Ribbon Breakout Cables

MPO Connector Pin	LC Duplex Connector Pin
1	Tx on LC Duplex 1
2	Tx on LC Duplex 2
3	Tx on LC Duplex 3
4	Tx on LC Duplex 4
5	Unused
6	Unused
7	Unused
8	Unused
9	Rx on LC Duplex 4

Table 26: Cable Pinouts for 12-Fiber Ribbon Breakout Cables *(Continued)*

MPO Connector Pin	LC Duplex Connector Pin
10	Rx on LC Duplex 3
11	Rx on LC Duplex 2
12	Rx on LC Duplex 1

12-Ribbon Patch and Breakout Cables Available from Juniper Networks

Juniper Networks sells 12-ribbon patch and breakout cables with MPO connectors that meet the requirements described above. It is not required to purchase cables from Juniper Networks. Table 27 on page 56 describes the available cables.

Table 27: 12-Ribbon Patch and Breakout Cables Available from Juniper Networks

Cable Type	Connector Type	Fiber Type	Cable Length	Juniper Model Number
12-ribbon patch	Socket MPO/PC to socket MPO/PC, key up to key up	MMF (OM3)	1 m	MTP12-FF-M1M
			3 m	MTP12-FF-M3M
			5 m	MTP12-FF-M5M
			10 m	MTP12-FF-M10M
	Socket MPO/APC to socket MPO/APC, key up to key up	SMF	1 m	MTP12-FF-S1M
			3 m	MTP12-FF-S3M
			5 m	MTP12-FF-S5M

Table 27: 12-Ribbon Patch and Breakout Cables Available from Juniper Networks *(Continued)*

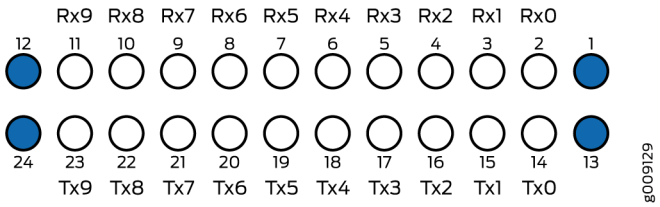
Cable Type	Connector Type	Fiber Type	Cable Length	Juniper Model Number
			10 m	MTP12-FF-S10M
12-ribbon breakout	Socket MPO/PC, key up, to four LC/UPC duplex	MMF (OM3)	1 m	MTP-4LC-M1M
			3 m	MTP-4LC-M3M
			5 m	MTP-4LC-M5M
			10 m	MTP-4LC-M10M
	Socket MPO/APC, key up, to four LC/UPC duplex	SMF	1 m	MTP-4LC-S1M
			3 m	MTP-4LC-S3M
			5 m	MTP-4LC-S5M
			10 m	MTP-4LC-S10M

24-Fiber MPO Connectors

You can use patch cables with 24-fiber MPO connectors to connect two supported transceivers of the same type—for example, 100GBASE-SR10-to-100GBASE-SR10.

Figure 24 on page 58 shows the 24-fiber MPO optical lane assignments.

Figure 24: 24-Fiber MPO Optical Lane Assignments



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

The MPO optical connector for the CFP2-100G-SR10-D3 is defined in *Section 5.6 of the CFP2 Hardware Specification and Section 88.10.3 of IEEE STD 802.3-2012*. These specifications include the following requirements:

- Recommended Option A in IEEE STD 802.3-2012.
- The transceiver receptacle is a plug. A patch cable with a socket connector is required to mate with the module.
- Ferrule finish shall be flat polished interface that is compliant with IEC 61754-7.
- Alignment key is key up.

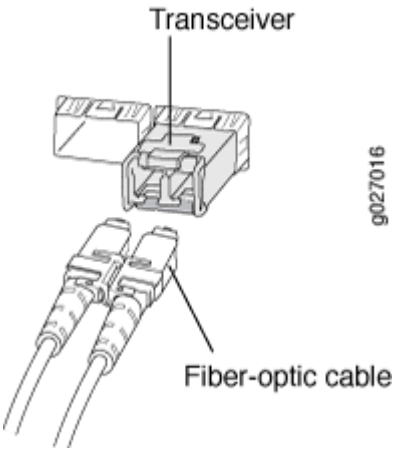
The optical interface must meet the requirement FT-1435-CORE in *Generic Requirements for Multi-Fiber Optical Connectors*. The module must pass the wiggle test defined by IEC 62150-3.

LC Duplex Connectors

You can use patch cables with LC duplex connectors to connect two supported transceivers of the same type—for example, 40GBASE-LR4-to-40GBASE-LR4 or 100GBASE-LR4-to100GBASE-LR4. The patch cable is one fiber pair with two LC duplex connectors at opposite ends. LC duplex connectors are also used with 12-fiber ribbon breakout cables, as described in "12-Fiber Ribbon Breakout Cables with MPO-to-LC Duplex Connectors" on page 54.

Figure 25 on page 59 shows an LC duplex connector being installed in a transceiver.

Figure 25: LC Duplex Connector



Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

IN THIS SECTION

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

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

Single-mode fiber is so small in diameter that rays of light can reflect internally through one layer only. Interfaces with single-mode optics use lasers as light sources. Lasers generate a single wavelength of

light, which travels in a straight line through the single-mode fiber. Compared with multimode fiber, single-mode fiber has higher bandwidth and can carry signals for longer distances.

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

Attenuation and Dispersion in Fiber-Optic Cable

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

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

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

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

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

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

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:

How to Calculate Power Budget for Fiber-Optic Cables

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

$$P_B = P_T - P_R$$

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

$$P_B = P_T - P_R$$

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

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

How to Calculate Power Margin for Fiber-Optic Cables

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

$P_M = P_B - LL$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 28 on page 62 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 28: Estimated Values for Factors Causing Link Loss

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

The following sample calculation for a 2-km-long multimode link with a power budget (P_B) of 13 dB uses the estimated values from Table 28 on page 62. This example calculates link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 7\ dB$

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 28 on page 62. This example calculates link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 5.5\ dB$

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

PTX10002-60C Management Cable Specifications and Pinouts

IN THIS SECTION

Cable Specifications for Console and Management Connections for the PTX10002-60C

Table 29 on page 64 lists the specifications for the cables that connect the PTX10002-60C to a management device.

NOTE: The PTX10002-60C also has an SFP management port that supports transceivers that use fiber-optic cables. See "Determining Transceiver Support for the PTX10002-60C" on page 50 for more information about supported transceivers.

Table 29: Cable Specifications for Console and Management Connections for the PTX10002-60C

Port on PTX10002-60C	Cable Specification	Cable Supplied	Maximum Length	Device Receptacle
Console (**CON**) port	RS-232 (EIA-232) serial cable	One 7-foot (2.13-meter)-long RJ-45 patch cable and RJ-45 to DB-9 adapter	7 feet (2.13 meters)	RJ-45
Management (**MGMT**) port	Category 5 cable or equivalent suitable for 1000BASE-T operation	One 7-foot (2.13-meter)-long RJ-45 patch cable	328 feet (100 meters)	RJ-45

Management Port Connector Pinouts for the PTX10002-60C

The 10/100/1000BASE-T RJ-45 management port (labeled **MGMT**) uses an RJ-45 connector to connect to a management device for out-of-band management.

Table 30 on page 64 provides the pinout information of the RJ-45 management port connector. An RJ-45 cable is supplied with the PTX10002-60C.

Table 30: RJ-45 Management Port Connector Pinouts for the PTX10002-60C

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

Table 30: RJ-45 Management Port Connector Pinouts for the PTX10002-60C *(Continued)*

Pin	Signal	Description
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

Console Port Connector Pinouts for the PTX10002-60C

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

Table 31 on page 65 provides the pinout information for the RJ-45 console connector. An RJ-45 cable and an RJ-45 to DB-9 adapter are supplied with the PTX10002-60C.

NOTE: If your laptop or PC does not have a DB-9 plug connector pin and you want to connect your laptop or PC directly to a PTX10002-60C, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter supplied with the router and a USB to DB-9 plug adapter. You must provide the USB to DB-9 plug adapter.

Table 31: Console Port Connector Pinouts for the PTX10002-60C

Pin	Signal	Description
1	RTS Output	Request to send

Table 31: Console Port Connector Pinouts for the PTX10002-60C *(Continued)*

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

USB Port Specifications for the PTX10002-60C

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

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

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

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

NOTE: USB flash drives used with the PTX Series device must support USB 2.0 or later.

SEE ALSO

PTX10002-60C Management Panel | 16

RJ-45 Port, SFP Port, SFP+ Port, QSFP+ Port, and QSFP28 Port Connector Pinout Information

The tables in this topic describe the connector pinout information for the RJ-45, QSFP+, QSFP28, SFP+, and SFP ports.

- Table 32 on page 67—10/100/1000BASE-T Ethernet network port connector pinout information
- Table 33 on page 68—SFP network port connector pinout information
- Table 34 on page 70—SFP+ network port connector pinout information
- Table 35 on page 71—QSFP+ and QSFP28 network module ports connector pinout information

Table 32: 10/100/1000BASE-T Ethernet Network Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1 Negative Vport (in PoE models)
2	TRP1-	Transmit/receive data pair 1 Negative Vport (in PoE models)

Table 32: 10/100/1000BASE-T Ethernet Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
3	TRP2+	Transmit/receive data pair 2 Positive Vport (in PoE models)
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2 Positive Vport (in PoE models)
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

Table 33: SFP Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent

Table 33: SFP Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
7	RS	Rate select
8	RX_LOS	Receiver loss of signal indication
9	VeeR	Module receiver ground
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3 V supply
16	VccT	Module transmitter 3.3 V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 34: SFP+ Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent
7	RS0	Rate select 0, optionally controls SFP+ module receiver
8	RX_LOS	Receiver loss of signal indication
9	RS1	Rate select 1, optionally controls SFP+ transmitter
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3-V supply

Table 34: SFP+ Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
16	VccT	Module transmitter 3.3-V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 35: QSFP+ and QSFP28 Network Port Connector Pinout Information

Pin	Signal
1	GND
2	TX2n
3	TX2p
4	GND
5	TX4n
6	TX4p
7	GND
8	ModSelL
9	LPMode_Reset

Table 35: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
10	VccRx
11	SCL
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n
22	RX2p
23	GND
24	RX4n

Table 35: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
25	RX4p
26	GND
27	ModPrsL
28	IntL
29	VccTx
30	Vcc1
31	Reserved
32	GND
33	TX3p
34	TX3n
35	GND
36	TX1p
37	TX1n
38	GND

CHAPTER 3

Initial Installation and Configuration

PTX10002-60C Installation Overview

IN THIS SECTION

Overview of Installing the PTX10002-60C

Before you begin to install and connect a PTX10002-60C, ensure that you have reviewed the information in PTX10002-60C Installation Safety Guidelines.

You can mount a PTX10002-60C:

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

To install and connect a PTX10002-60C:

1. Unpack the PTX10002-60C and verify the components received. See "Unpacking the PTX10002-60C" on page 77.
2. Mount the PTX10002-60C in a rack. See "Mounting the PTX10002-60C in a Rack" on page 79.
3. For installations that require a separate grounding conductor to the chassis, follow the instructions in "Connecting the PTX10002-60C to Ground" on page 83.
4. Connect the PTX10002-60C to power. Depending on your configuration, follow the instructions in "Connecting AC Power to the PTX10002-60C" on page 85 or "Connecting DC Power to the PTX10002-60C" on page 88
5. Connect the PTX10002 to a management console for initial configuration. See "Connecting the PTX10002-60C to a Management Console" on page 94.
6. Initially configure Junos OS following the instructions in "Performing the Initial Software Configuration for the PTX10002-60C" on page 96.

SEE ALSO

PTX10002-60C Site Preparation Checklist | 41

PTX10002-60C Installation Safety Guidelines

IN THIS SECTION

Observe the following guidelines before and during PTX10002-60C installation:

General Installation Safety Guidelines

Before installing or moving the PTX10002-60C, verify that the intended site meets the specified power, environmental, and clearance requirements. See the following documentation:

- "PTX10002-60C Site Preparation Checklist" on page 41
- "PTX10002-60C Clearance Requirements for Airflow and Hardware Maintenance" on page 46
- "PTX10002-60C Rack Requirements" on page 48
- "PTX10002-60C Chassis Physical Specifications" on page 47
- "PTX10002-60C AC Power Specifications" on page 35or "PTX10002-60C DC Power Specifications" on page 37

PTX10002-60C Chassis Lifting Guidelines

The weight of a fully-loaded PTX10002-60C is approximately 68.6 lb (31.1 kg) with AC power supplies and 67.8 lb (30.8 kg) with DC power supplies installed. Observe the following guidelines for lifting and moving a PTX10002-60C:

CAUTION: If you are installing the PTX10002-60C above 60 in. (152.4 cm) from the floor, remove the power supplies and fan modules before attempting to install the

device. Unless you are using a mechanical lift, at least three persons are required to perform the rack installation.

- Before lifting or moving the PTX10002-60C, disconnect all external cables.
- When manually raising the PTX10002-60C into the rack, have two persons lift and align the PTX10002-60C with the rack while another person secures the device to the rack. As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

SEE ALSO

Mounting the PTX10002-60C in a Rack | 79

Unpacking and Mounting the PTX10002-60C

IN THIS SECTION

Unpacking the PTX10002-60C

The PTX10002-60C chassis is a rigid sheet-metal structure that houses the hardware components. The PTX10002-60C is shipped in a cardboard carton, secured with foam packing material. The carton also contains an accessory kit and quick start instructions.

CAUTION: PTX10002-60C routers are maximally protected inside the shipping carton. Do not unpack the PTX10002-60C until you are ready to begin installation.

To unpack a PTX10002-60C:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the system components.
2. Position the carton so that the arrows point upward.
3. Open the top flaps on the shipping carton.
4. Remove the accessory kit and verify the contents against the inventory of components listed in Table 36 on page 78.
5. Pull out the packing material holding the PTX10002-60C in place.
6. Verify the chassis components received:
   - Three fan modules
   - Four power supplies
7. Save the shipping carton and packing materials in case you need to move or ship the chassis later.

Table 36: Inventory of Components Supplied with a PTX10002-60C

Component	Quantity
Chassis with three fan modules and four power supplies	1
Rear-mounting blades	2
Front-mounting rails	2
RJ-45 cable and RJ-45 to DB-9 serial port adapter	1
Flat-head M4x6-mm Phillips mounting screws to secure the mounting rails to the chassis	24
Power cords with plugs for that are appropriate for your geographical location	4

Mounting the PTX10002-60C in a Rack

IN THIS SECTION

Mount a PTX10002-60C in a 19-in four-post rack by using the included mounting brackets. The shipping carton contains two front mounting rails with two matching rear mounting blades. This configuration allows either end of the PTX10002-60C to be mounted flush with the rack and still be adjustable for racks with different depths. The minimum distance the front and rear rack rails can be spaced apart is 28 in. (71.1 cm) front to back. The maximum distance the front and rear rack rails can be spaced apart is 36 in. (91.4 cm) front to back.

Before You Begin Mounting the PTX10002-60C

PTX10002-60C routers require at least three people for installation, two people to lift the PTX10002-60C into place and another person to attach the device to the rack. You can remove the power supplies and fan modules to minimize the weight before attempting to install the PTX10002-60C. For overhead installation—for example, if you are installing the PTX10002-60C above 60 in. (152.4 cm) from the floor—we recommend that you use a mechanical lift.

Before you begin mounting a PTX10002-60C in the rack:

1. Read "General Safety Guidelines and Warnings" on page 139 and PTX10002-60C Installation Safety Guidelines.

   NOTE: If you are mounting multiple units in the rack, mount the heaviest unit at the bottom and mount the others from bottom to top in order of decreasing weight. The PTX10002-60C weighs 80.5 lbs (36.5 kgs). Installing the router in a rack requires either a mechanical lift or two people to lift the device and another person to secure it to the rack.

2. Ensure that you understand how to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 164.
3. Verify that the site meets the requirements described in "PTX10002-60C Site Preparation Checklist" on page 41.
4. Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the building structure.

5. Decide whether the field-replaceable unit (FRU) end of the switch or the port end is to be placed at the front of the rack. Position the switch in such a manner that the **AIR OUT** labels on components are next to the hot aisle.
6. Remove the PTX10002-60C and the mounting kit from the shipping carton (see "Unpacking the PTX10002-60C" on page 77).

You'll need to provide the following items to mount the PTX10002-60C in a rack:

- Management host, such as a PC laptop, with a serial port
- (Optional) Grounding cable kit with bracket, lug, and three nuts with integrated washers
- Sixteen (16) screws to secure the chassis and mounting blades to the rack)
- Screwdriver appropriate for the rack-mounting screws
- ESD grounding strap

Mounting the PTX10002-60C

WARNING: PTX10002-60C routers must be supported at all four corners. Mounting the chassis by using only the front brackets will damage the chassis and can result in serious bodily injury.

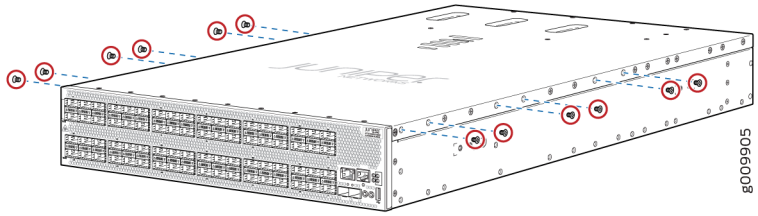
CAUTION: If you are mounting multiple devices in a rack, mount the device in the lowest position of the rack first. Proceed to mount the rest of the devices from the bottom to the top of the rack to minimize the risk of the rack toppling.

To mount the PTX10002-60C on four posts in a rack by using the provided mounting kit:

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

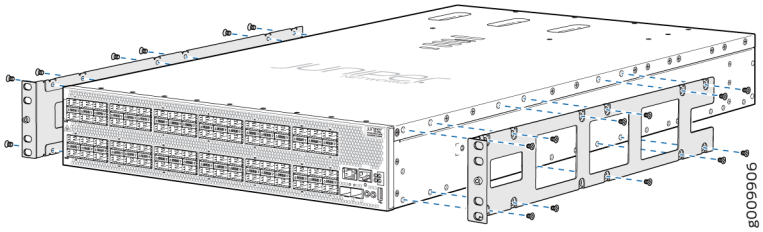
2. Using a Phillips screwdriver, remove the six screws on each side of the chassis that hold the cover to the chassis (see Figure 26 on page 81). These screws will be replaced with the mounting screws included in the box.

Figure 26: Removing the Screws Holding the Cover



3. Align one of the front-mounting rails with the screw holes on the side of the chassis (see Figure 27 on page 81).

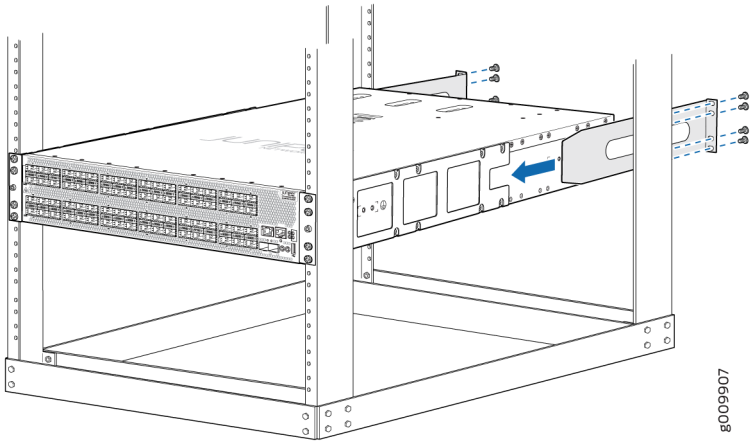
Figure 27: Attaching Front Mounting Rails (PTX10002-60C)



4. Attach the mounting rail to the PTX10002-60C by using 11 flat-head M4x6-mm Phillips mounting screws. Tighten the screws.
5. Repeat Step 3 and Step 4 on the opposite side of the PTX10002-60C.
6. Perform one of the following steps:
   - Use a mechanical lift to position the PTX10002-60C in the rack so that the front brackets on the front-mounting rails are aligned with the rack holes.
   - Have two people grasp both sides of the PTX10002-60C, lift it, and position it in the rack so that the front brackets on the front mounting rails are aligned with the rack holes.
7. Have another person secure the front of the PTX10002-60C to the rack by using eight mounting screws (and cage nuts and washers if your rack requires them). Tighten the screws.
8. Continue to support the PTX10002-60C while sliding the rear mounting blades into the channel of the side-mounting rails and securing the blades to the rack (see Figure 28 on page 82). Use eight

mounting screws (and cage nuts and washers if your rack requires them) to attach the blade to the rack. Tighten the screws.

Figure 28: Attaching Rear Mounting Blades to the Rack (PTX10002-60C)



9. Ensure that the PTX10002-60C chassis is level by verifying that all the screws on the front of the rack are aligned with the screws at the back of the rack.
10. Attach a grounding cable to earth ground and then attach it to the chassis grounding points.

Replacement Rack Mounting Kit for the PTX10002-60C

If you need to order a replacement rack mounting kit for the PTX10002-60C, use part number EX4500-4PST-RMK. The replacement rack mounting kit contains:

Rear-mounting blades	2
Front-mounting rails	2

(Continued)

Flat-head M4x6-mm Phillips mounting screws to secure the mounting rails to the chassis	24

RELATED DOCUMENTATION

Rack-Mounting and Cabinet-Mounting Warnings | 147

Connect the PTX10002-60C to Power

IN THIS SECTION

Connecting the PTX10002-60C to Ground

You must install the PTX10002 in a restricted-access location and ensure that the chassis is always properly grounded. The PTX10002 has a two-hole protective grounding terminal provided on the chassis. See Figure 29 on page 85. We recommend that you use this protective grounding terminal as the preferred method 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 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

NOTE: An AC-powered PTX10002-60C gains additional grounding when you plug the power supply in the device into a grounded AC power outlet by using an AC power cord appropriate for your geographical location. See "PTX10002-60C AC Power Cord Specifications" on page 36.

CAUTION: Before you connect power to the PTX10002-60C, 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 PTX10002-60C (for example, by causing a short circuit).

NOTE: Mount the PTX10002-60C in the rack before attaching the grounding lug to the PTX10002-60C. See "Mounting the PTX10002-60C in a Rack" on page 79.

Ensure that you have the following parts and tools available:

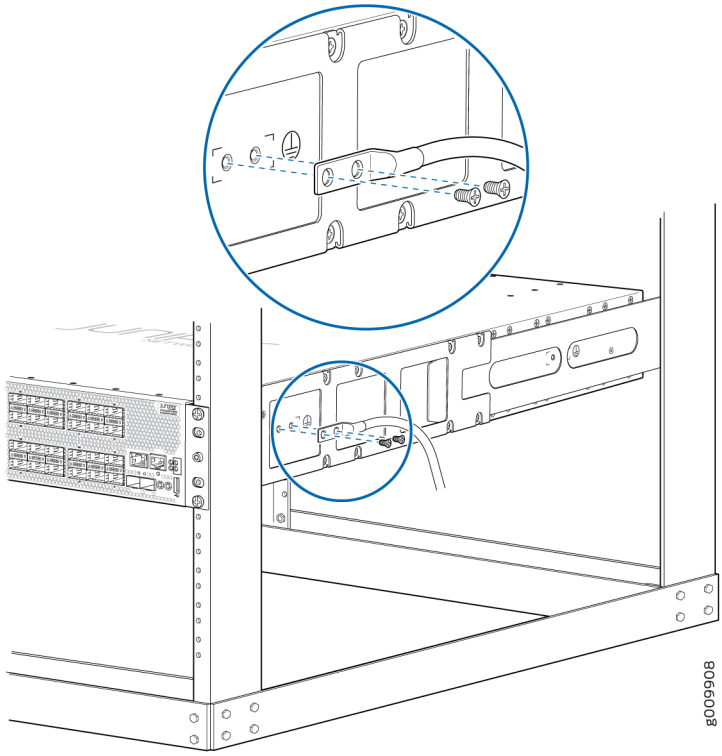
- Grounding cable—The grounding cable must be 8 AWG (8.4 mm^2), minimum 90° C wire, or as permitted by the local code (not provided).
- Grounding lug for your grounding cable—The grounding lug required is a Panduit LCD6-14BH-L or equivalent (provided).
- Two #10-32 UNF screws and washers (not provided).
- Screwdriver appropriate for the #10-32 UNF screws (not provided).

To connect a grounding cable to the PTX10002-60C:

1. Connect one end of the grounding cable to a proper site earth ground, such as the rack in which the PTX10002-60C is mounted.

2. Place the grounding lug attached to the grounding cable over the protective earthing terminal on the chassis (see Figure 29 on page 85).

Figure 29: Connecting a Grounding Cable to the PTX10002-60C



3. Secure the grounding lug to the protective earthing terminal with the washers and screws.
4. Dress the grounding cable and ensure that it does not touch or block access to other device components and that it does not drape where people could trip over it.

Connecting AC Power to the PTX10002-60C

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

Before you begin connecting AC power to the PTX10002-60C:

- Read "General Electrical Safety Guidelines and Warnings" on page 162 and "Action to Take After an Electrical Accident" on page 163.
- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).

- Ensure that you have connected the PTX10002-60C chassis to earth ground.
- Ensure that you have electrostatic discharge (ESD) grounding strap.
- Install the power supply in the chassis following the instructions in "Installing a Power Supply in a PTX10002-60C" on page 107.

> ⚠ **CAUTION**: Before you connect power to the router, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router (for example, by causing a short circuit).
>
> To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the router chassis to connect to the earth ground. For instructions, see "Connecting the PTX10002-60C to Ground" on page 83. The router gains additional grounding when you plug the power supply in the router into a grounded AC power outlet by using the AC power cord appropriate for your geographical location. See "PTX10002-60C AC Power Cord Specifications" on page 36.

The power supply in a PTX10002-60C is a hot-removable and hot-insertable field-replaceable unit (FRU). After removing the power cord from an individual power supply, you can remove and replace it without powering off the router or disrupting router functions.

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

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

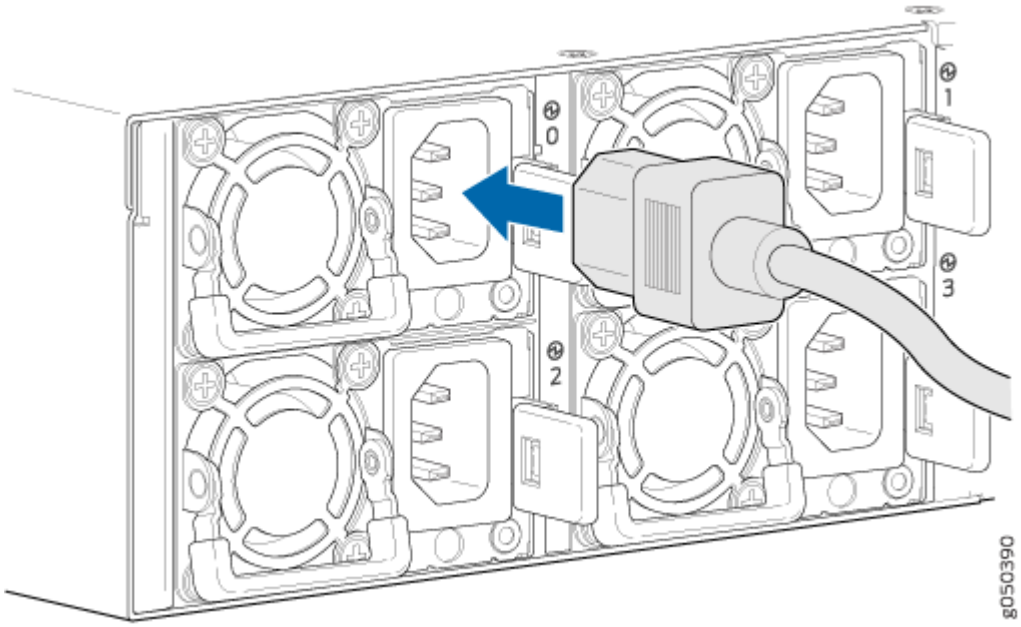
To connect AC power to a PTX10002-60C:

1. To prevent damage to the equipment caused by static discharge, attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure.
3. Locate the power cords shipped with the PTX10002-60C; the cords have plugs appropriate for your geographical location. Refer to "PTX10002-60C AC Power Cord Specifications" on page 36

> ⚠ **WARNING**: Ensure that the power cord does not block access to router components or drape where people could trip over it.

4. Connect each power supply to the power sources. Insert the coupler end of the power cord into the AC power cord inlet on the AC power supply faceplate (see Figure 30 on page 87).

Figure 30: Connecting an AC Power Cord to an AC Power Supply in the PTX10002-60C



5. If the AC power source outlet has a power switch, set it to the off (**O**) position.

> **NOTE**: The PTX10002-60C powers on as soon as power is provided to the power supply. There is no power router on the router.

6. Insert the power cord plug into an AC power source outlet.
7. If the AC power source outlet has a power switch, set it to the on (|) position.
8. Repeat Step 4 through Step 6 for each power supply that you are connecting to power.
9. Verify that the status LEDs on each power supply are lit green.

   If the status LED is lit amber, remove power from the power supply, and replace the power supply (see "Removing a Power Supply from the PTX10002-60C" on page 105). Do not remove the power supply until you have a replacement power supply ready. The power supplies or a blank cover panel must be installed in the router to ensure proper airflow.

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

SEE ALSO

PTX10002-60C AC Power Supply Description | 28

Figure 20 | 32

Connecting DC Power to the PTX10002-60C

Before you begin connecting DC power to the PTX10002-60C:

- Read "General Electrical Safety Guidelines and Warnings" on page 162, PTX10002 Electrical Safety Guidelines and Warnings, and the following DC power warnings:
  - "DC Power Copper Conductors Warning" on page 168
  - "DC Power Disconnection Warning" on page 169
  - "DC Power Grounding Requirements and Warning" on page 170
  - "DC Power Wiring Sequence Warning" on page 171
  - "DC Power Wiring Terminations Warning" on page 172
- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).
- Ensure that you have connected the PTX10002-60C chassis to earth ground.

CAUTION: Before you connect power to the PTX10002-60C, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router (for example, by causing a short circuit).

NOTE: To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground before you connect it to power. For installations that require a separate grounding conductor to the chassis, use the protective earthing terminal on the PTX10002-60C chassis to connect to the earth ground (see "Connecting the PTX10002-60C to Ground" on page 83).

- Install the power supply in the chassis following the instructions in "Installing a Power Supply in a PTX10002-60C" on page 107. The battery returns of the DC power supply must be connected as an isolated DC return (DC-I).
- Ensure that you have the following parts and tools available:
  - ESD grounding strap
  - Slotted (–) screwdriver, 1/4-in., with a torque range between 6 lb-in (0.68 Nm) and 7 lb-in (0.79 Nm)

    CAUTION: You must use an appropriate torque-controlled tool to tighten the screws on the DC power cable connector. Do not overtighten the screws. Applying excessive torque damages the terminal block and the wiring tray. The absolute maximum torque that may be applied to this screw is 10 lb-in (1.13 Nm).
  - Power cable or cables appropriate for your geographical location available to connect DC power to the PTX10002-60C. There are two types of DC power cables—a straight DC power cable (CBL-JNP-PWR-DSUB) and a right-angle DC power cable (CBL-JNP-PWR-DSUB2 or CBL-JNP-PWR-DSUB3). See "PTX10002-60C DC Power Cable Specifications" on page 38 for more information.

The power supply in a PTX10002 is a hot-removable and hot-insertable field-replaceable unit (FRU). You can remove and replace it without powering off the router or disrupting router functions. You do, however, need to remove power from the power supply before attempting to remove the unit.

WARNING: A DC-powered PTX10002-60C is intended for installation only in a restricted-access location.

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

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

To connect DC power to a PTX10002-60C:

1. To prevent damage to the equipment caused by static discharge, attach an ESD grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
2. Ensure that the power supplies are fully inserted in the chassis and the latches are secure.

3. If you are using the straight DC power cable (CBL-JNP-PWR-DSUB), connect the green grounding wire in each power cable to ground. Right angled DC cables, do not have a grounding wire.

4. Connect each power supply to the power source, by inserting the DC connector into the power supply. See Figure 31 on page 91, Figure 32 on page 91, or Figure 33 on page 92.

Figure 31: Connecting a Straight DC Power Cable to a DC Power Supply in a PTX10002-60C (CBL-JNP-PWR-DSUB)

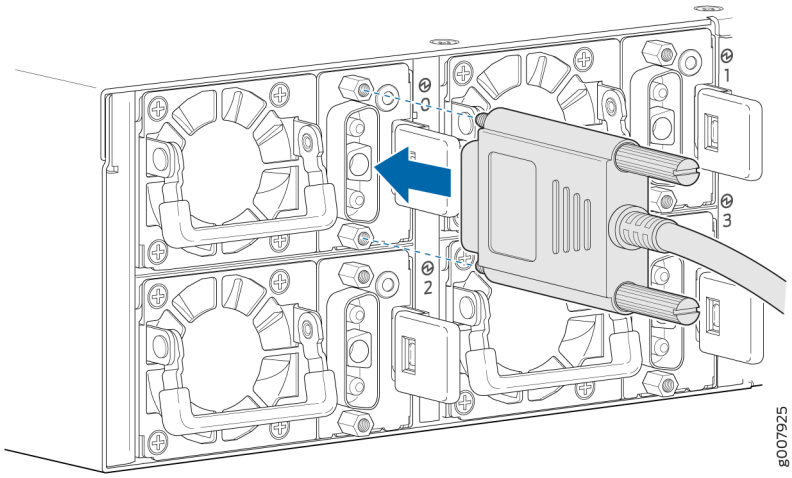


Figure 32: Connecting a Right-Angle DC Power Cable to a DC Power Supply in a PTX10002-60C (CBL-JNP-PWR-DSUB2)

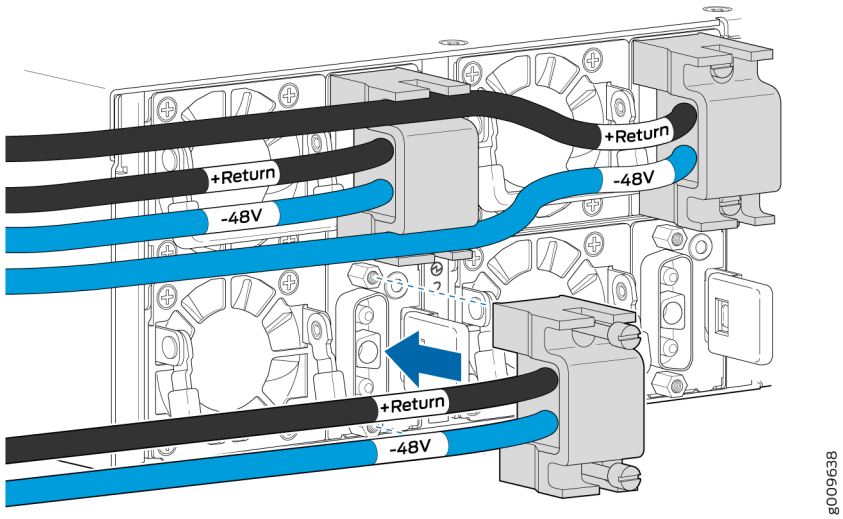
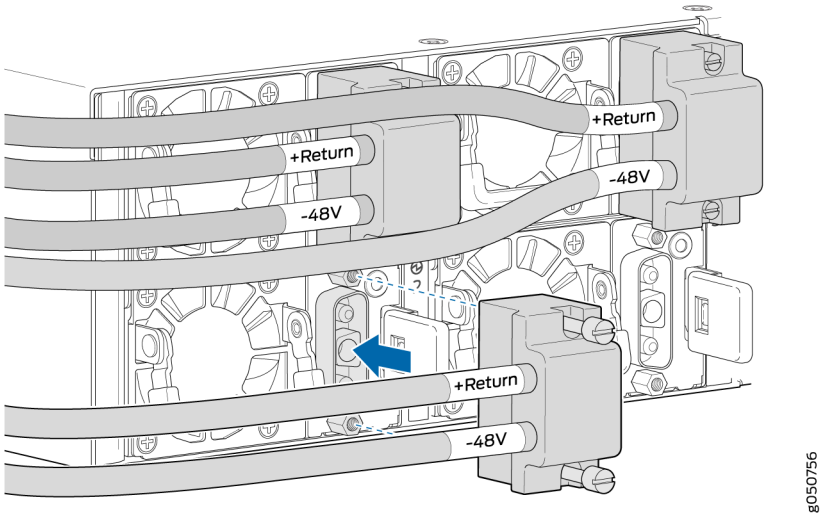


Figure 33: Connecting a Right-Angle DC Power Cable to a DC Power Supply in a PTX10002-60C (CBL-JNP-PWR-DSUB3)



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

5. Using the slotted screwdriver, tighten the screws on the power cable connector to between 6 lb-in (0.68 Nm) and 7 lb-in (0.79 Nm).

CAUTION: You must use an appropriate torque-controlled tool to tighten the screws on the DC power cable connector. Do not overtighten the screws. Applying excessive torque damages the terminal block and the wiring tray. The absolute maximum torque that may be applied to this screw is 10 lb-in (1.13 Nm).

6. Repeat Step 4 and Step 5 for each power supply that you are connecting to power.
7. Close the input circuit breaker.

NOTE: We recommend that the 48-VDC facility DC source be equipped with a circuit breaker rated at 40 A (–48 VDC) minimum, or as required by local code.

NOTE: The PTX10002-60C powers on as soon as power is provided to the power supply. There is no power switch on the router.

8. Verify that the status LEDs on each power supply are lit green and on steadily.

   If the status LED is lit amber, remove power from the power supply, and replace the power supply (see "Removing a Power Supply from the PTX10002-60C" on page 105). Do not remove the power supply until you have a replacement power supply ready. The power supplies must be installed in the PTX10002-60C to ensure proper airflow.

CAUTION: Replace a failed power supply with a new power supply within 30 seconds of removal to prevent chassis overheating.

SEE ALSO

PTX10002-60C DC Power Supply Description | 30

PTX10002-60C Power Supply LED | 32

Connecting the PTX10002-60C to External Devices

IN THIS SECTION

Connecting the PTX10002-60C to a Management Ethernet Device

Ensure that you have an appropriate cable available. See "PTX10002-60C Management Cable Specifications and Pinouts" on page 63.

You can monitor and manage the PTX10002-60C by using a dedicated management channel. The PTX10002-60C has two management ports—a 10/100/1000BASE-T RJ-45 port for copper connections

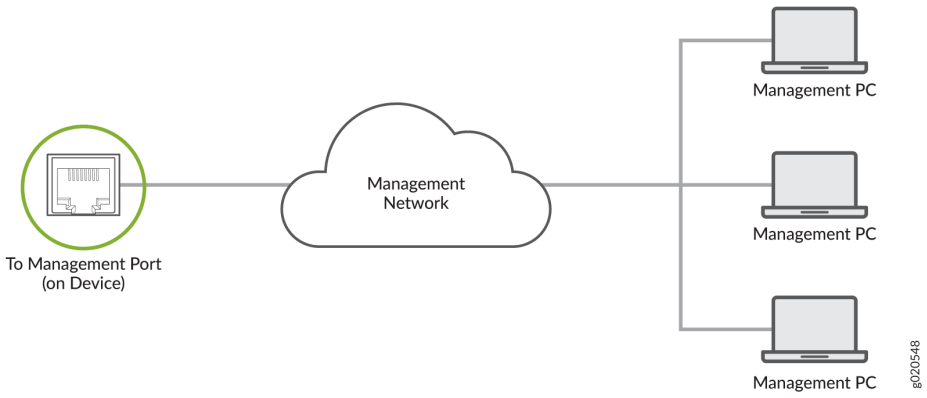
and a Gigabit Ethernet SFP port for fiber-optic connections. Use the management ports to connect the PTX10002-60C to a network for out-of-band management.

NOTE: You cannot use the management ports to perform the initial configuration of the PTX10002-60C. You must configure the management ports through the console connection before you can successfully connect to the PTX10002-60C by using these ports. See "Performing the Initial Software Configuration for the PTX10002-60C" on page 96.

To connect a PTX10002-60C to a network for out-of-band management (see Figure 34 on page 94):

1. Connect one end of the cable to one of the two management ports—labeled **MGMT**—on the PTX10002-60C.
2. Connect the other end of the cable to the management network device.

Figure 34: Connecting a PTX10002-60C to a Network for Out-of-Band Management



SEE ALSO

PTX10002-60C Management Panel | 16

PTX10002-60C Management Cable Specifications and Pinouts | 63

Connecting the PTX10002-60C to a Management Console

Ensure that you have an RJ-45 to DB-9 rollover cable available. An RJ-45 cable with an RJ-45 to DB-9 adapter is provided with the PTX10002-60C.

NOTE: If your laptop or PC does not have a DB-9 plug connector pin and you want to connect your laptop or PC directly to the PTX10002-60C, use a combination of the RJ-45 cable and RJ-45 to DB-9 adapter (provided) and a USB to DB-9 plug adapter (not provided).

The PTX10002-60C has a console port with an RJ-45 connector. Use the console port to connect the router directly to a management console, such as a laptop, or to a console server.

To connect the PTX10002-60C to a management console (see Figure 35 on page 95 or Figure 36 on page 95):

1. Connect one end of the Ethernet cable to the console port (labeled **CON**).
2. Connect the other end of the Ethernet cable directly to a management console or console server.

Figure 35: Connecting the PTX10002-60C Directly to a Management Console

Figure 36: Connecting the PTX10002-60C to a Management Console Through a Console Server

SEE ALSO

PTX10002-60C Management Panel | 16

PTX10002-60C Management Cable Specifications and Pinouts | 63

Register Products—Mandatory to Validate SLAs

Register all new Juniper Networks hardware products and changes to an existing installed product using the Juniper Networks website to activate your hardware replacement service-level agreements (SLAs).

CAUTION: Register product serial numbers on the Juniper Networks website. Update the installation base data if any addition or change to the installation base occurs or if the installation base is moved. Juniper Networks is not responsible for not meeting the hardware replacement service-level agreement for products that do not have registered serial numbers or accurate installation base data.

Register your product(s) at https://tools.juniper.net/svcreg/SRegSerialNum.jsp.
Update your installation base at https://www.juniper.net/customers/csc/management/updateinstallbase.jsp.

Performing the Initial Software Configuration for the PTX10002-60C

Before you begin connecting and configuring a PTX10002-60C, set the following parameter values on the management console or console server:

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

You can provision the PTX10002-60C modular switch through the console port using the command-line interface (CLI) or through Zero Touch Provisioning (ZTP). To provision the PTX10002-60C using ZTP, you'll need access to a Dynamic Host Control Protocol (DHCP) server and a File Transfer Protocol (anonymous FTP), Hypertext Transfer Protocol (HTTP), or Trivial File Transfer Protocol (TFTP) server on which the software image and configuration files are stored.

To connect and configure the PTX10002-60C using the command-line interface (CLI):

1. Connect the console port to a laptop or PC by using the supplied RJ-45 cable and RJ-45 to DB-9 adapter. The console port (labeled **CON**) is located on the management panel of the PTX10002-60C (see "Connecting the PTX10002-60C to a Management Console" on page 94 for more information).
2. Log in as **root**. There is no password. If the software boots before you connected to the console port, you might need to press the Enter key for the prompt to appear.

```
login: root
```

3. Start the CLI.

```
root@% cli
```

4. Enter configuration mode.

```
root> configure
```

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

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

6. (Optional) Configure the name of the PTX10002-60C. If the name includes spaces, enclose the name in quotation marks (“ ”).

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

7. Configure the default gateway.

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

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

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

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

> **NOTE**: The RJ-45 management port `em0` and SFP management port `em1` are both labeled **MGMT**.

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

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

10. Enable the Telnet service.

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

> **NOTE**: When Telnet is enabled, you cannot log in to a PTX10002-60C through Telnet by using root credentials. Root login is allowed only for SSH access.

11. Commit the configuration to activate it on the PTX10002-60C.

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

Powering Off the PTX10002-60C

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 164.
- Ensure that you do not need to route traffic through the PTX10002-60C.
- Ensure that you have the following parts and tools available to power off the PTX10002-60C:
  - An ESD grounding strap
  - An external management device such as a PC
  - An RJ-45 to DB-9 rollover cable to connect the external management device to the console port

Use the following procedure to power off a PTX10002-60C.

To power off a PTX10002-60C:

1. Connect to the router by using one of the following methods:
   - Connect a management device to the console (**CON**) port on a PTX10002-60C by following the instructions in "Connecting the PTX10002-60C to a Management Console" on page 94.
   - Connect a management device to one of the two management (**MGMT**) ports by following the instructions in "Connecting the PTX10002-60C to a Management Ethernet Device" on page 93.
2. Shut down Junos OS from the external management device by issuing the `request vmhost halt` operational mode CLI command. This command shuts down Junos OS gracefully and preserves system state information. A message appears on the console, confirming that the operating system has halted.

   ```
   user@host> request vmhost halt
   Halt the system ? [yes,no] (no) yes
   ```

   You see the following output (or something similar) after entering the command:

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

```
System going down IMMEDIATELY


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

> **CAUTION**: The final output of any version of the `request system halt` command is the "The operating system has halted." Although traffic and the operating system have stopped, the PTX10002-60C PSM LEDs remain lit and a fan module continues to run. Wait at least 60 seconds after first seeing this message before following the instructions in Step 4 and Step 5 to power off the PTX10002-60C.

3.

4. Disconnect power to the PTX10002-60C:
   - AC power supply—If the AC power source outlet has a power switch, set it to the off (**O**) position. If the AC power source outlet does not have a power switch, gently pull out the plug end of the power cord connected to the power source outlet.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the off position.
5. Remove the power source cable from the power supply faceplate:
   - AC power supply—Gently pull out the socket end of the power plug connected to the power supply faceplate.
   - DC power supply—Loosen the thumb screws for the power cable. Gently pull out the socket end of the power plug connected to the power supply faceplate.
6. Uncable the switch before removing it from the rack.

RELATED DOCUMENTATION

Connecting AC Power to the PTX10002-60C | **85**

Connecting DC Power to the PTX10002-60C | **88**

CHAPTER 4

Maintaining Components

Maintaining the PTX10002-60C Fan Modules

IN THIS SECTION

Removing a Fan Module from the PTX10002-60C

Before you remove a fan module from a PTX10002-60C, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).

Ensure that you have the following parts and tools available:

- ESD grounding strap
- Antistatic bag or an antistatic mat
- Phillips (+) screwdriver, number 1

The fan modules in a PTX10002-60C are hot-removable and hot-insertable field-replaceable units (FRUs)—you can remove and replace them without powering off the PTX10002-60C or disrupting routing functions.

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

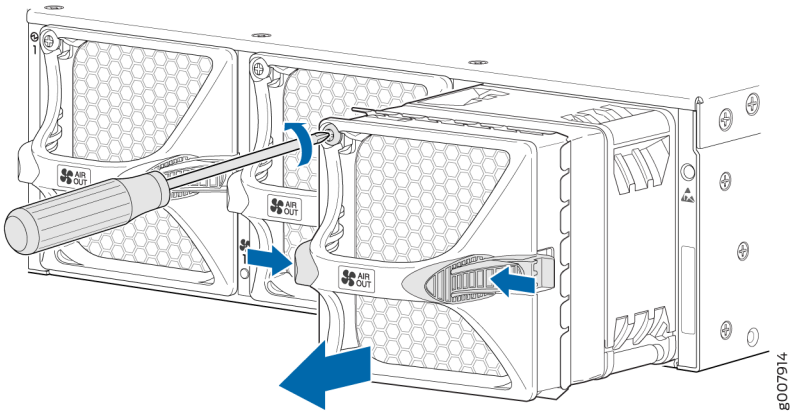
To remove a fan module from a PTX10002-60C (see Figure 37 on page 103):

1. Place the antistatic bag or the antistatic mat on a flat, stable surface.
2. To prevent damage to the equipment caused by static discharge, 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. Using the Phillips screwdriver, loosen the locking screw (3 or 4 turns).
4. Grasp the handle on the fan module and squeeze the outside of the handle to release the module.

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

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

Figure 37: Removing a Fan Module from a PTX10002-60C



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

Installing a Fan Module in the PTX10002-60C

Before you install a fan module in a PTX10002-60C, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).

Ensure that you have the following parts and tools available:

- ESD grounding strap
- #1 Phillips (+) screwdriver, number 1

The fan modules in a PTX10002-60C are hot-removable and hot-insertable field-replaceable units (FRUs)—you can remove and replace them without powering off the PTX10002-60C or disrupting routing functions.

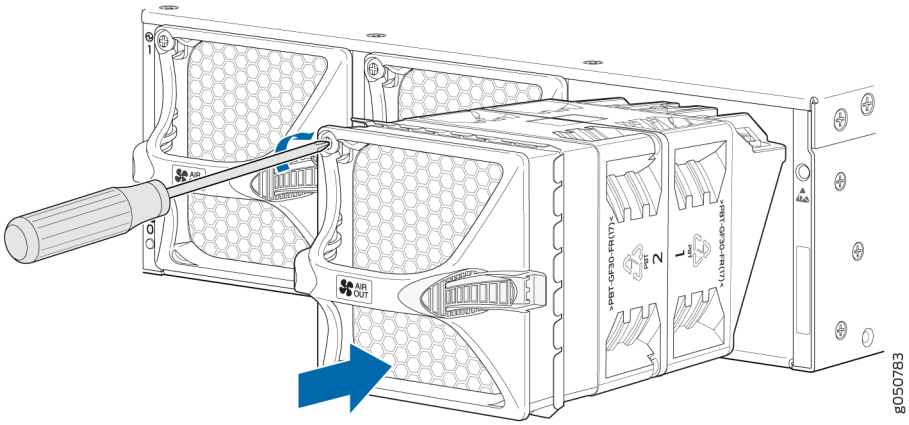
CAUTION: Replace a failed fan module with a new fan module within 1 minute of removal to prevent chassis overheating. Before removing the fan module, ensure you have a replacement fan module at hand.

NOTE: The fan module provides airflow out, which is also known as *port-to-FRU* airflow.

To install a fan module in a PTX10002-60C (see Figure 38 on page 104):

1. To prevent damage to the equipment caused by static discharge, 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. Taking care not to touch the connectors, remove the fan module from its bag.
3. Align the module with the open slot on the FRU end of the PTX10002-60C and slide it in until it is fully seated.
4. Using the Phillips screwdriver, tighten the locking screw (3 or 4 turns).

Figure 38: Installing a Fan Module in a PTX10002-60C



Maintaining the PTX10002-60C Power Supplies

IN THIS SECTION

Removing a Power Supply from the PTX10002-60C

Before you remove a power supply from a PTX10002-60C, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).

Ensure that you have the following parts and tools available:

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

If you are removing a redundant power supply and do not plan to replace it with another immediately, have a power supply cover for the opening.

The power supplies in a PTX10002-60C are hot-removable and hot-insertable field-replaceable units (FRUs)—you can remove and replace them without powering off the PTX10002-60C or disrupting routing functions.

CAUTION: Replace the power supply within 1 minute of removal to prevent chassis overheating. Before removing the power supply, ensure you have a replacement power supply available.

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

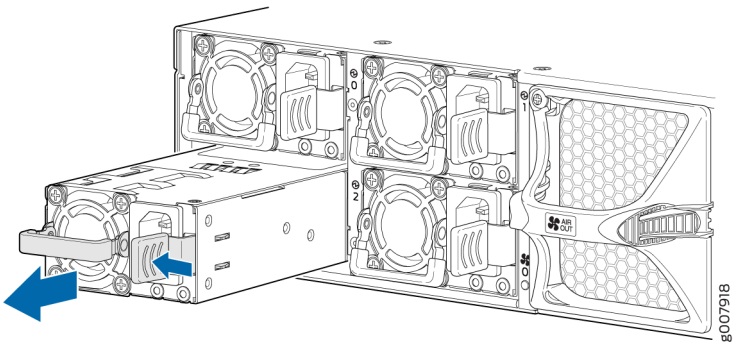
To remove a power supply from a PTX10002-60C (see Figure 39 on page 106):

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

2. To prevent damage to the equipment caused by static discharge, 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. Disconnect power to the PTX10002-60C:
   - AC power supply—If the AC power source outlet has a power switch, set it to the off (**O**) position. If the AC power source outlet does not have a power switch, gently pull out the plug end of the power cord connected to the power source outlet.
   - DC power supply—Switch the circuit breaker on the panel board that services the DC circuit to the off position.

   NOTE: If you need to remove all the power supplies installed in your PTX10002-60C, you must power off the PTX10002-60C before removing the power supplies. See "Powering Off the PTX10002-60C" on page 99.
4. Remove the power source cable from the power supply faceplate:
   - AC power supply—Remove the power cord from the power supply faceplate by detaching the power cord retainer and gently pulling out the socket end of the power plug connected to the power supply faceplate.
   - DC power supply—Loosen the thumb screws for the power cable. Gently pull out the socket end of the power plug connected to the power supply faceplate.
5. Slide the locking lever toward the handle until it stops.
6. Grasp the power supply handle and pull firmly to slide the power supply halfway out of the chassis. See Figure 39 on page 106.
7. Place one hand under the power supply to support it and slide it completely out of the chassis. Take care not to touch power supply components, pins, leads, or solder connections.

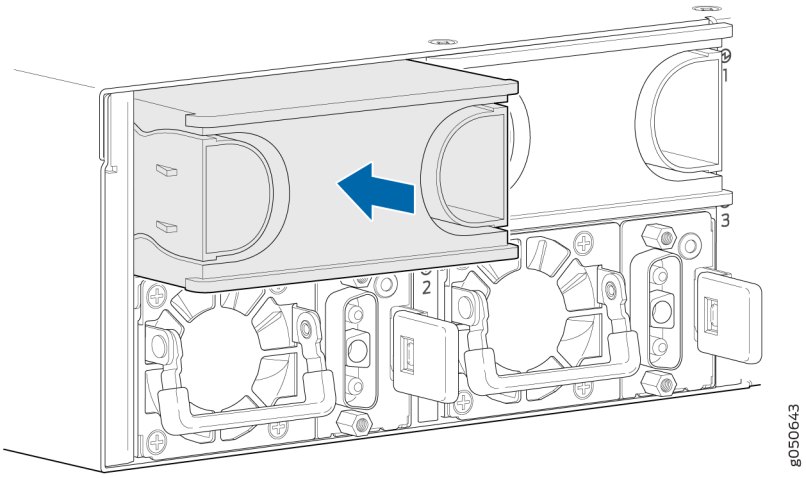
Figure 39: Removing a Power Supply from a PTX10002-60C



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

9. Either replace with another power supply or insert a PSU blank cover (PTX10002-PWR-BLNK). Refer to Figure 40 on page 107

Figure 40: Inserting a Power Supply Blank Cover



Installing a Power Supply in a PTX10002-60C

- Before you install a power supply in a PTX10002-60C, ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage (see "Prevention of Electrostatic Discharge Damage" on page 164).
- Ensure that the airflow direction of the power supply is the same as the chassis. Labels on the power supply handle indicate the direction of airflow. See "PTX10002-60C Cooling System Description and Airflow" on page 23.
- Ensure that you have an ESD grounding strap.
- If the power supply has protective plastic wrap, peel and remove the plastic wrap from all four sides of the power supply.

The power supplies in a PTX10002-60C are hot-removable and hot-insertable field-replaceable units (FRUs)—you can remove and replace them without powering off the PTX10002-60C or disrupting routing functions.

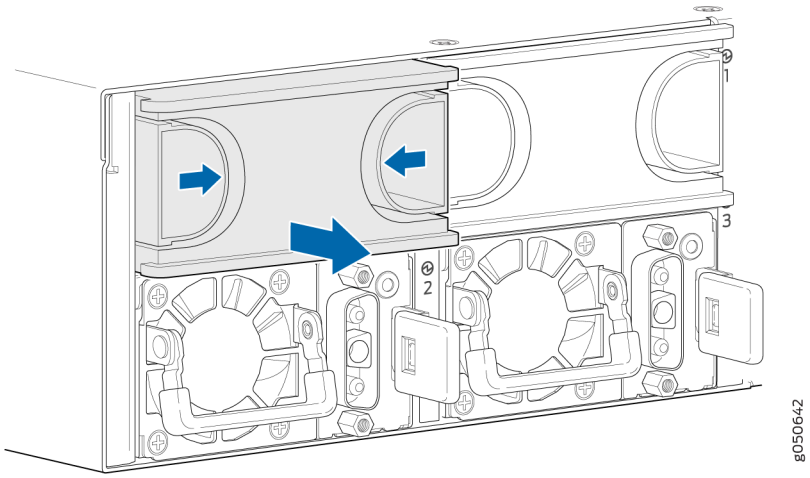
CAUTION: Replace the power supply within one minute of removal to prevent chassis overheating. Before removing the power supply, ensure you have a replacement power supply available.

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

To install a power supply in a PTX10002-60C (see Figure 42 on page 109):

1. To prevent damage to the equipment caused by static discharge, 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 power supply is being installed in an empty slot, remove the blank cover by squeezing the finger holds and pulling the cover straight out.

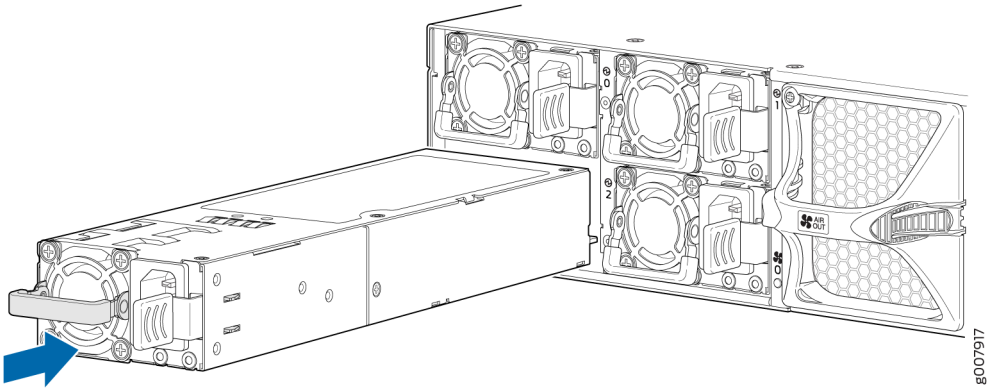
Figure 41: Removing a Power Supply Blank Cover



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

4. Using both hands, place the power supply in the power supply slot on the FRU panel of the PTX10002-60C and slide it in until it is fully seated and the locking lever slides into place.

Figure 42: Installing a Power Supply in a PTX10002-60C



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

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

Maintaining Transceivers and Fiber-Optic Cables on PTX10002-60C

IN THIS SECTION

Removing a Transceiver

Before you begin removing 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" on page 152).

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

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 device functions.

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

Figure 43 on page 112 shows how to remove a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers.

To remove a transceiver from a device:

1. Place the antistatic bag or antistatic mat on a flat, stable surface.
2. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the switch.
3. Label the cable connected to the transceiver so that you can reconnect it correctly.

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 transceivers 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.

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

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.
5. To remove an SFP, SFP+, XFP, or a QSFP+ transceiver:
   a. By using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.

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

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

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

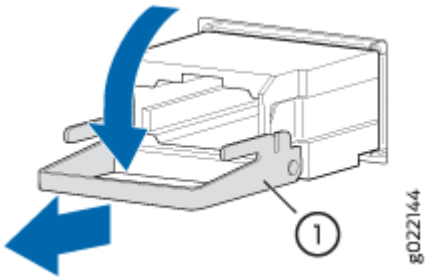
   To remove a CFP transceiver:

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

   b. Grasp the screws on the transceiver and gently slide the transceiver approximately 0.5 in. (1.3 cm) straight out of the port.

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

Figure 43: Removing an SFP, SFP+, XFP, or a QSFP+ Transceiver



1– Ejector lever

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

Installing a Transceiver

Before you begin installing 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" on page 152).

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.

Figure 44 on page 114 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers.

To install a transceiver:

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

1. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the switch.
2. Remove the transceiver from its bag.
3. Check to see whether the transceiver is covered with a rubber safety cap. If it is not, cover the transceiver with a rubber safety cap.

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.

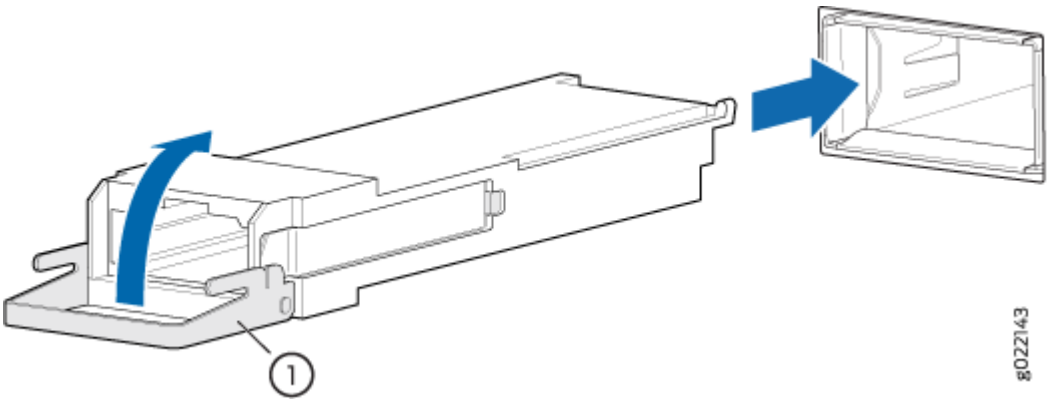
4. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later. If you are hot-swapping a transceiver, wait for at least 10 seconds after removing the transceiver from the port before installing a new transceiver.
5. 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.

6. Slide the transceiver in gently until it is fully seated. If you are installing a CFP transceiver, tighten the captive screws on the transceiver by using your fingers.
7. Remove the rubber safety cap when you are ready to connect the cable to 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 transceivers emit laser light that can damage your eyes.

Figure 44: Installing a Transceiver



1– Ejector lever	

Disconnecting a Fiber-Optic Cable from a Device

Before you begin disconnecting a fiber-optic cable from an optical transceiver, ensure that you have taken the necessary precautions for safe handling of lasers. See "Laser and LED Safety Guidelines and Warnings" on page 152.

Ensure that you have the following parts and tools available:

- A rubber safety cap to cover the transceiver
- A rubber safety cap to cover the fiber-optic cable connector

Juniper Networks devices have field-replaceable unit (FRU) optical transceivers to which you can connect fiber-optic cables.

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

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

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

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 transceivers emit laser light that can damage your eyes.

2. Carefully unplug the fiber-optic cable connector from the transceiver.
3. Cover the transceiver with a rubber safety cap.

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

Connecting a Fiber-Optic Cable

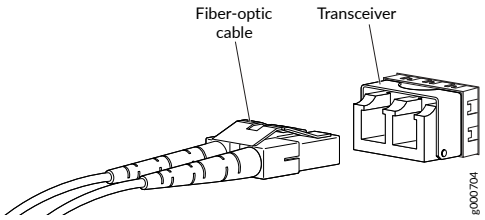
Before you begin connecting a fiber-optic cable to an optical transceiver installed in a device, ensure that you have taken the necessary precautions for safe handling of lasers (see "Laser and LED Safety Guidelines and Warnings" on page 152).

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

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 transceivers emit laser light that can damage your eyes.

1. If the fiber-optic cable connector is covered with a rubber safety cap, remove the cap. Save the cap.
2. Remove the rubber safety cap from the optical transceiver. Save the cap.
3. Insert the cable connector into the optical transceiver (see Figure 45 on page 116).

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



4. Secure the cables so that they do not support their own weight. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on a loop helps cables maintain their shape.

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

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

Maintaining Fiber-Optic Cables

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

To maintain fiber-optic cables:

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

Uninstalling the PTX10002-60C

Before removing a PTX10002-60C from a rack:

Ensure that you have the following parts and tools available:

- Either a mechanical lift or two persons to support the weight of the PTX10002-60C. An additional person is needed to remove the screws securing the router to the rack.
- Screwdriver appropriate for your rack-mounting screws.

If you need to relocate an installed PTX10002-60C, perform the following procedure.

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

- Ensure that the rack is stable and secured to the building.
- Ensure that there is enough space to place the removed PTX10002-60C in its new location and along the path to the new location.
- Read "General Safety Guidelines and Warnings" on page 139 and PTX10002-60C Installation Safety Guidelines.
- Power off the device (see "Powering Off the PTX10002-60C" on page 99).
- Disconnect the power cords.
- Ensure that you have disconnected any cables or wires attached to the PTX10002-60C (see Disconnecting a Fiber-Optic Cable from a Device).

To remove a PTX10002-60C from a rack:

1. Perform one of the following steps:
   - Position a mechanical lift under the PTX10002-60C. Use the screwdriver to remove the front-mounting screws that attach the router to the rack.
   - Have two persons support the weight of the PTX10002-60C while another person uses the screwdriver to remove the front-mounting screws that attach the router to the rack.
2. Remove the PTX10002-60C from the rack.
3. Use the screwdriver to remove the mounting screws that attach the rear-mounting blades to the rear of the rack.
4. Place the removed screws and rear-mounting blades in a labeled bag. You will need them when you reinstall the chassis.
5. Transport the PTX10002-60C to your desired new location.

RELATED DOCUMENTATION

Mounting the PTX10002-60C | 80

CHAPTER 5

Troubleshooting Hardware

Troubleshooting the PTX10002-60C

IN THIS SECTION

PTX10002-60C Troubleshooting Resources Overview

To troubleshoot a PTX10002-60C, you use the Junos OS CLI, alarms, and LEDs on the network ports, management panel, and components.

- LEDs—When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the management panel as appropriate. In addition, you can also use component LEDs and network port LEDs to troubleshoot the PTX10002-60C. For more information, see the following topics:
  - "PTX10002-60C Chassis Status LEDs" on page 19
  - "PTX10002-60C Management Port LEDs " on page 17
  - "PTX10002-60C Network Port LEDs" on page 14
  - Figure 15 on page 27
  - "PTX10002-60C Power Supply LED" on page 32
- CLI—The CLI is the primary tool for controlling and troubleshooting hardware, Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the ping and traceroute utilities. For information about using the CLI to troubleshoot Junos OS, see the appropriate Junos OS configuration guide.
- JTAC—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

SEE ALSO

PTX10002-60C Management Panel | 16

Contact Customer Support | 127

PTX10002-60C Alarm Messages Overview

When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the management panel as appropriate. To view a more detailed description of the alarm cause, issue the `show chassis alarms` CLI command:

```
user@host> show chassis alarms
6 alarms currently active
Alarm time               Class  Description
2018-02-07 12:12:18 PST  Major  FPC Management1 Ethernet Link Down
2018-02-07 12:11:54 PST  Minor  FPC0: LED 3:Alarm LED Read Error
2018-02-07 12:11:54 PST  Minor  FPC0: LED 3:Alarm LED Write Error
2018-02-07 12:11:54 PST  Major  FPC0: PEM 1 Not Supported
2018-02-07 12:11:54 PST  Major  FPC0: PEM 0 Not Supported
2018-02-07 12:11:54 PST  Major  FPC0: PEM 0 Not Powered
```

SEE ALSO

Definitions of Safety Warning Levels | 140

Chassis Alarm Messages on the PTX10002-60C and Recommended Actions

Chassis alarms indicate a failure on the device or one of its components. Chassis alarms are preset and cannot be modified.

Chassis alarms on PTX10002-60C routers have two severity levels:

- Major (red)—Indicates a critical situation on the device that has resulted from one of the conditions described in Table 37 on page 122. A red alarm condition requires immediate action.

- Minor (yellow or amber)—Indicates a noncritical condition on the device that, if left unchecked, might cause an interruption in service or degradation in performance. A yellow alarm condition requires monitoring or maintenance.

Table 37 on page 122 describes the chassis alarm messages on the PTX10002-60C.

Table 37: PTX10002-60C Chassis Alarm Messages

Component	Alarm Type	CLI Message	Recommended Action
Fans	Major (red)	`Fan Failure`	Replace the fan module and report the failure to customer support.
		`Fan I2C Failure`	Check the system log for one of the following messages and report the error message to customer support: • `CM ENV Monitor: Get fan speed failed.` • *`fan-number`* `is NOT spinning @ correct speed`, where *`fan-number`* can be 1, 2, or 3.
		`Fan` *`fan-number`* `Not Spinning`	Remove and check the fan module for obstructions, and then reinsert the fan module. If the problem persists, replace the fan module.
	Minor (yellow)	`Fan/Blower Absent`	Check the system log for the message *`fan-number`* `Absent`, where *`fan-number`* can be 1, 2, or 3. Install the fan module.
Power supplies	Major (red)	`PEM` *`pem-number`* `Airflow not matching Chassis Airflow`	Replace the power supply with a power supply that supports the same airflow direction as the chassis.

Table 37: PTX10002-60C Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
		PEM *pem-number* I2C Failure	Check the system log for one of the following messages and report the error message to customer support: • I2C Read failed for device *number*, where *number* may be from 123 to 125. • PS *number*: Transitioning from online to offline, where power supply (PS) *number* may be 1, 2, 3, or 4.
		PEM *pem-number* is not powered	Check the power cord connection and reconnect, if necessary.
		PEM *pem-number* is not supported	Replace the power supply with a supported power supply.
		PEM *pem-number* Not OK	Indicates a problem with the incoming AC power or outgoing DC power. Report the error to customer support.
	Minor (yellow)	PEM *pem-number* Absent	A power supply is not installed. Install a supported power supply in the appropriate slot.
		PEM *pem-number* Power Supply Type Mismatch	Check if there is a mix of AC and DC power supplies in the same chassis. Reboot the device with only AC or only DC power supplies.
		PEM *pem-number* Removed	Replace the removed power supply.

Table 37: PTX10002-60C Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
Temperature sensors	Major (red)	*sensor-location* Temp Sensor Fail	Check the system log for the following message and report it to customer support: Temp sensor *sensor-number* failed, where *sensor-number* ranges from 1 through 10.
		sensor-location Temp Sensor Too Hot	Check environmental conditions and alarms on other devices. Ensure that environmental factors (such as hot air blowing around the equipment) do not affect the temperature sensor. If the condition persists, the device might shut down.
	Minor (yellow)	*sensor-location* Temp Sensor Too Warm	For information only. Check environmental conditions and alarms on other devices. Ensure that environmental factors (such as hot air blowing around the equipment) do not affect the temperature sensor.
Routing Engine	Minor (yellow)	RE *RE number* /var partition usage is high	Clean up the system file storage space on the switch. For more information, see *Cleaning Up the System File Storage Space*.
	Major (red)	RE *RE number* /var partition is full	Clean up the system file storage space on the switch. For more information, see *Cleaning Up the System File Storage Space*.

Table 37: PTX10002-60C Chassis Alarm Messages *(Continued)*

Component	Alarm Type	CLI Message	Recommended Action
	Minor (yellow)	`Rescue configuration is not set`	Use the **`request system configuration rescue save`** command to set the rescue configuration. For more information, see *Setting or Deleting the Rescue Configuration*.
		`Feature` `usage requires a license` or `License for` *`feature`* `expired`	Install the required license for the feature specified in the alarm. For more information, see *Software Features That Require Licenses on the PTX Series*.
Management Ethernet interface	Major (red)	`Management Ethernet 1 Link Down`	Check whether a cable is connected to the management Ethernet interface, or whether the cable is defective. Replace the cable, if required. If the problem cannot be resolved, open a support case by using the Case Manager link at https://www.juniper.net/support/ or call 1-888-314-5822 (toll free, US and Canada)or 1-408-745-9500 (from outside the United States).

SEE ALSO

> *Configuring Junos OS to Determine Conditions That Trigger Alarms on Different Interface Types*
>
> *alarm*

CHAPTER 6

Contacting Customer Support and Returning the Chassis or Components

Contact Customer Support

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

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

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

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

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

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

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

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

Returning the PTX10002-60C Chassis or Components

IN THIS SECTION

Locating the Serial Number on a PTX10002-60C Chassis or Component

IN THIS SECTION

If you are returning a PTX10002-60C or a PTX10002-60C field-replaceable unit (FRU) to Juniper Networks for repair or replacement, you must locate the serial number of the router or FRU. 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" on page 127.

If the PTX10002-60C is operational and you can access the command-line interface (CLI), you can list serial numbers for the router and some components with a CLI command. If you do not have access to the CLI or if the serial number for the FRU does not appear in the command output, you can locate the serial number ID label on the router or FRU.

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

NOTE: You must remove the fan module to read the serial number from the serial number ID label. The fan module serial number cannot be viewed through the CLI.

Listing the Chassis and PTX10002-60C Component Details by Using the CLI

To list the PTX10002-60C and components and their serial numbers, use the `show chassis hardware` CLI operational mode command.

```
user@host> show chassis hardware

Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                DB665             PTX1000
Pseudo CB 0
Routing Engine 0          BUILTIN      BUILTIN           RE-PTX1000
FPC 0            REV 06   750-065110   ACMX7555          PTX1000-FPC-P2-BUILTIN
  CPU                     BUILTIN      BUILTIN           FPC CPU
  PIC 0                   BUILTIN      BUILTIN           288X10GE/72X40GE/24X100GE
    Xcvr 1       REV 01   740-032986   QB300994          QSFP+-40G-SR4
    Xcvr 2       REV 01   740-032986   QB491187          QSFP+-40G-SR4
    Xcvr 3       REV 01   740-046565   QE440568          QSFP+-40G-SR4
    Xcvr 4       REV 01   740-046565   QF2805JS          QSFP+-40G-SR4
    Xcvr 5       REV 01   740-046565   QE413802          QSFP+-40G-SR4
    Xcvr 6       REV 01   740-032986   QA470512          QSFP+-40G-SR4
    Xcvr 71      REV 01   740-061405   1ACQ104400S       100GBASE-SR4
  Mezz           REV 04   711-064764   ACMX2345          PTX1000 Mezz
Power Supply 0   REV 03   740-054405   1EDN5190265       AC AFO 1600W PSU
Power Supply 1   REV 03   740-054405   1EDN5190075       AC AFO 1600W PSU
Power Supply 2   REV 03   740-054405   1EDN5200472       AC AFO 1600W PSU
Power Supply 3   REV 03   740-054405   1EDN5200539       AC AFO 1600W PSU
Fan Tray 0                                              PTX1000 Fan Tray 0, Front to Back
Airflow - AFO
Fan Tray 1                                              PTX1000 Fan Tray 1, Front to Back
Airflow - AFO
Fan Tray 2                                              PTX1000 Fan Tray 2, Front to Back
```

```
Airflow - AFO
```

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

Locating the Chassis Serial Number ID Label on a PTX10002-60C

The serial number ID label is located on a label on the top cover.

Locating the Serial Number ID Labels on FRU Components

For each FRU, you must remove the FRU from the chassis to see the FRU's serial number ID label.

- AC power supply—The serial number ID label is on the top of the AC power supply.
- DC power supply—The serial number ID label is on the top of the DC power supply.
- Fan module—The serial number ID label is on the top of the fan module.

Removing the Solid State Drives for RMA

The PTX10002 has two solid-state drives (SSDs) that store the software images, system logs, and the configuration files. Before returning a chassis to Juniper Networks as part of a Return Merchandise Authorization (RMA), you have the option of removing the SSDs and disposing them according to your own company's security procedures. Before you begin this procedure, ensure you have the following tools:

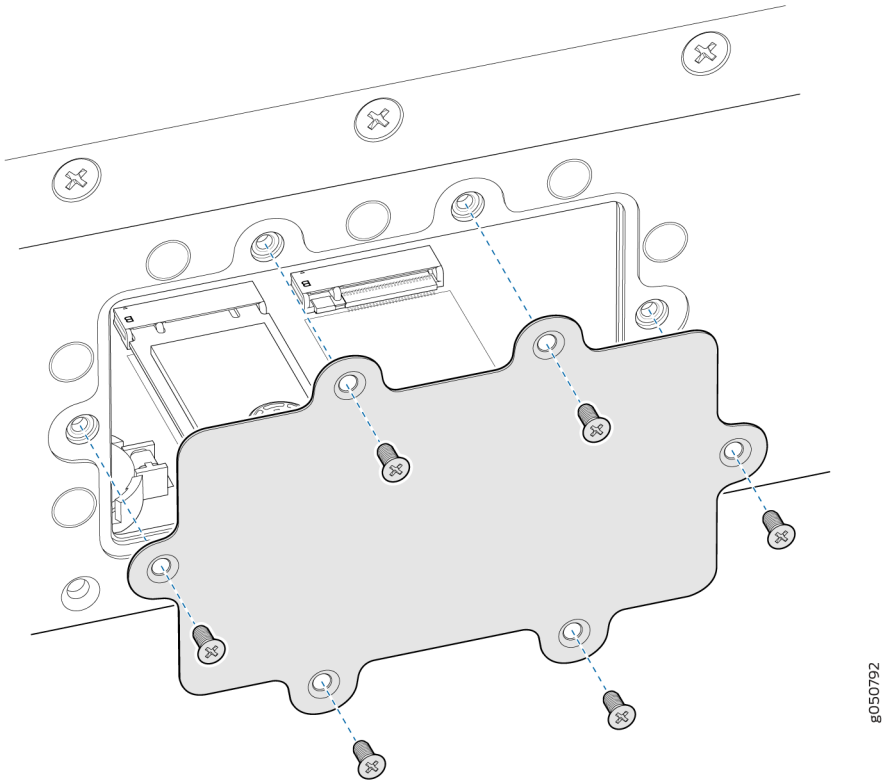
- ESD grounding strap (not provided)
- Number 2 Phillips screwdriver

Use this optional procedure to remove the drives from the PTX10002 after the device has shutdown and removed from the rack.

1. Attach the ESD grounding strap to your bare wrist and to a site ESD point.
2. Place the device on a firm surface such as a workbench or a table.

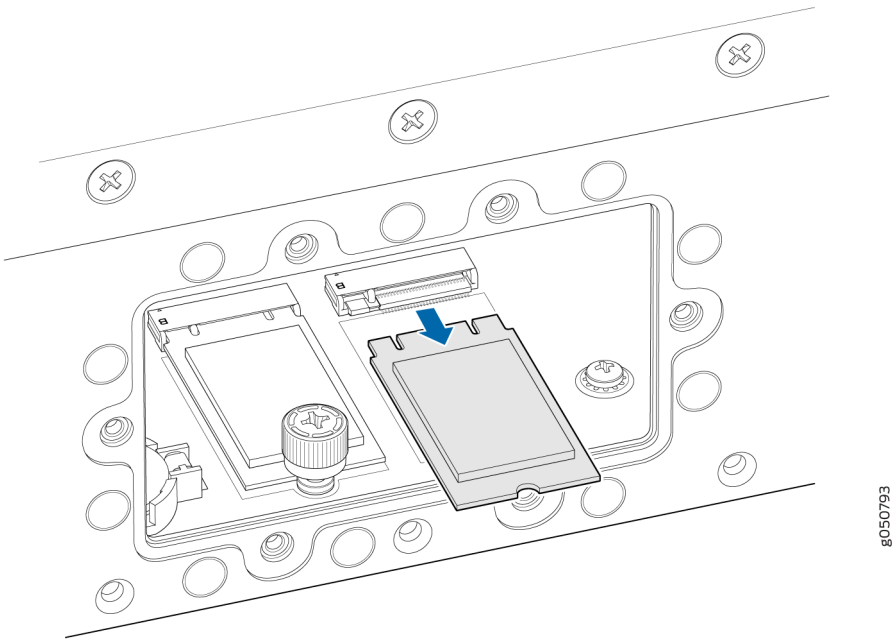
3. Using the number 2 Phillips screwdriver, remove the six flat-head screws that secure the access door on the right-side of the device. Retain the screws for later use.

Figure 46: Removing or Replacing Flat-head Screws in the Access Door



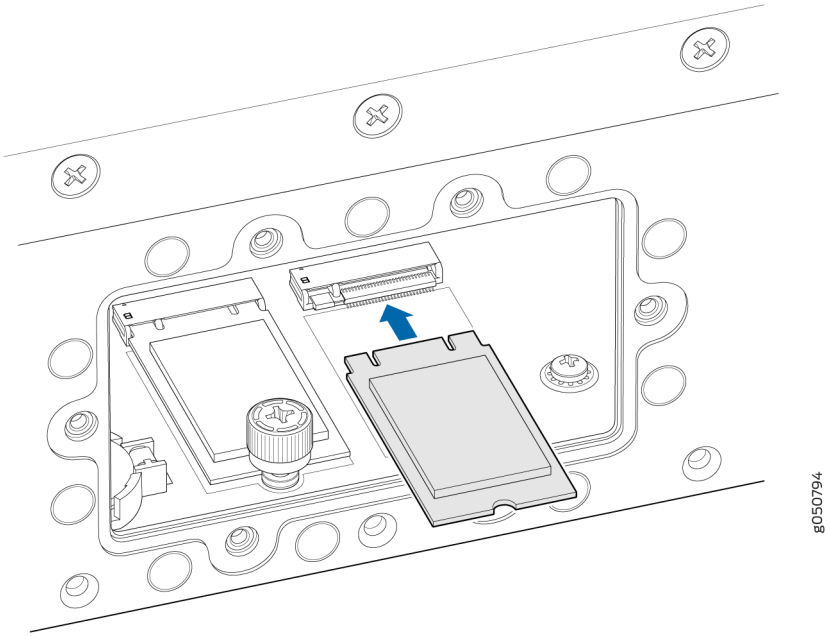
4. Reach inside of the cavity and unscrew the two thumb-screw fasteners and set aside with the screws.

Figure 47: Remove or Replacing the Thumb-screw Fasteners



5. Slide the SSD out of the slot and set aside; repeat with the second SSD.

Figure 48: Removing the SSDs



6. Replace the two thumbscrews and hand-tighten.
7. Replace the six flat-head screws and hand tighten using the number 2 Phillips screwdriver.
8. Dispose of the SSDs according to your site security procedures.

Returning a PTX10002-60C or Component for Repair or Replacement

If you need to return a PTX10002 or component to Juniper Networks for repair or replacement, follow this procedure:

1. Determine the serial number of the component. For instructions, see "Locating the Serial Number on a PTX10002-60C Chassis or Component" on page 128.
2. Obtain a Return Materials Authorization (RMA) number from the Juniper Technical Assistance Center (JTAC) as described in "Contact Customer Support to Obtain a Return Material Authorization" on page 134.

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

3. Pack the router or component for shipping as described in "Packing a PTX10002-60C Chassis or Component for Shipping" on page 135.

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

Contact Customer Support to Obtain a Return Material Authorization

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

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

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

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

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

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

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

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

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

Packing a PTX10002-60C Chassis or Component for Shipping

IN THIS SECTION

If you are returning a PTX10002-60C or component to Juniper Networks for repair or replacement, pack the item as described in this topic.

Before you pack a PTX10002-60C or component:

- Ensure that you have taken the necessary precautions to prevent electrostatic discharge (ESD) damage. See "Prevention of Electrostatic Discharge Damage" on page 164.
- Retrieve the original shipping carton and packing materials. Contact your JTAC representative if you do not have these materials, to learn about approved packing materials (see "Contact Customer Support" on page 127).

Ensure that you have the following parts and tools available:

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

Packing a PTX10002-60C for Shipping

To pack a PTX10002-60C for shipping:

1. Power off the PTX10002-60C and remove the AC power cords or DC power cables. See "Powering Off the PTX10002-60C" on page 99.
2. Remove the cables that connect the PTX10002-60C to all external devices. See Disconnecting a Fiber-Optic Cable from a Device.
3. Remove all field-replaceable units (FRUs) from the router. See:
   - "Removing a Fan Module from the PTX10002-60C" on page 102
   - "Removing a Power Supply from the PTX10002-60C" on page 105
4. Remove the PTX10002-60C from the rack. See "Uninstalling the PTX10002-60C" on page 117.
5. Place the PTX10002-60C in an antistatic bag.
6. Place the PTX10002-60C in the shipping carton.
7. Place the packing foam on top of and around the PTX10002-60C.
8. If you are returning accessories or FRUs with the PTX10002-60C, pack them as instructed in "Packing a PTX10002-60C Chassis or Component for Shipping" on page 135.
9. Close the top of the cardboard shipping box and seal it with packing tape.
10. Write the return materials authorization (RMA) number on the exterior of the box to ensure proper tracking. See Contact Customer Support to Obtain a Return Material Authorization for instructions on obtaining an RMA number.

Packing PTX10002-60C Components for Shipping

CAUTION: Do not stack PTX10002-60C components. Return individual components in separate boxes if they do not fit together on one level in the shipping box.

To pack and ship PTX10002-60C components:

1. Place individual FRUs in antistatic bags.
2. Ensure that the components are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
3. Close the top of the cardboard shipping box and seal it with packing tape.
4. Write the RMA number on the exterior of the box to ensure proper tracking. See Contact Customer Support to Obtain a Return Material Authorization for instructions on obtaining an RMA number.

CHAPTER 7

Safety and Compliance Information

General Safety Guidelines and Warnings

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

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

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

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

Definitions of Safety Warning Levels

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Qualified Personnel Warning

WARNING: Only trained and qualified personnel should install or replace the device.
Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

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

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

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

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

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

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

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

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

Warning Statement for Norway and Sweden

WARNING: The equipment must be connected to an earthed mains socket-outlet.
Advarsel Apparatet skal kobles til en jordet stikkontakt.

Varning! Apparaten skall anslutas till jordat nätuttag.

Fire Safety Requirements

IN THIS SECTION

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).

Restricted Access Warning

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

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

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

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

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

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

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

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

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

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

Ramp Warning

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

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

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

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

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

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

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

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

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

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

Rack-Mounting and Cabinet-Mounting Warnings

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

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

- Install the device in a rack that is secured to the building structure.
- Mount the device at the bottom of the rack if it is the only unit in the rack.
- When mounting the device on a partially filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.

- If the rack is provided with stabilizing equipment, install the stabilizers before mounting or servicing the device in the rack.

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

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

Varoitus Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta 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 edificio.
- Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
- Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
- Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

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

- El Juniper Networks switch debe instalarse en un bastidor fijado a la estructura del edificio.
- Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.

- Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
- Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

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

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

Grounded Equipment Warning

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

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

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

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

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

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

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

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

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

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

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.

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.

Prevention of Electrostatic Discharge Damage

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

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

  If a grounding strap is not available, hold the component in its antistatic bag (see Figure 49 on page 165) 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).

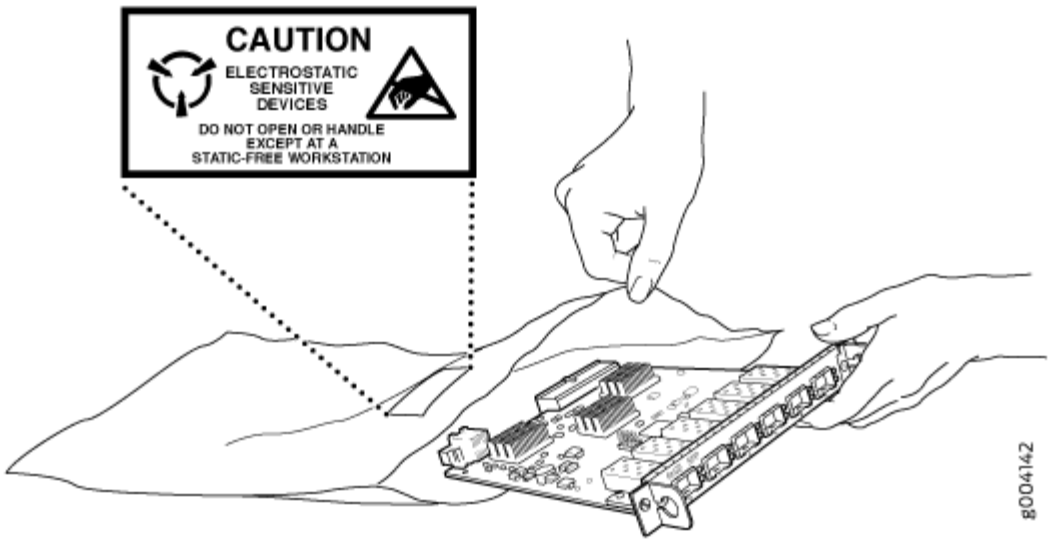
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  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 49 on page 165). If you are returning a component, place it in an antistatic bag before packing it.

Figure 49: Placing a Component into an Antistatic Bag



> **CAUTION**: ANSI/TIA/EIA-568 cables such as Category 5e and Category 6 can get electrostatically charged. To dissipate this charge, always ground the cables to a suitable and safe earth ground before connecting them to the system.
>
> **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.

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 Electrical Safety Guidelines

- A DC-powered device is equipped with a DC terminal block that is rated for the power requirements of a maximally configured device.
- For permanently connected equipment, a readily accessible disconnect device shall be incorporated external to the equipment.
- For pluggable equipment, the socket-outlet shall be installed near the equipment and shall be easily accessible.
- Be sure to connect the ground wire or conduit to a solid central office earth ground.
- A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC.
- A DC-powered device that is equipped with a DC terminal block is intended only for installation in a restricted-access location. In the United States, a restricted-access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker must protect against excess currents, short circuits, and earth grounding faults in accordance with NEC ANSI/NFPA 70.

- Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.
- The marked input voltage of –48 VDC for a DC-powered device is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.
- Because the device is a positive ground system, you must connect the positive lead to the terminal labeled **RTN**, the negative lead to the terminal labeled –48 VDC, and the earth ground to the device grounding points.

DC Power Copper Conductors Warning

WARNING: Use copper conductors only.
Waarschuwing Gebruik alleen koperen geleiders.

Varoitus Käytä vain kuparijohtimia.

Attention Utilisez uniquement des conducteurs en cuivre.

Warnung Verwenden Sie ausschließlich Kupferleiter.

Avvertenza Usate unicamente dei conduttori di rame.

Advarsel Bruk bare kobberledninger.

Aviso Utilize apenas fios condutores de cobre.

¡Atención! Emplee sólo conductores de cobre.

Varning! Använd endast ledare av koppar.

DC Power Disconnection Warning

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

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

Varoitus Varmista, että tasavirtapiirissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paikanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suojakytkin, 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.

PTX10002-60C Agency Approvals and Compliance Statements

IN THIS SECTION

PTX10002-60C Agency Approvals

IN THIS SECTION

The PTX10002-60C complies with the following standards:

- Safety
  - CAN/CSA-22.2 No. 60950–1–07/UL 60950–1, 2nd Ed., Safety of Information Technology Equipment
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EMC
  - AS/NZS 3548 Class A (Australia/New Zealand)
  - EN55022 Class A (Europe)
  - FCC Part 15 Class A (USA)
  - VCCI Class A (Japan)
- Immunity
  - EN-61000-3-3 Voltage Fluctuations and Flicker
  - EN-61000-4-2 ESD
  - EN-61000-4-3 Radiated Immunity
  - EN-61000-4-4 EFT
  - EN-61000-4-5 Surge
  - EN-61000-4-6 Low Frequency Common Immunity
- ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

The PTX10002-60C is designed to comply with the following standard:

- NEBS
  - GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment
  - SR-3580 NEBS Criteria Levels (Level 3 Compliance)
  - GR-63-Core: NEBS, Physical Protection

Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

Compliance Statements for EMC Requirements

IN THIS SECTION

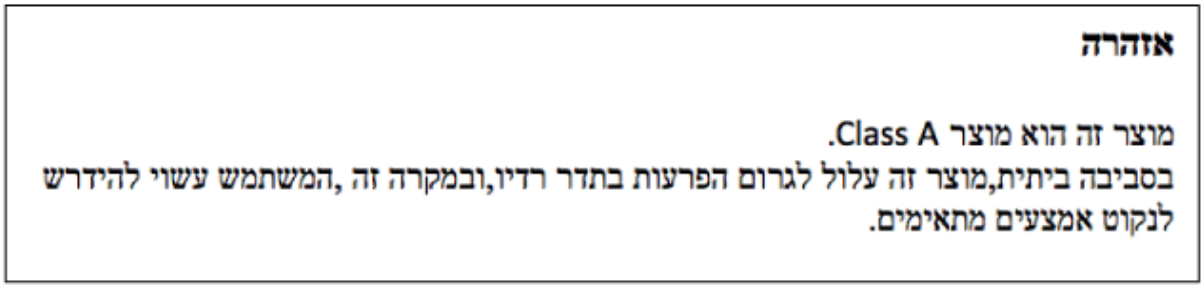
Canada

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

European Community

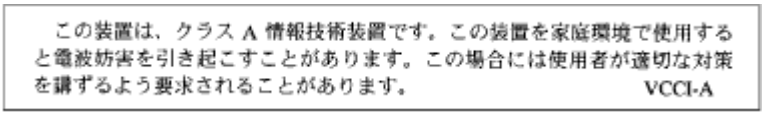
This is a Class A product. In a domestic environment, this product might cause radio interference in which case the user might be required to take adequate measures.

Israel



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

Japan



The preceding translates as follows:

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

United States

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Compliance Statements for Environmental Requirements

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

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.

PTX10002-60C Compliance Statements for Acoustic Noise

Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70dB(A) oder weniger gemäss EN ISO 7779

Translation:

The emitted sound pressure is below 70 dB(A) per EN ISO 7779.