Engineering
Simplicity

PTX5000 Packet Transport Router Hardware Guide

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YEAR 2000 NOTICE

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

END USER LICENSE AGREEMENT

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About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the PTX5000 Packet Transport Router.

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

RELATED DOCUMENTATION

PTX5000 Quick Start

PTX Series Interface Module Reference

1

CHAPTER

Overview

PTX5000 System Overview

IN THIS SECTION

PTX5000 Description

IN THIS SECTION

The Juniper Networks PTX5000 Packet Transport Router is designed for large networks and network applications, such as those supported by ISPs and high-volume content providers.

Benefits of the PTX5000 Router

- Increased scalability—The PTX5000 scales to 24 Tbps in a single chassis, supporting up to 1536 10-Gigabit Ethernet interfaces, 384 40-Gigabit Ethernet interfaces, and 240 100-Gigabit Ethernet interfaces, giving service providers the performance and scalability needed as networks grow. The purpose-built ASICs in the PTX5000 provide enhanced packet processing for both full IP functionality and MPLS transport, accommodating scale as traffic continues to increase and optimizing IP/MPLS transit functionality.

- Always-on infrastructure base—The PTX5000 is engineered with full hardware redundancy for cooling, power, Routing Engines, Control Boards, and Switch Interface Boards (SIBs), allowing service providers to meet stringent service-level agreements across the core.
- Nondisruptive software upgrades—The PTX5000 features a resilient operating system that supports high availability (HA) features such as graceful Routing Engine switchover (GRES), nonstop active routing (NSR), and unified in-service software upgrade (unified ISSU), providing software upgrades and changes without disrupting network traffic.

System Overview

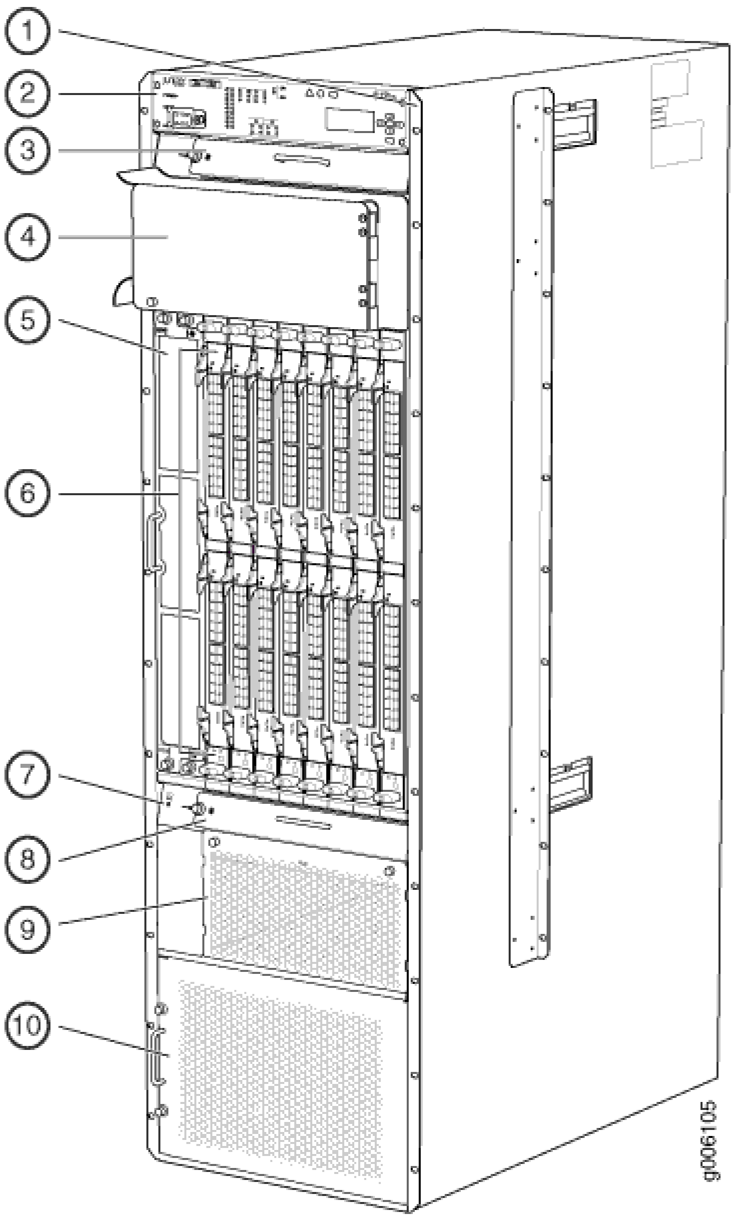
The PTX5000 occupies 36 rack units (36 U) and accommodates up to eight Flexible PIC Concentrators (FPCs), each of which can be configured with two Physical Interface Cards (PICs) to support a variety of network media types.

The system architecture of the PTX5000 cleanly separates control operations from packet forwarding operations. This design eliminates processing and traffic bottlenecks, permitting the PTX5000 to achieve high performance.

- Control operations are performed by the host subsystem, which runs the Junos operating system (Junos OS) to handle routing protocols, traffic engineering, policy, policing, monitoring, and configuration management.
- Forwarding operations are performed by the Packet Forwarding Engines, which consist of hardware, including ASICs, designed by Juniper Networks. The ASICs are a definitive part of the hardware design and enable the PTX5000 to achieve data forwarding rates that match current fiber-optic capacity. For the forwarding capacity of each supported FPC type, see "FPCs Supported on the PTX5000" on page 137.

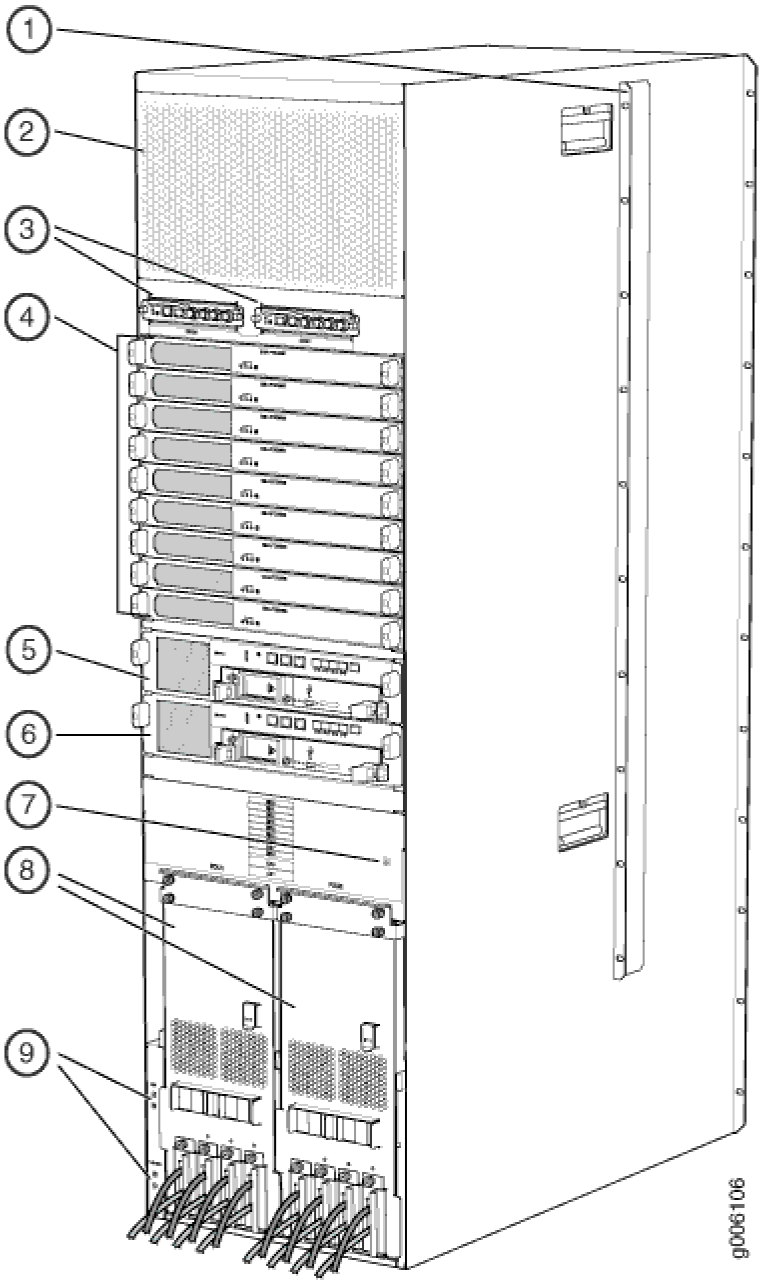
Figure 1 on page 4 and Figure 2 on page 5 illustrate the front and rear of a PTX5000 and its components.

Figure 1: Front View of the PTX5000



1– Front-mounting flange	6– FPCs and PICs
2– Craft interface	7– ESD point
3– Upper horizontal fan tray	8– Lower horizontal fan tray
4– Cable management system	9– Horizontal air filter
5– Vertical fan tray and vertical air filter	10– Power supply module door and power supply modules air filter

Figure 2: Rear View of the PTX5000



1– Center-mounting bracket	6– Control Board **CB1** and Routing Engine **RE1**
2– Air exhaust	7– ESD point
3– Centralized Clock Generators (CCGs)	8– Power distribution units (PDUs)
4– Switch Interface Boards (SIBs)	9– Chassis grounding points
5– Control Board **CB0** and Routing Engine **RE0**	

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PTX5000 System Architecture Description

The PTX5000 has two main architectural components:

- Routing Engine—One or more Routing Engines provide Layer 3 routing services and network management.
- Packet Forwarding Engines—These high-performance, ASIC-based components provide packet forwarding, route lookups, and Layer 2 and Layer 3 packet switching. See "PTX5000 Packet Forwarding Engine Architecture" on page 6 for more information.

The Routing Engines and the Packet Forwarding Engines perform their primary tasks independently, but communicate through multiple links. This arrangement streamlines forwarding and routing control and runs Internet-scale backbone networks at high speeds.

PTX5000 Packet Forwarding Engine Architecture

The Packet Forwarding Engines provide Layer 2 and Layer 3 packet switching, forwarding, and route lookup functions.

The Packet Forwarding Engines are implemented in ASICs that are physically located on the FPCs. Each Packet Forwarding Engine consists of the following components:

- Lookup ASICs, which provide the route lookup function, control functions, Layer 2 and Layer 3 encapsulation and de-encapsulation, and manage the division and reassembly of packets within the PTX5000.
- Queuing and Memory Interface ASICs, which manage the buffering of data cells in memory and the queueing of notifications.

The fabric ASICs, located on the Switch Interface Boards (SIBs), extract the route lookup key and manage the flow of data cells across the switch fabric.

PTX5000 Hardware Component Overview

The PTX5000 supports the components in Table 1 on page 7 listed in alphabetic order.

> **NOTE**: The en dash (–) means that the item is not applicable.

Table 1: PTX5000 Hardware Components

Component	Model Number	Hardware Label	CLI Output	Description
Cable management system	–	–	–	"PTX5000 Cable Management System" on page 18
Centralized Clock Generator (CCG)	CCG-PTX	**CCG**	`Clock Generator`	"PTX5000 Centralized Clock Generator Description" on page 28
CCG-BLANK-PTX	–	–	–	–
Chassis	–	–	`PTX5000`	"PTX5000 Chassis Description" on page 14
Vertical fan tray	FAN-PTX-V	**FANTRAY PTX VERTICAL**	`Vertical Fan Tray`	"PTX5000 Cooling System" on page 31
Horizontal fan tray	FAN-PTX-H	**FANTRAY PTX HORIZONTAL**	`Horizontal Fan Tray`	
	FAN3-PTX-H	**FANTRAY PTX 2 HORIZONTAL**	`Horizontal Fan Tray V3`	

Table 1: PTX5000 Hardware Components *(Continued)*

Component	Model Number	Hardware Label	CLI Output	Description
Air filter kit including the horizontal air filter, vertical air filter, and PSM air filter **NOTE**: The air filter kit is available for replacements required for maintenance. See "Maintaining the PTX5000 Air Filters" on page 316	FLTR-PTX-KIT	–	–	–
Control Board	CB-PTX	**CB-PTX**	`Control Board`	"PTX5000 Control Board Description" on page 122
	CB2-PTX	**CB2-PTX**	`Control Board 2`	
CB-BLANK	–	–	–	–
Craft interface	CRAFT-PTX5000	**JUNIPER NETWORKS PTX5000**	`Front Panel Display`	"PTX5000 Craft Interface Description" on page 19
FPC	FPC-PTX-P1-A	**FPC-PTX-P1-A**	`FPC`	"PTX5000 FPC Description" on page 134
	FPC2-PTX-P1A	**FPC2-PTX-P1A**	`FPC E`	
	FPC3-PTX-U2	**FPC3-PTX-U2**	`FPC-P1`	
	FPC3-PTX-U3	**FPC3-PTX-U3**	`FPC-P2`	
FPC-BLANK	–	–	–	–
Host subsystem including Control	CB-PTX	**CB-PTX**	`Control Board`	"PTX5000 Host Subsystem Description"

Table 1: PTX5000 Hardware Components *(Continued)*

Component	Model Number	Hardware Label	CLI Output	Description
Board and Routing Engine **NOTE**: CB2-PTX is not supported with RE-DUO-C2600-16G.	CB2-PTX	**CB2-PTX**	`Control Board 2`	on page 108
	RE-DUO-C2600-16G	–	`RE-DUO-2600`	
	RE-PTX-X8-64G	**RE-PTX-X8-64G**	`RE-PTX-2X00x8`	
Midplane	–	–	`Midplane-8S`	"PTX5000 Midplane Description" on page 18
			`Midplane-8SeP`	
PIC	See the PTX Series Interface Module Reference for information about the PICs supported on the PTX5000.			"PTX5000 PIC Description" on page 139
PIC-BLANK-PTX	–	–	–	–
Three-phase AC delta PDU	PDU-PTX-AC-D	–	`AC Delta Pwr Dist Unit`	"PTX5000 AC Power System Description" on page 37
Three-phase AC wye PDU	PDU-PTX-AC-W	–	`AC Wye Pwr Dist Unit`	
Three-phase AC PSM	PSM-PTX-AC	–	`AC 12V Power Supply`	
120-A DC PDU	PDU-PTX-DC-120	–	`DC Power Dist Unit`	"PTX5000 DC Power System Description" on page 78
60-A DC PDU	PDU-PTX-DC-60	–	`DC PDU 2x60A`	

Table 1: PTX5000 Hardware Components *(Continued)*

Component	Model Number	Hardware Label	CLI Output	Description
High Capacity DC PDU	PDU2-PTX-DC	–	`High Capacity DC PDU`	
120-A DC PSM	PSM-PTX-DC-120	–	`DC 12V Power Supply`	
60-A DC PSM	PSM-PTX-DC-60	–	`DC 12V PSM 2x60A`	
High Capacity DC PSM	PSM2-PTX-DC	–	`High Capacity DC PSM`	
PSM blank	PSM-BLANK-PTX	–	–	–
High Capacity Single-Phase AC PDU	PDU2-PTX-AC-SP	**PDU2-PTX-AC-SP**	`Single Phase High Capacity AC PDU`	"PTX5000 AC Power System Description" on page 37
Metal sleeves and overlay kit for the chassis to upgrade PSM to High Capacity PSMs	PTX5K-PSM2TRAY	–	–	–
Routing Engine	RE-DUO-C2600-16G	–	`RE-DUO-2600`	"PTX5000 Routing Engine Description" on page 109
	RE-PTX-X8-64G	**RE-PTX-X8-64G**	`RE-PTX-2X00x8`	
RE-BLANK	–	–	–	–
Switch Interface Board (SIB)	SIB-I-PTX5008	**SIB-I-PTX5008**	`SIB-I-8S`	"PTX5000 Switch Interface Board

Table 1: PTX5000 Hardware Components *(Continued)*

Component	Model Number	Hardware Label	CLI Output	Description
	SIB2-I-PTX5K	**SIB2-I-PTX5K**	`SIB2-I-PTX5K`	Description" on page 131
	SIB3-PTX5K	**SIB3-I-PTX5K**	`SIB-I`	
Front Door	PTX5000-DOOR-S	–	–	–

PTX5000 Component Redundancy

The PTX5000 is designed so that no single point of failure can cause the entire system to fail. The following major hardware components are redundant:

- Switch Interface Boards (SIBs)—The PTX5000 has nine SIBs. All nine SIBs are active and can sustain full throughput rate. The fabric plane can tolerate one SIB failure without any loss of performance. See "PTX5000 Switch Interface Board Description" on page 131.

- Host subsystem—The host subsystem consists of a Routing Engine functioning together with a Control Board. To operate, each host subsystem requires a Routing Engine installed in a slot in the Control Board. The PTX5000 can have one or two host subsystems. If two host subsystems are installed, one functions as the primary and the other functions as the backup. If the primary host subsystem (or either of its components) fails, the backup can take over as the primary. See "PTX5000 Host Subsystem Description" on page 108.

  If the Routing Engines are configured for *nonstop active routing*, the backup Routing Engine automatically synchronizes its configuration and state with the primary Routing Engine. Any update to the primary Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes the primary role, packet forwarding continues through the PTX5000 without interruption. For more information about nonstop active routing, see *Nonstop Active Routing Concepts* and *Nonstop Active Routing System Requirements*.

- Centralized Clock Generators (CCGs)—The PTX5000 has a standard configuration of one CCG. If two CCGs are installed, the second CCG functions as backup. If one CCG fails, the other becomes the primary CCG. Primary Role of the CCG is independent of the host subsystem, so routing functions are not affected. See "PTX5000 Centralized Clock Generator Description" on page 28.

- Power system—The PTX5000 has two redundant, load-sharing power distribution units (PDUs), located at the lower rear of the chassis in slots **PDU0** on the right and **PDU1** on the left. The PDUs are hot-removable and hot-insertable. When the PTX5000 is operating normally and both PDUs are switched on, load sharing between them occurs automatically. If one PDU fails in a fully redundant power system, the other PDU can provide full power to the PTX5000 indefinitely.

  > **NOTE**: Redundant PDUs must be the same model number during normal operations.

  The PDUs provide connections for the DC power cables or AC power cords; configure the output voltages produced by the power supply modules (PSMs); and connect to the midplane, which distributes the different output voltages to PTX5000 components, depending on their voltage requirements. The number of PSMs required for full redundancy varies depending on the configuration of the chassis.

  > **NOTE**: The normal-capacity power system distributes power into three different output zones. The high-capacity power system does not use power zones. See the "Understanding Normal-Capacity Power System Power Zones" on page 172 for more information about normal-capacity power system power zones.

- Cooling system—The cooling system has redundant components, which are controlled by the host subsystem. If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient cooling for the PTX5000 indefinitely. See "PTX5000 Cooling System" on page 31.

PTX5000 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site. Replacing most FRUs requires minimal router downtime. The PTX5000 uses the following types of FRUs:

- Hot-removable and hot-insertable FRUs—You can remove and replace these components without powering off the PTX5000 or disrupting the routing functions.

- Hot-pluggable FRUs—You can remove and replace these components without powering down the PTX5000, but the routing functions of the system are interrupted when the component is removed.

Before you replace a component in the host subsystem, you must take the host subsystem offline.

Table 2 on page 13 lists the FRUs for the PTX5000.

Table 2: Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• Air filters • Craft interface • Horizontal and vertical fan trays • Power distribution units (PDUs) • Power supply modules (PSMs) • Switch Interface Boards (SIBs) if at least eight other SIBs are operational • Backup Control Boards • Primary Control Boards if nonstop active routing is configured • Backup Routing Engines • Primary Routing Engines if nonstop active routing is configured	• SIBs if fewer than eight SIBs are operational • Primary Control Board if nonstop active routing is not configured • Nonredundant Control Board • Primary Routing Engine if nonstop active routing is not configured • Nonredundant Routing Engine

PTX5000 Chassis

IN THIS SECTION

PTX5000 Chassis Description

The PTX5000 chassis is a rigid sheet metal structure that houses all the other hardware components (see Figure 3 on page 15 and Figure 4 on page 16). The chassis measures 62.5 in. (158.8 cm) high, 33.1 in. (84.1 cm) deep, and 17.5 in. (44.5 cm) wide. The chassis can be installed into many types of racks or cabinets.

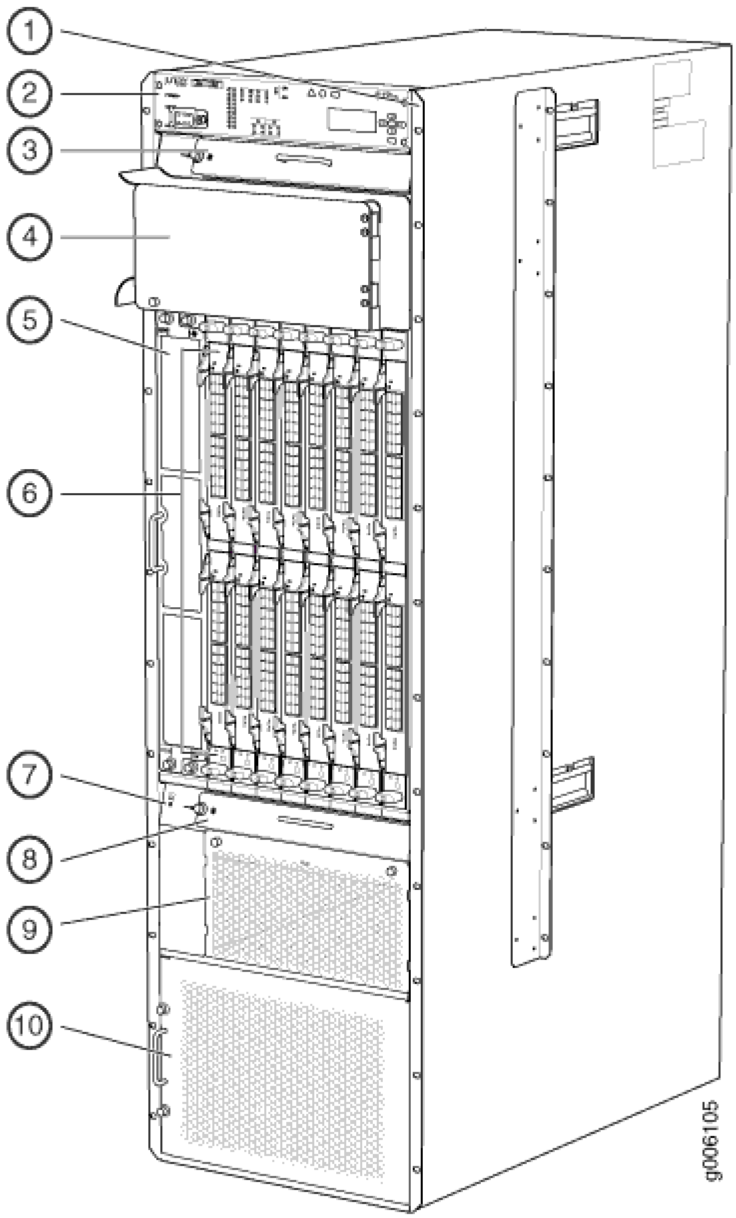
The chassis includes the following features (see Figure 3 on page 15 and Figure 4 on page 16):

- Front-mounting flanges for mounting in a four-post rack or cabinet.
- Center-mounting metal brackets for center-mounting in an open-frame rack.
- Handles on each side to facilitate positioning the PTX5000 in the rack. Do not use the handles to lift the PTX5000.
- Two electrostatic discharge (ESD) points (banana plug receptacles), one front and one rear (see Figure 5 on page 17).

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

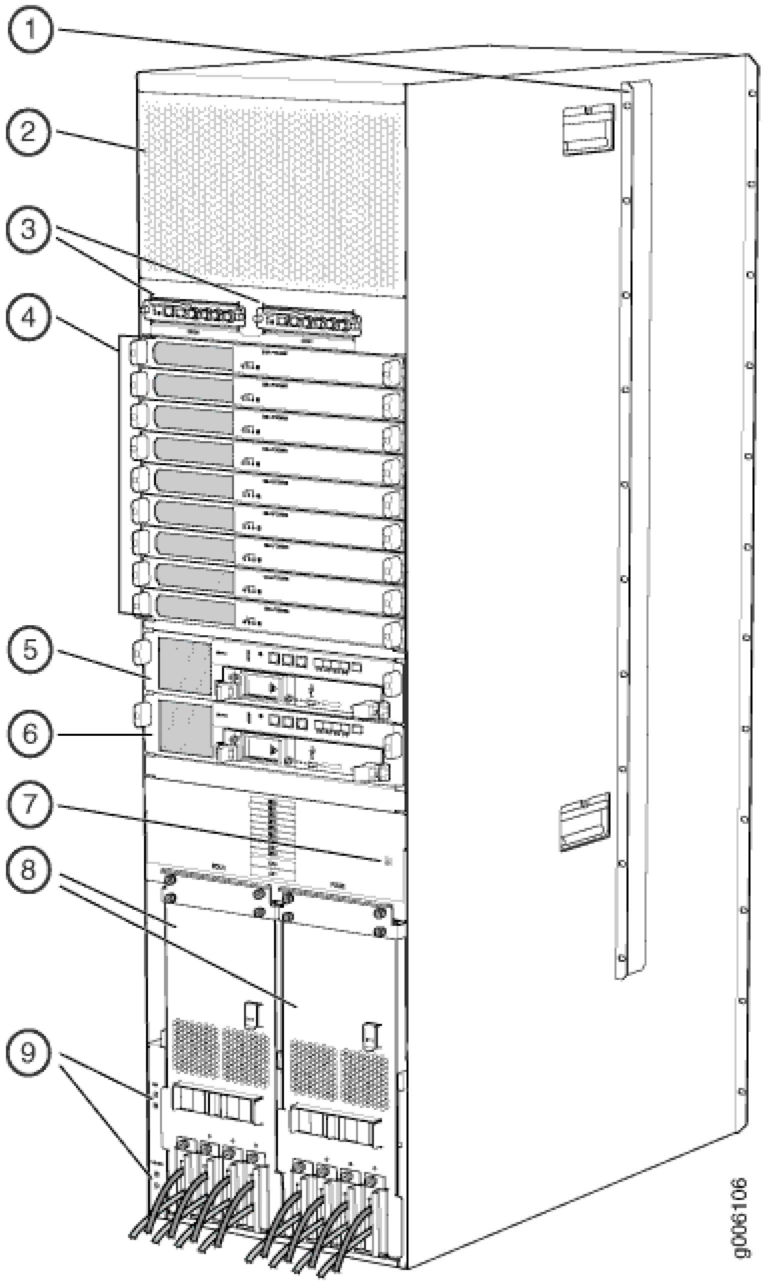
> **WARNING**: The PTX5000 must be connected to earth ground during normal operation.

Figure 3: Front View of the PTX5000 Chassis



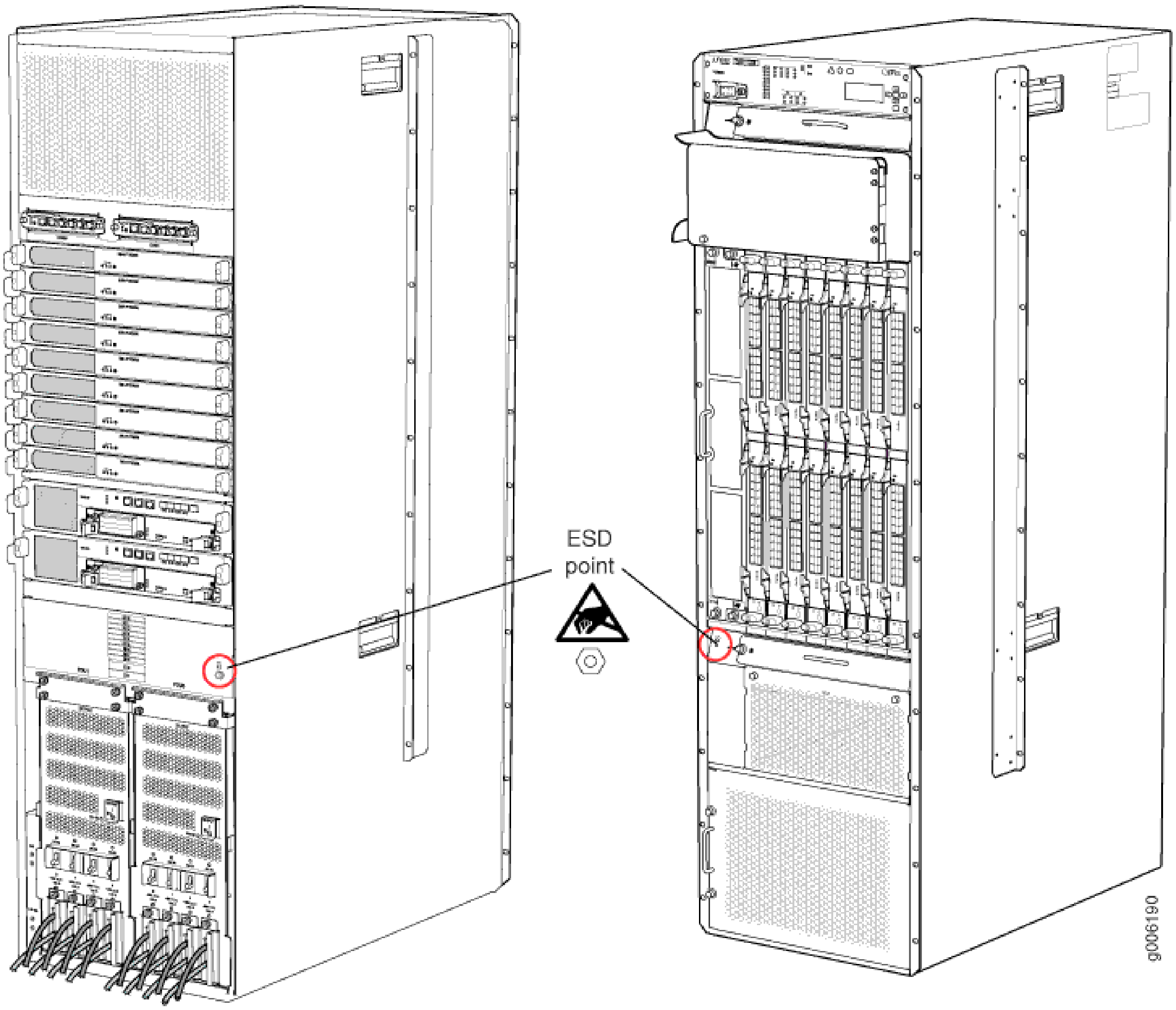
1– Front-mounting flange	6– FPCs and PICs
2– Craft interface	7– ESD point
3– Upper horizontal fan tray	8– Lower horizontal fan tray
4– Cable management system	9– Horizontal air filter
5– Vertical fan tray and vertical air filter	10– Power supply module door and power supply modules air filter

Figure 4: Rear View of the PTX5000 Chassis



1– Center-mounting bracket	6– Control Board **CB1** and Routing Engine **RE1**
2– Air exhaust	7– ESD points
3– Centralized Clock Generators (CCGs)	8– Power distribution units (PDUs)
4– Switch Interface Boards (SIBs)	9– Chassis grounding points
5– Control Board **CB0** and Routing Engine **RE0**	

Figure 5: ESD Points on the PTX5000



SEE ALSO

PTX5000 Midplane Description

The midplane is located in the center of the chassis and forms the rear of the Flexible PIC Concentrator (FPC) card cage. The FPCs install into the midplane from the front of the chassis; and the Switch Interface Boards (SIBs), Routing Engines, Control Boards, Centralized Clock Generators (CCGs), and power distribution units (PDUs) install into the midplane from the rear of the chassis. The cooling system components also connect to the midplane.

The midplane performs the following major functions:

- Data path—Data packets are transferred across the midplane from the Packet Forwarding Engine on the originating FPC to the SIBs, and from the SIBs across the midplane to the Packet Forwarding Engine on the destination FPC.
- Power distribution—The power distribution units are connected to the midplane, which distributes power to all the PTX5000 components.
- Signal path—The midplane provides the signal path to the FPCs, SIBs, Routing Engines, Control Boards, and other system components for monitoring and control of the system.

NOTE: The PTX5000 supports two midplanes. First supported in Junos 14.1, the PTX5000BASE2 model is a chassis with an enhanced midplane that requires high-capacity PDUs and PSMs. The enhanced midplane is identified as `Midplane-8SeP` in the output from the `show chassis hardware` operational-mode CLI command.
If you are installing FPC3-PTX-U3, it must be installed in the PTX5000BASE2 model.

PTX5000 Cable Management System

The front cable management system for the PTX5000 consists of channels above the FPCs. The cable management system organizes, supports, and provides strain relief for the PIC cables. The PIC cables are routed toward the top into the cable management system, keeping the cables organized and securely in place. All the cables from one FPC are routed to one channel. The cables are routed from the cable management system to the left side of the PTX5000. The front cable management system adds 3.8 in. (9.7 cm) to the depth of the chassis.

You can install a rear cable management system with the High Capacity DC power supply. The rear cable management system adds 5.5 in. (14 cm) to the depth of the chassis. See "Installing the PTX5000 Cable Management System for a High Capacity DC PDU" on page 246 for details.

NOTE: We recommend that you use the cable management system to maintain the cable bend radius.

SEE ALSO

Maintaining the PTX5000 PIC Cables | 504

PTX5000 Craft Interface Description

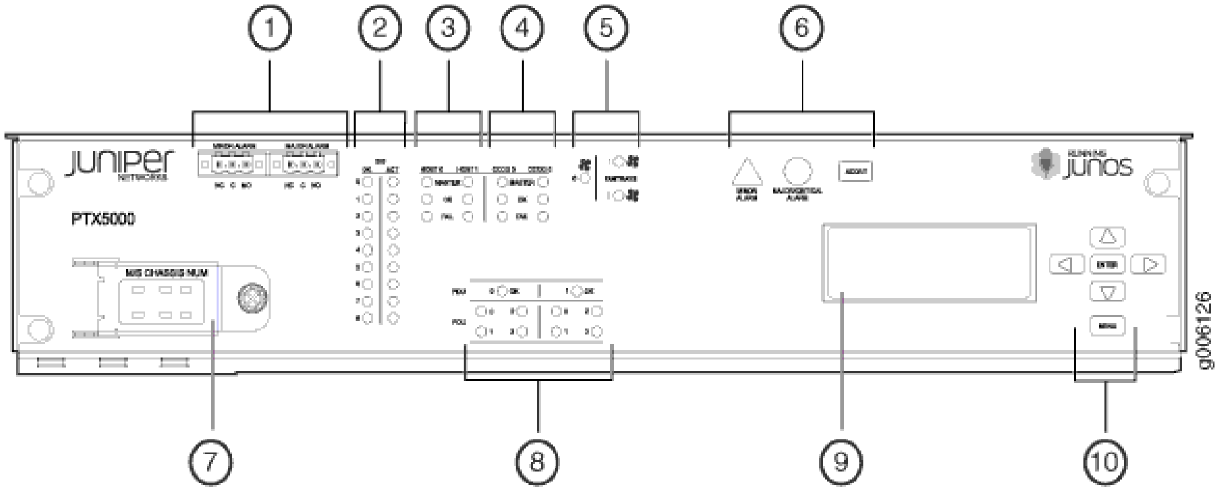
IN THIS SECTION

The craft interface allows you to view status and troubleshooting information at a glance and to perform many system control functions. It is hot-insertable and hot-removable. The craft interface is located at the upper front of the PTX5000.

Craft Interface Front Panel

Figure 6 on page 20 shows the craft interface.

Figure 6: Craft Interface



1– Alarm relay contacts	6– Alarm LEDs and ACO/LT button
2– SIB LEDs	7– **M/S CHASSIS NUM** configuration switches
3– Host Subsystem LEDs	8– Power system LEDs
4– CCG LEDs	9– LCD
5– Fan tray LEDs	10– LCD navigation buttons

The front panel of the craft interface contains:

- A four-line LCD display, along with six navigation buttons. The LCD display operates in Idle mode or alarm mode.
- Alarm relay contacts.
- Two configuration switches:
  - The M/S configuration switch must be set to **S**.
  - The CHASSIS ID configuration switch must always be set to **0**.

  > **NOTE**: The CHASSIS ID configuration switch is set to 0 by default.

- LEDs
  - Yellow **Minor Alarm** LED, Red **Major Critical Alarm** LED, and alarm cutoff/lamp test **ACO/LT** button
  - Host Subsystem **Master**, **OK**, and **FAIL** LEDs
  - SIB **OK** and **ACT** LEDs

- Fan tray LEDs
- PDU LEDs
- PSM LEDs

Craft Interface LCD

A four-line LCD is located in the craft interface, along with six navigation buttons. The LCD operates in two modes:

- LCD idle mode
- LCD alarm mode

Idle Mode

During normal operation, the LCD operates in idle mode and reports current status information, as shown in Figure 7 on page 21.

Figure 7: LCD in Idle Mode

The lines in the display report the following information:

- First line—Router name.
- Second line—Length of time the PTX5000 has been running, reported in the following form:

```
Up days + hours:minutes
```

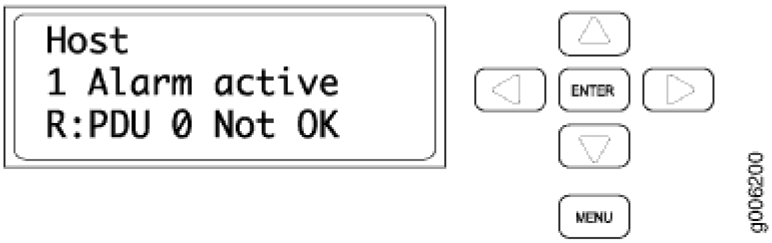
- Third and fourth lines—Status messages, which rotate at 2-second intervals. Some conditions, such as removal or insertion of a system component, can interrupt the messages.

To add a message that alternates every 2 seconds with the default status messages, use the `set chassis display message` command.

Alarm Mode

When a red or yellow alarm occurs, the LCD switches to alarm mode and reports the alarm condition, as shown in Figure 8 on page 22.

Figure 8: LCD in Alarm Mode



The lines in the display report the following information:

- First line—Router name.
- Second line—Number of active alarms.
- Third and fourth lines—Individual alarm messages, with the most severe condition shown first. The prefix on each line indicates whether the alarm is a red (R) or yellow (Y) alarm.

LCD Navigation Buttons

The LCD display has the following navigation buttons:

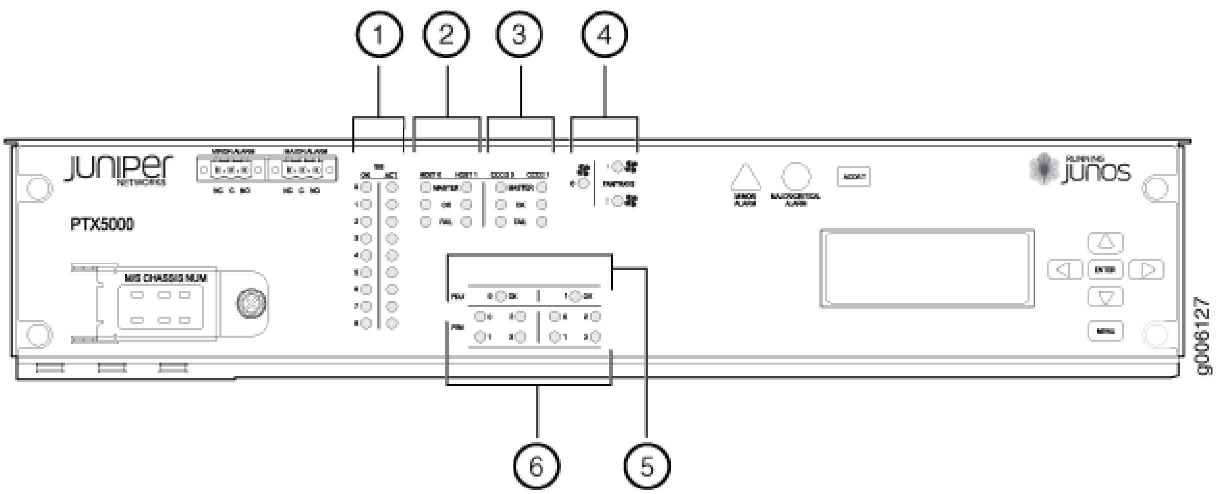
- Menu button
- Enter button
- Four arrow buttons for scrolling up or down, and left or right

PTX5000 Craft Interface LEDs

IN THIS SECTION

Figure 9 on page 23 shows the craft interface LEDs.

Figure 9: Craft Interface LEDs



1– SIB LEDs	4– Fan tray LEDs
2– Host subsystem LEDs	5– Power distribution unit LEDs
3– CCG LEDs	6– Power supply module LEDs

Craft Interface Alarm LEDs

Two large alarm LEDs are located on the craft interface. Both LEDs can be lit simultaneously.

- The circular red LED lights to indicate a critical condition that can result in a system shutdown.
- The triangular yellow LED lights to indicate a less severe condition that requires monitoring or maintenance.

The LCD display on the craft interface reports the cause of the alarm. A condition that causes an alarm LED to light also activates the corresponding alarm relay contact on the craft interface.

Table 3 on page 24 describes the alarm LEDs.

Table 3: Alarm LEDs on the PTX5000 Craft Interface

Shape	Color	State	Description
	Red	On steadily	Critical alarm LED—Indicates a critical condition that can cause the PTX5000 to stop functioning. Possible causes include component removal, failure, or overheating.
	Yellow	On steadily	Warning alarm LED—Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature.

Craft Interface SIB LEDs

The left side of the craft interface has two LEDs for each SIB, which indicate the status of that SIB. The corresponding SIB slots are labeled **0** through **8**. Table 4 on page 24 describes the functions of the SIB LEDs.

Table 4: SIB LEDs on the PTX5000 Craft Interface

Label	Color	State	Description
OK	Green	On steadily	SIB is functioning normally.
	Red	On steadily	SIB has failed.
	–	Off	SIB is offline or absent.
ACT	Green	On steadily	SIB is in active mode and actively passing traffic.
	–	Off	SIB is either offline or not actively passing traffic.

Craft Interface Host Subsystem LEDs

Each host subsystem has three LEDs—labeled **MASTER**, **OK**, and **FAIL**—located to the right of the SIB LEDs on the craft interface, that indicate the status of the host subsystem. The LEDs listed under **HOST0** show the status of the Routing Engine in slot **RE0** and the CB in slot **CB0**. The LEDs listed under **HOST1** show the status of the Routing Engine in slot **RE1** and the CB in slot **CB1**. Table 5 on page 25 describes the functions of the host subsystem LEDs.

Table 5: PTX5000 Host Subsystem LEDs

Label	Color	State	Description
MASTER	Green	On steadily	Host subsystem is functioning as the primary.
	–	Off	Host subsystem is offline or functioning as the backup.
OK	Green	On steadily	Host subsystem is online and is functioning normally.
	–	Off	Host subsystem is offline or absent.
FAIL	Red	On steadily	Host subsystem has failed.
	–	Off	No failure has been detected.

CCG LEDs

Each Centralized Clock Generator (CCG) has three LEDs—labeled **MASTER**, **OK**, and **FAIL**—located to the right of the host subsystem LEDs on the craft interface that indicate the status of the CCGs. The LEDs labeled **CCG0** show the status of the CCG in slot **CCG0**. The LEDs labeled **CCG1** show the status of the CCG in slot **CCG1**. Table 6 on page 25 describes the functions of the CCG LEDs.

Table 6: PTX5000 CCG LEDs

Label	Color	State	Description
MASTER	Green	On steadily	CCG is functioning as the primary.

Table 6: PTX5000 CCG LEDs *(Continued)*

Label	Color	State	Description
	–	Off	CCG is offline or functioning as the backup.
OK	Green	On steadily	CCG is online and is functioning normally.
	–	Off	CCG is offline or absent.
FAIL	Red	On steadily	CCG has failed.
	–	Off	No failure has been detected.

Fan Trays LEDs

One status LED for each fan tray is located to the right of the host subsystem LEDs on the craft interface. The three fan tray status LEDs are labeled **0** through **2**.

Table 7: Fan Tray LEDs on the Craft Interface

Color	State	Description
Green	On steadily	The fan tray is functioning normally.
Red	On steadily	The fan tray has failed.
–	Off	The fan tray is offline or absent.

Power Distribution Unit LEDs

One **OK** LED for each power distribution unit is located on the craft interface below the host subsytem LEDs. The two LEDs are labeled **0** and **1**.

Table 8: Power Distribution Unit LEDs

Colour	State	Description
Green	On steadily	PDU is functioning normally.
Red	On steadily	PDU has failed.
Off	—	PDU might be starting up or not receiving any input voltage. The circuit breakers might be off.

Power Supply Modules LEDs

A status LED for each power supply module is located on the craft interface below the PDU LEDs. The four PSM status LEDs are labeled **0** through **3**.

> **NOTE**: The existing PDUs support four PSMs whereas high capacity PDUs support eight PSMs.

Table 9: PSM-LED Mapping

PDU Type	No of PSMs per PDU	Mapping of the PSM LEDs on the Craft Interface and the PSMs			
		PSM 0 LED	PSM 1 LED	PSM 2 LED	PSM 3 LED
Existing PDUs: PDU-PTX-DC-120 PDU-PTX-DC-60 PDU-PTX-AC-W PDU-PTX-AC-D	4	PSM 0	PSM 1	PSM 2	PSM 3
High Capacity PDU: PDU2-PTX-DC	8	PSMs 0 and 4	PSMs 1 and 5	PSMs 2 and 6	PSMs 3 and 7

Table 10: Power Supply Module LEDs on the Craft Interface

Color	State	Description for normal capacity PDU/PSMs	Description for high capacity PDU/PSMs
Green	On steadily	The PSM is functioning normally.	All the PSMs are working.
Red	On steadily	The PSM has failed.	At least one PSM is not working. Additional status is available on the LCD, CLI, and PSM LEDs on the PSM.
–	Off	The PSM is offline or absent.	The PSMs are offline or absent.

PTX5000 Centralized Clock Generator Description

IN THIS SECTION

CCG Slots

The Centralized Clock Generators (CCGs) are installed into the upper rear of the chassis in the slots labeled **CCG0** and **CCG1**. One CCG is shipped as part of the standard PTX5000 configuration, but up to two CCGs can be installed to provide redundancy.

A nonredundant CCG is hot-pluggable. For redundant CCGs, the primary CCG is hot-pluggable. The backup CCG is hot-removable and hot-insertable if the primary CCG is functioning. Removing the backup CCG does not affect the functioning of the PTX5000. Taking the primary CCG offline might result in a brief loss of the clock lock while the backup CCG becomes the primary.

CCG Function

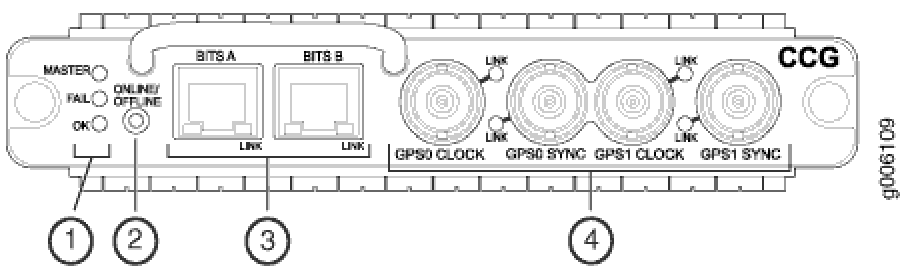
CCGs provide a 19.44-MHz Stratum 3E clock signal for the Ethernet network interfaces on the PTX5000.

CCG Components

Each CCG (see Figure 10 on page 29) consists of the following components:

- 19.44-MHz Stratum 3E clock.
- Field-programmable gate array (FPGA) that performs multiplexing of clock sources.

Figure 10: CCG



1– Three LEDs—**OK**, **FAIL**, and **MASTER**—that display the status of the CCG.	3– Two RJ-48 connectors labeled **BITS A** and **BITS B** for BITS external clock inputs, 1.5444 MHz or 2.048 MHz. Two LEDs for each BITS connector—**FAULT** and **LINK**—that display the status of the BITS ports.
2– **ONLINE/OFFLINE** button	4– Four GPS connectors labeled **GPS0 CLOCK**, **GPS0 SYNC**, **GPS1 CLOCK**, and **GPS1 SYNC**, for GPS external clock inputs, 5 MHz or 10 MHz. The LEDs for the GPS ports are not supported.

SEE ALSO

Troubleshooting the PTX5000 Centralized Clock Generators | 548

PTX5000 Centralized Clock Generator LEDs

Table 11 on page 30 describes the functions of the CCG LEDs.Table 12 on page 30 describes the functions of the CCG port LEDs.

Table 11: CCG LEDs

Label	Color	State	Description
OK	Green	On steadily	The CCG is online and is functioning normally.
	–	Off	The CCG is not online or is not powered on.
FAIL	Yellow	On steadily	The CCG has detected a failure.
	–	Off	The CCG has not detected a failure or is not powered on.
MASTER	Blue	On steadily	The CCG is functioning as the primary.
	–	Off	The CCG is functioning as the backup or is not powered on.

Table 12: CCG Port LEDs

Label	Color	State	Description
LINK **NOTE**: The **LINK** LEDs are supported only for the BITS ports. This LED is not supported for the GPS ports.	Green	On steadily	BITS signal is detected.
	Yellow	On steadily	BITS loss of signal
	–	Off	There is no loss of signal, no signal is detected.
FAULT	Yellow	On steadily	The CCG has detected a failure.
	–	Off	The CCG has not detected a failure or is not powered on.

SEE ALSO

Troubleshooting the PTX5000 Centralized Clock Generators | 548

RELATED DOCUMENTATION

Maintaining the PTX5000 Chassis | 298

PTX5000 Cooling System

IN THIS SECTION

Fan Trays

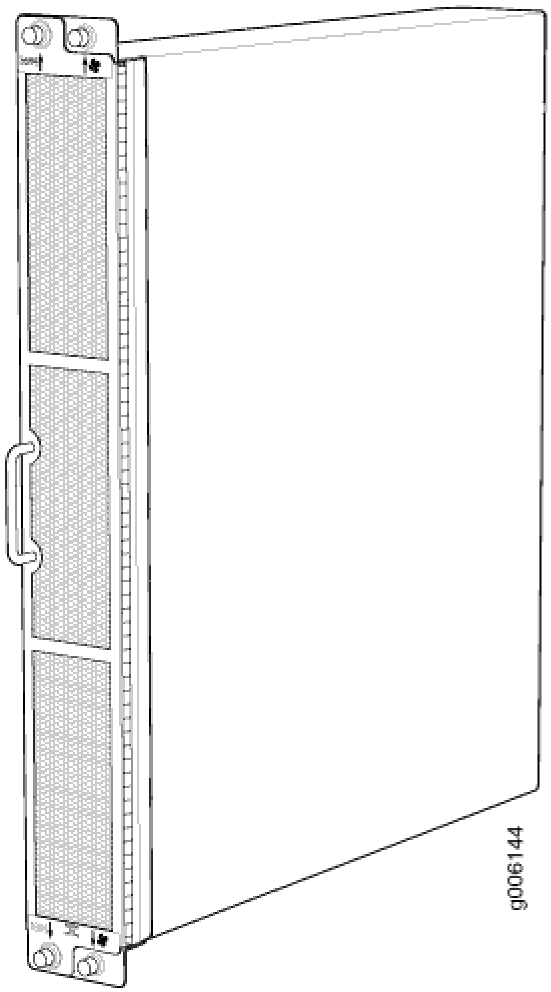
The PTX5000 cooling system components work together to keep all components within the acceptable temperature range. If the maximum temperature specification is exceeded and the system cannot be adequately cooled, the Routing Engine shuts down some or all of the hardware components. If a fan fails or the temperature rises above the temperature thresholds, the speed of the remaining fans in the zone is automatically adjusted to keep the temperature within the acceptable range.

All fan trays are hot-insertable and hot-removable.

The cooling system contains the following fan trays:

- Cooling zone 0—One vertical fan tray (**Fan Tray 0**) with fourteen fans cools the following components installed in the rear card cage: Routing Engines, Control Boards, and SIBs. The vertical fan tray is not interchangeable with the horizontal fan trays. The fans in the **Fan Tray 0** are set to a default speed of 21% of maximum speed.

Figure 11: Vertical Fan Tray



- Cooling zone 1—The upper **Fan Tray 1** and lower **Fan Tray 2** horizontal fan trays, each of which contain six fans, cool the components installed in the front card cage (FPCs and PICs), and the CCGs. Both horizontal fan trays are interchangeable with each other.

  Cooling zone 1 has two sections:

  - Cooling zone 1 section 1 cools FPCs 0 through 4.

  - Cooling zone 1 section 2 cools FPCs 3 through 7.

  > **NOTE**: FPCs 3 and 4 can be cooled by either cooling zone 1 section.

  When FPCs are installed in a section, the software sets the fan speeds according to the temperature. When no FPCs are installed in cooling zone 1 section 1, the left fans in the horizontal fan trays in cooling zone 1 are set to 34% of maximum speed. When no FPCs are installed in cooling zone 1 section 2, the right fans in the horizontal fan trays in cooling zone 1 are set to 34% of maximum speed.

Figure 12: FAN-PTX-H Horizontal Fan Tray

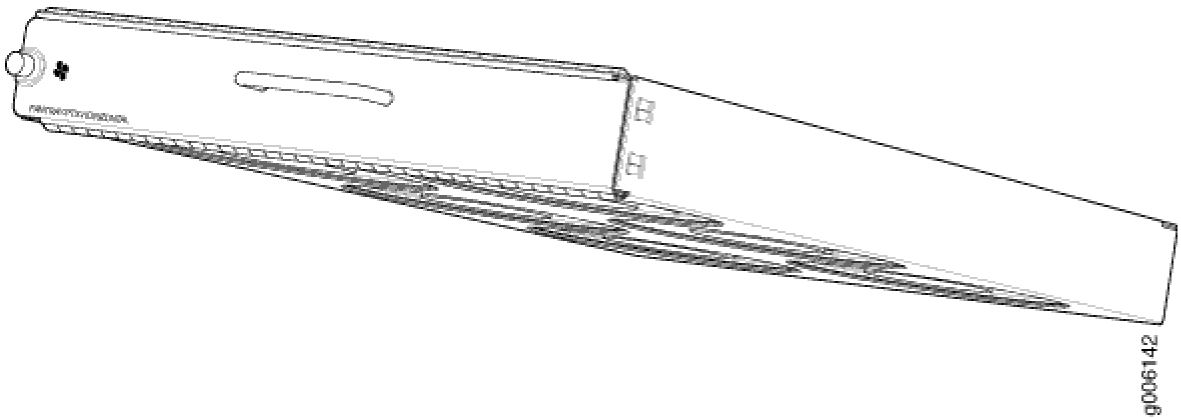
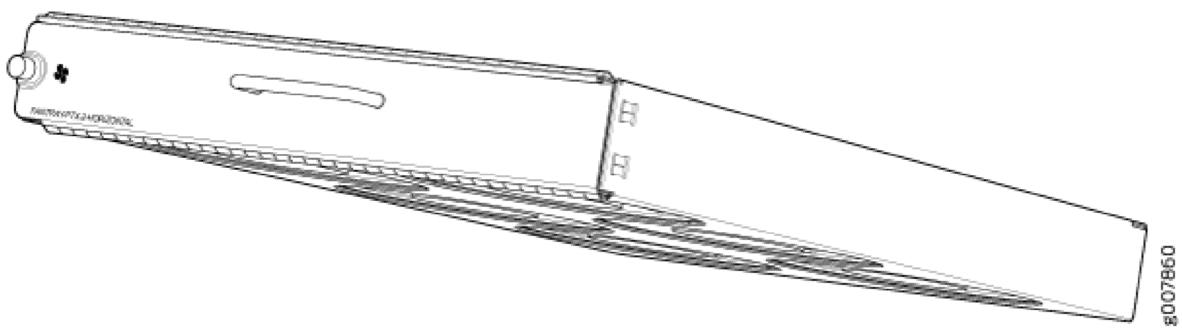


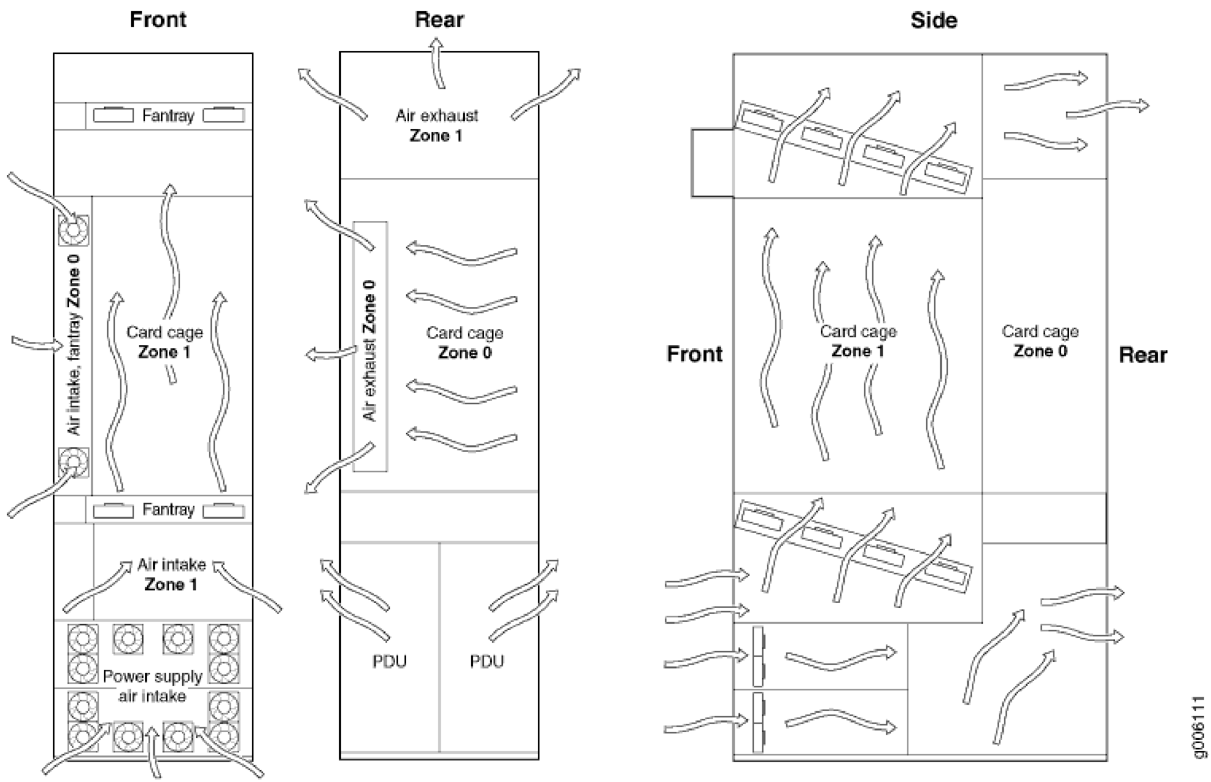
Figure 13: FAN3-PTX-H Horizontal Fan Tray



Airflow

Figure 14 on page 34 shows the airflow through the PTX5000.

Figure 14: Airflow Through the Chassis

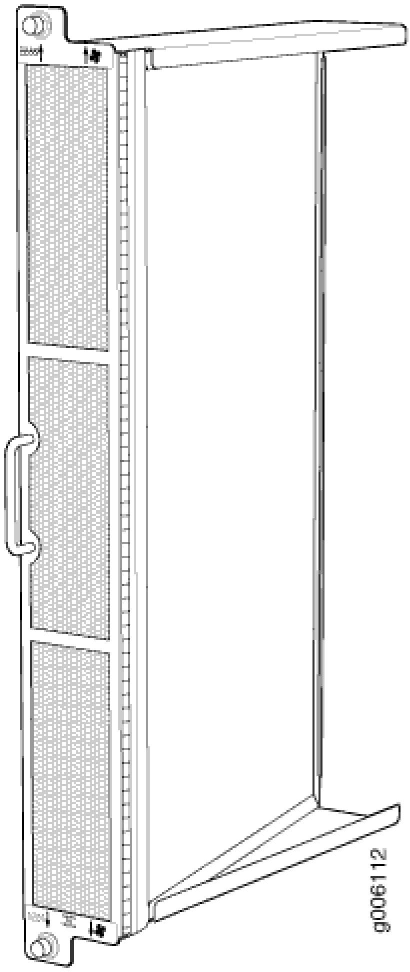


Air Filters

The cooling system contains three air filters:

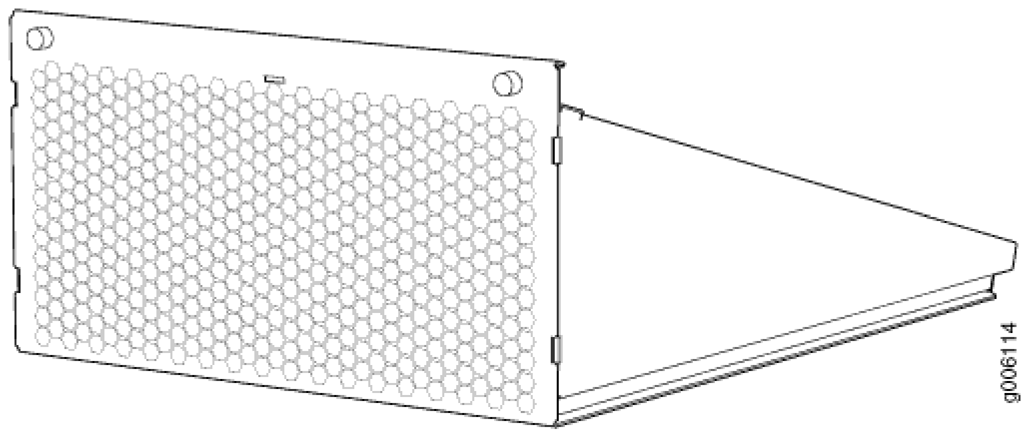
- One air filter is located inside the vertical fan tray (Figure 15 on page 35).

Figure 15: Vertical Fan Tray Air Filter



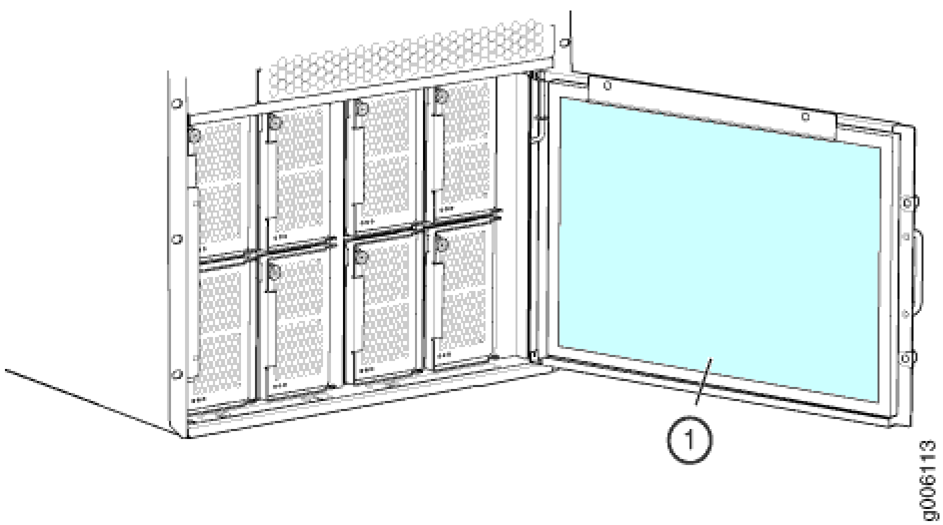
- One air filter is located below the lower horizontal fan tray (Figure 16 on page 36).

Figure 16: Horizontal Fan Tray Air Filter



- One air filter is located inside the door for the power supply modules (Figure 17 on page 36).

Figure 17: PSM Door Air Filter



All air filters are hot-insertable and hot-removable.

Power Supplies

Each DC power supply module contains two fans that cools that PSM. The power distribution units are also cooled by the fans in the PSMs.

RELATED DOCUMENTATION

PTX5000 Clearance Requirements for Airflow and Hardware Maintenance | 157
Maintaining the PTX5000 Cooling System | 308
Troubleshooting the PTX5000 Cooling System | 551

PTX5000 AC Power System

IN THIS SECTION

PTX5000 AC Power System Description

IN THIS SECTION

AC PDUs Supported on the PTX5000

The PTX5000 supports the AC PDUs in Table 13 on page 38.

NOTE: Ensure that you use AC PDUs of the same model number during normal operation.

Table 13: AC PDUs Supported on the PTX5000

Name	Model Number	First Supported Junos OS Release
Delta AC PDU	PDU-PTX-AC-D	12.3
Wye AC PDU	PDU-PTX-AC-W	12.3
High Capacity Delta AC PDU	PDU2-PTX-AC-D	14.2
High Capacity Wye AC PDU	PDU2-PTX-AC-W	14.2
High Capacity Single-Phase AC PDU	PDU2-PTX-AC-SP	15.1F3, 16.1

PTX5000 Normal Capacity Delta and Wye AC PDUs

Normal Capacity Three-Phase Delta AC PDU Components

Each normal-capacity three-phase delta AC PDU has the following components (see Figure 18 on page 40):

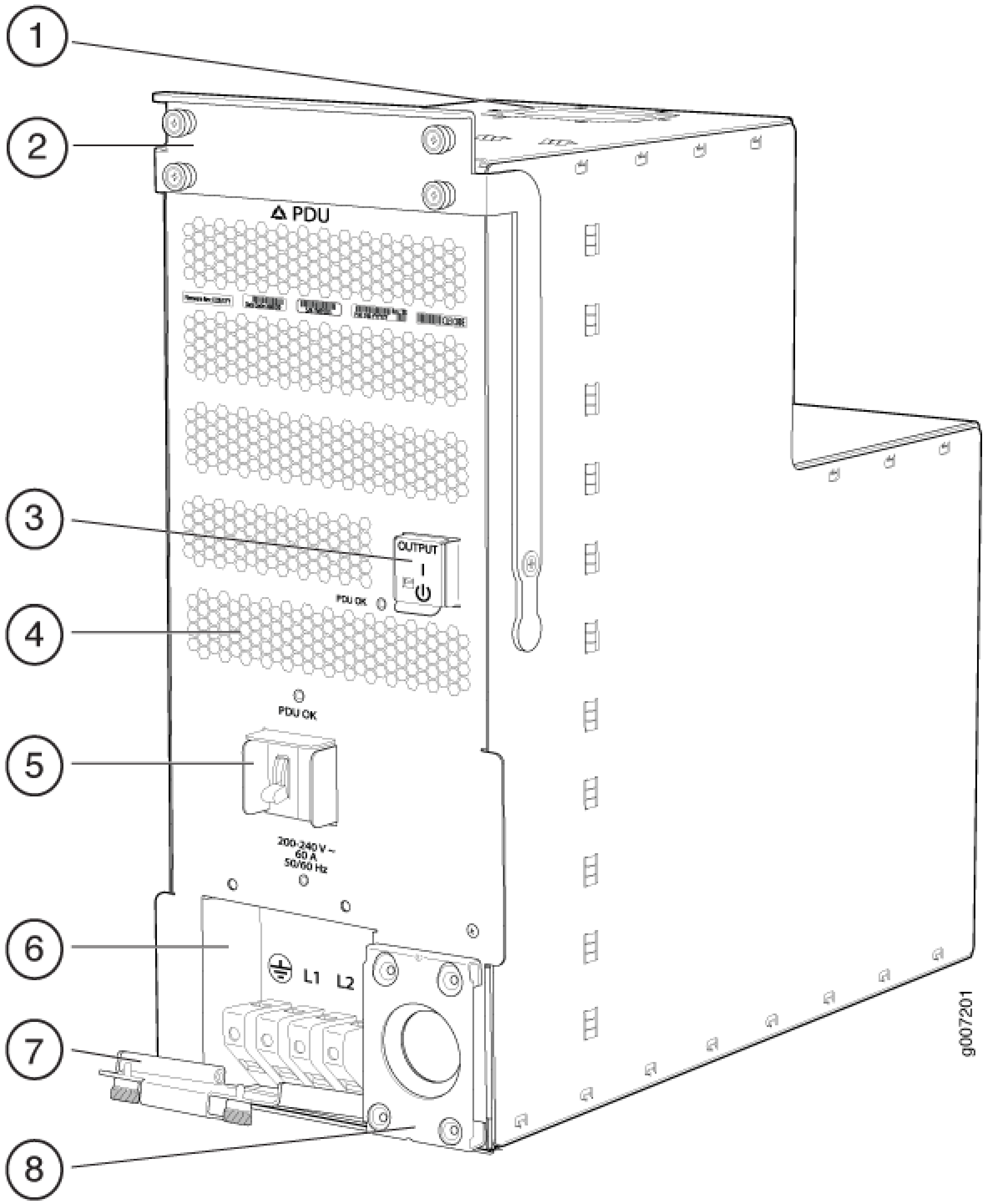
- A metal retaining bracket located on the lower right to connect the delta AC power cord to the PDU.

- A metal wiring compartment that contains the AC input terminal block and ground. The AC terminal block consists of three input terminals labeled **L1**, **L2**, and **L3**.
- One 60-A circuit breaker
- A power **OUTPUT** switch that provides power to the PSMs.
- LEDs to monitor the status of the PDU.
- Twenty-one monitored electronic fuses for the fan trays, Control Boards, and FPCs.

  NOTE: There are no mechanical fuses in the PDU to be replaced. For output voltage, current protection is provided by electronic fuses, hot-swap circuits, or ORing circuit. Electronic fuses and hot-swap circuits also provide current limitation.

NOTE: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

Figure 18: Three-Phase Delta AC PDU



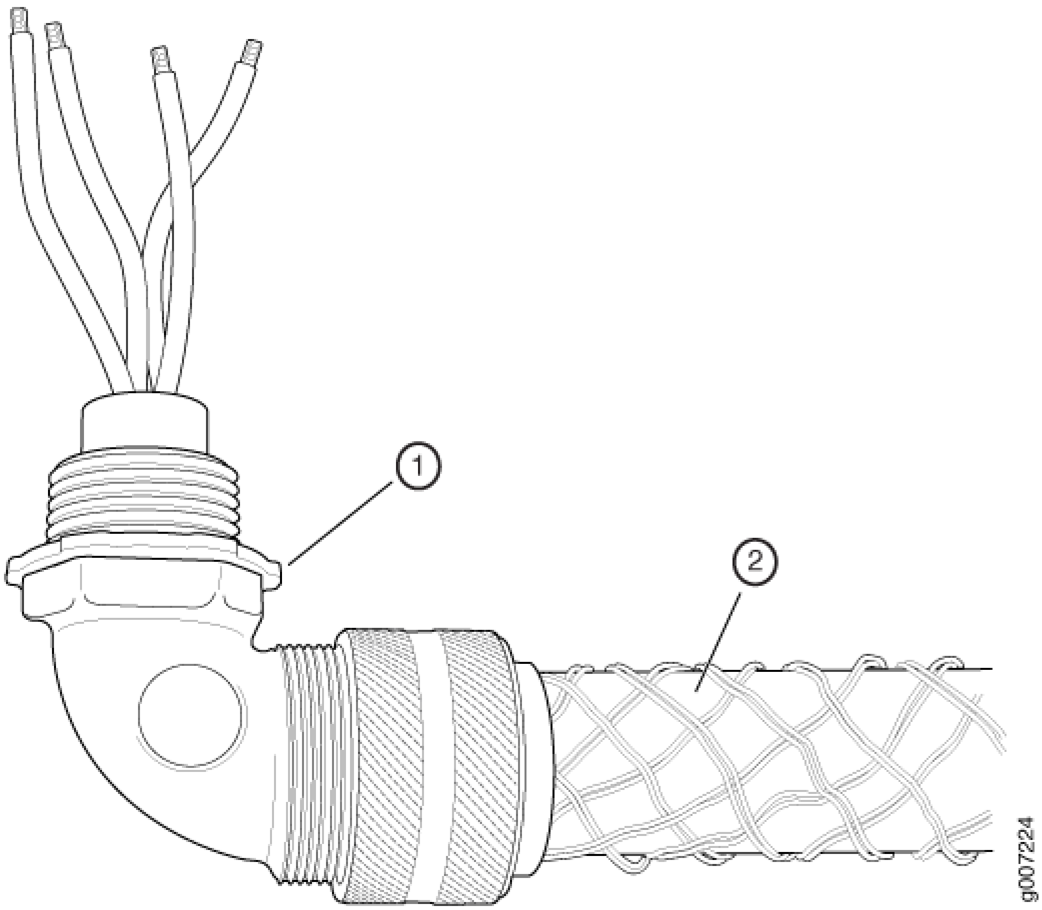
1– Top Installation handle	5– Circuit breaker
2– Front installation handle	6– Wiring compartment
3– Power **OUTPUT** switch	7– Wiring compartment door

4– Air exhaust ventilation	8– Metal retaining bracket

Each three-phase delta AC PDU weighs approximately 51.2 lb (23.2 kg).

Figure 19 on page 41 shows the three-phase delta AC power cord.

Figure 19: Three-Phase Delta AC Power Cord



1– Retaining nut	2– Three-phase delta AC power cord

Normal Capacity Three-Phase Wye AC PDU Components

Each normal-capacity three-phase wye AC PDU has the following components (Figure 20 on page 43):

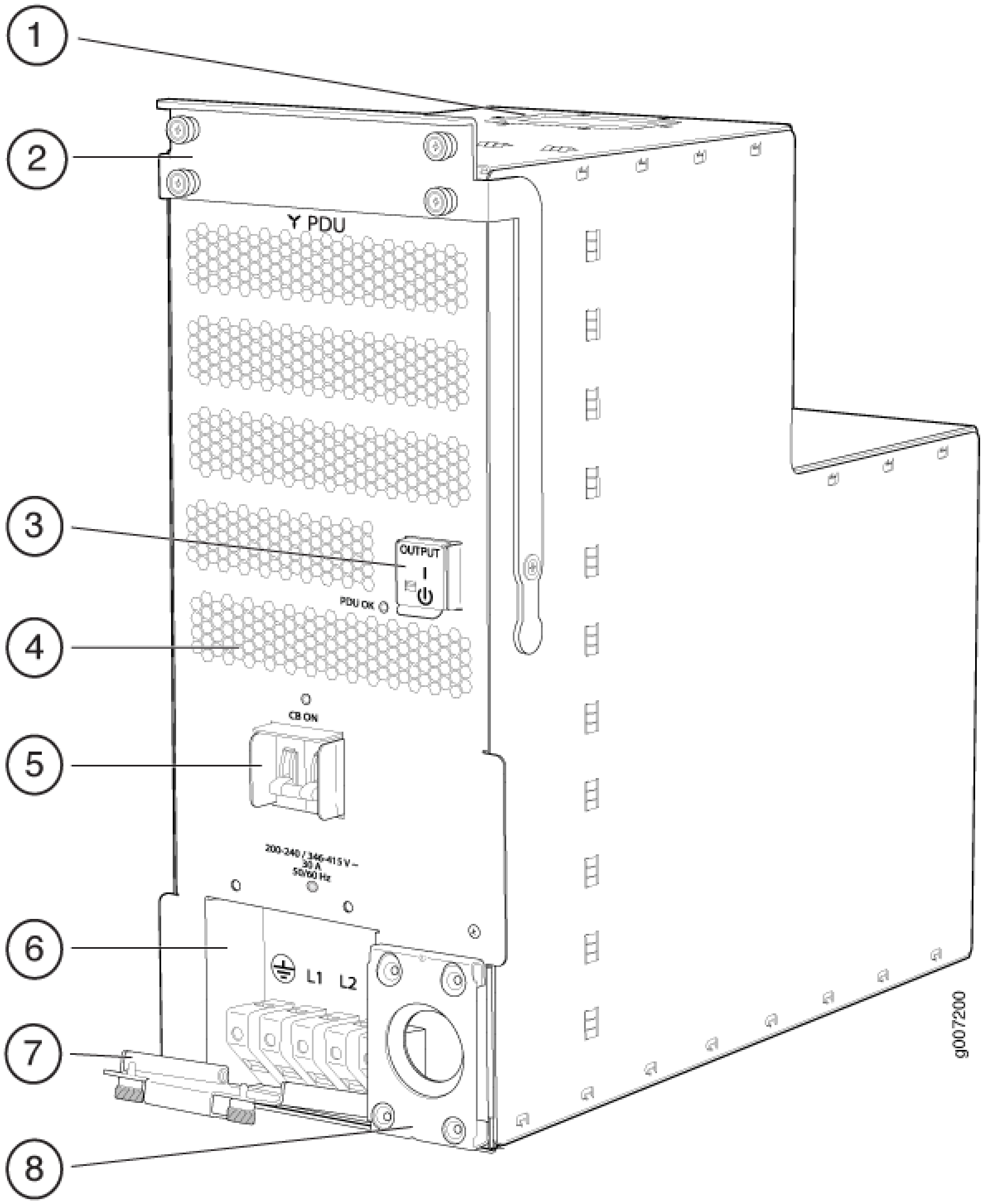
- A metal bracket located on the lower right to connect the wye AC power cord to the PDU.
- A metal wiring compartment that contains the AC input terminal block and ground. The AC terminal block consists of three input terminals labeled **L1**, **L2**, and **L3**, from left to right. The neutral input is labeled **N**.

- One 32-A circuit breaker.
- A power **OUTPUT** switch provides power to the PSMs.
- LEDs to monitor the status of the PDU.
- Twenty-one monitored electronic fuses for the fan trays, Control Boards, and FPCs.

  NOTE: There are no mechanical fuses in the PDU to be replaced. For output voltage, current protection is provided by electronic fuses, hot-swap circuits, or ORing circuit. Electronic fuses and hot-swap circuits also provide current limitation.

NOTE: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

Figure 20: Three-Phase Wye AC PDU



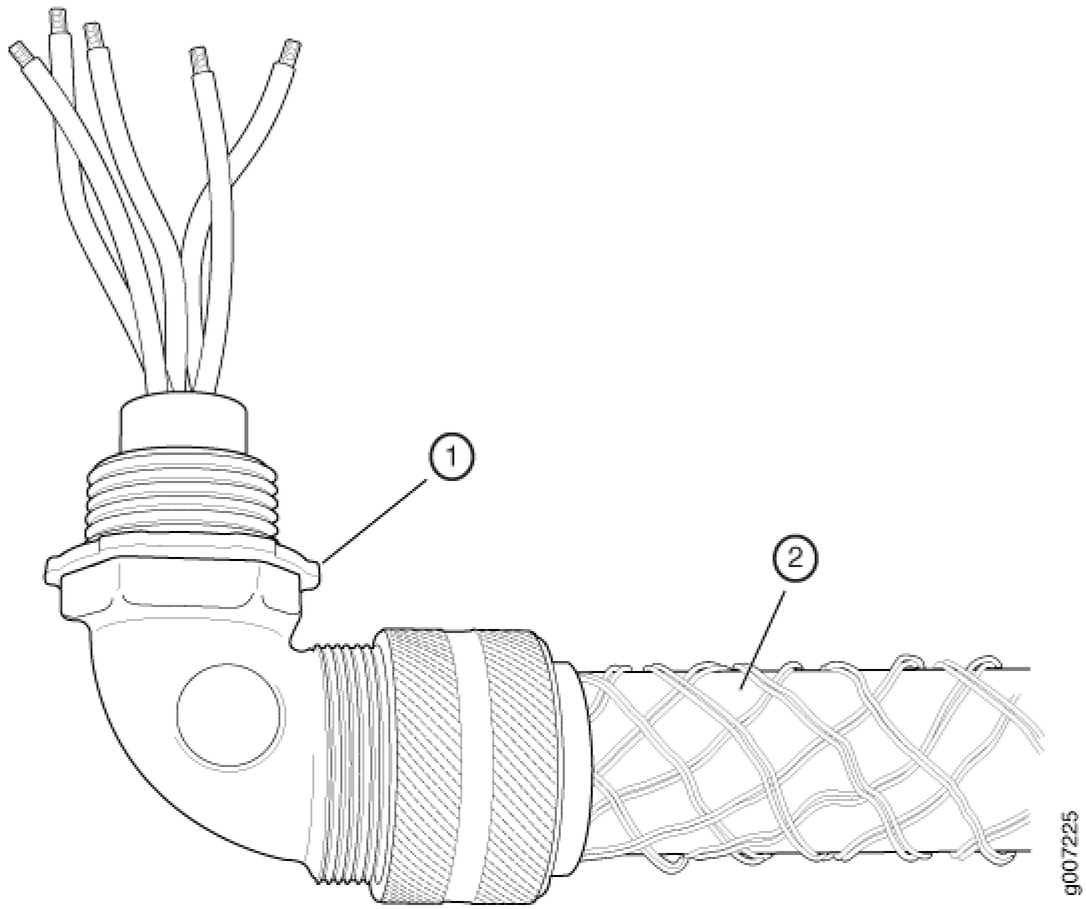
1– Top Installation handle	5– Circuit breaker
2– Front installation handle	6– Wiring compartment
3– Power **OUTPUT** switch	7– Wiring compartment door

4– Air exhaust ventilation	8– Metal retaining bracket

Each three-phase wye AC PDU weighs approximately 51.2 lb (23.2 kg).

Figure 21 on page 44 shows the three-phase wye AC power cord.

Figure 21: Three-Phase Wye AC Power Cord



1– Retaining nut	2– Three-phase wye AC power cord

PTX5000 High Capacity Delta and Wye AC PDU

The High Capacity AC Delta and Wye AC PDUs support the following features:

- Up to eight PSMs are installed for each PDU. Each High Capacity Delta AC PDU requires a 60-A, 100-A, or 150-A feed, and each High Capacity Wye AC PDU requires a 63-A feed.
- Operates from 180 VAC through 305 VAC.
- I2C bus protocol fault reporting and control.

- Front-to-back airflow direction.
- Single output enable or disable switch to switch on or switch off the output of the PDU.
- Reverse polarity protection—The PDU or PSMs are not damaged even if the input voltage is reversed for an indefinite period of time.
- Hot-pluggable and hot-removable.
- No power zoning for PSMs.

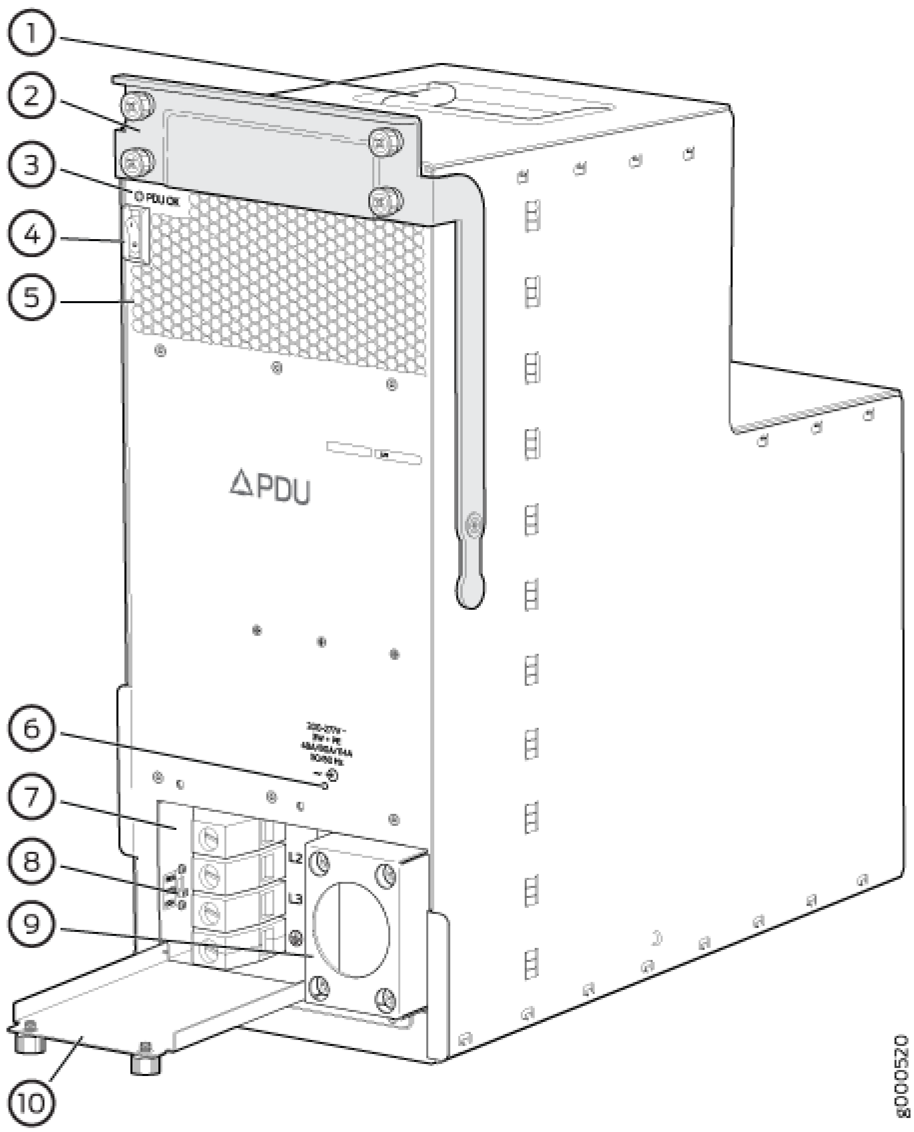
High Capacity Delta AC PDU Components

Each High Capacity Delta AC PDU has the following components (see Figure 22 on page 46):

- A metal retaining bracket located on the lower right to connect the delta AC power cord to the PDU.
- A metal wiring compartment that contains the AC input terminal block and ground. The AC terminal block consists of three input terminals labeled **L1**, **L2**, and **L3**.
- A power input cord selection switch inside the wiring compartment to select the input power to the PDU—that is, 60 A, 100 A, or 150 A.
- The power switch provides power to the power supply modules.
- LEDs to monitor the status of the PDU.

NOTE: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

Figure 22: High Capacity Delta AC PDU

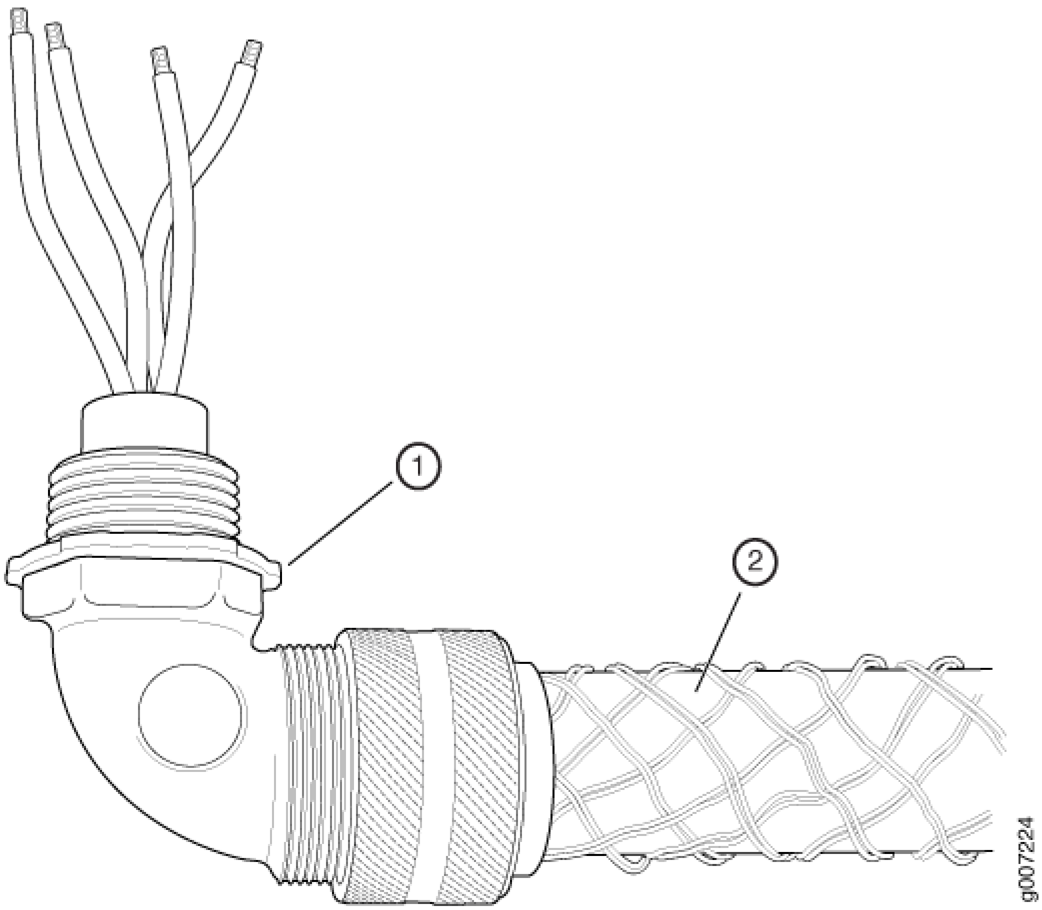


1– Top installation handle	6– Input voltage LED
2– Front installation handle	7– Wiring compartment
3– **PDU OK** LED	8– Power input cord selection switch
4– Power switch labeled (|) for the on position and (⏻) for the standby position.	9– Metal retaining bracket
5– Air exhaust ventilation	10– Wiring compartment door

Each High Capacity Delta AC PDU weighs approximately 63.3 lb (28.7 kg).

Figure 23 on page 47 shows the AC power cord. The High Capacity Delta AC PDU supports three power cords for 60 A, 100 A, and 150 A. See "Connecting Power to the PTX5000 High Capacity Delta AC PDUs" on page 226 for setting the power cord selection switch.

Figure 23: AC Power Cord



1– Retaining nut	2– AC power cord

High Capacity Wye AC PDU Components

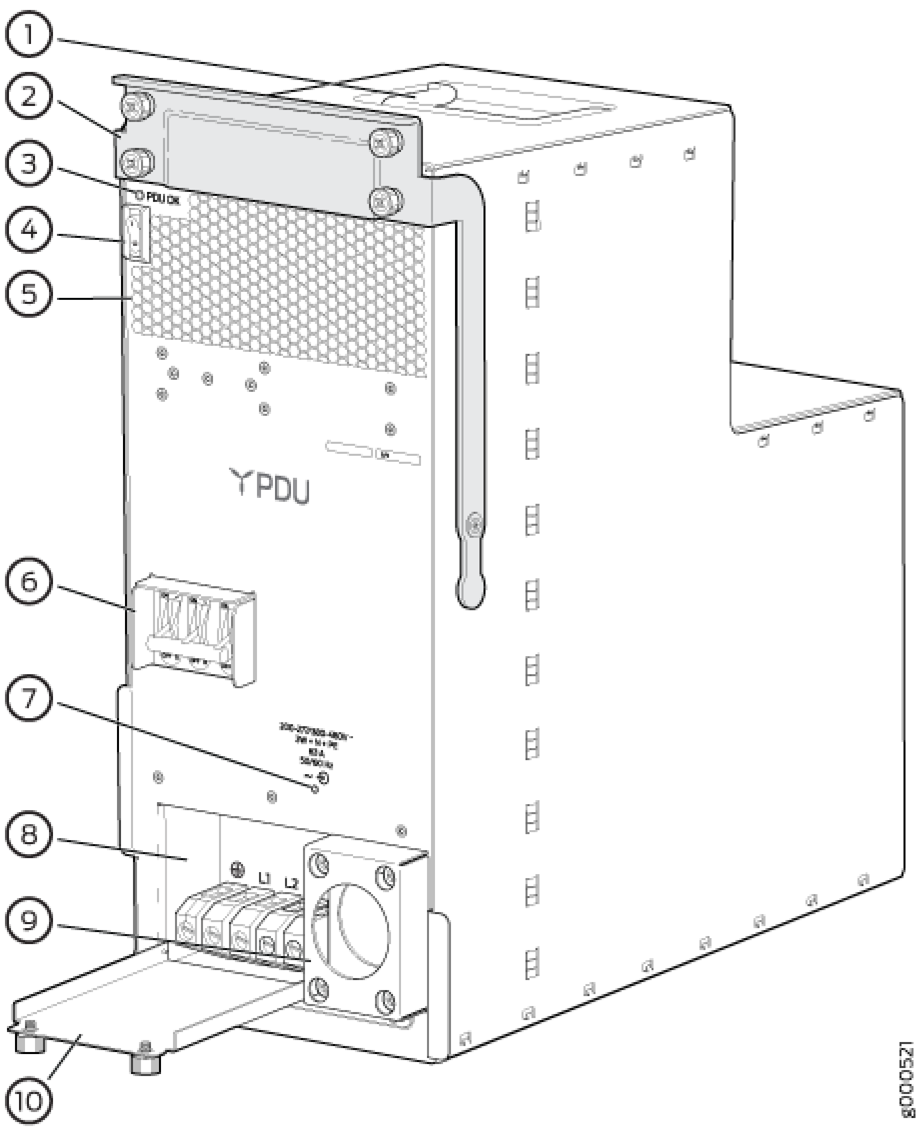
Each High Capacity Wye AC PDU has the following components (Figure 24 on page 48):

- A metal retaining bracket located on the lower right to connect the wye AC power cord to the PDU.
- A metal wiring compartment that contains the AC input terminal block and ground. The AC terminal block consists of three input terminals labeled **L1**, **L2**, and **L3**, from left to right. The neutral input is labeled **N**.
- One 80-A circuit breaker.

- The output power switch provides power to the power supply modules.
- LEDs to monitor the status of the PDU.

> **NOTE**: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

Figure 24: High Capacity Wye AC PDU



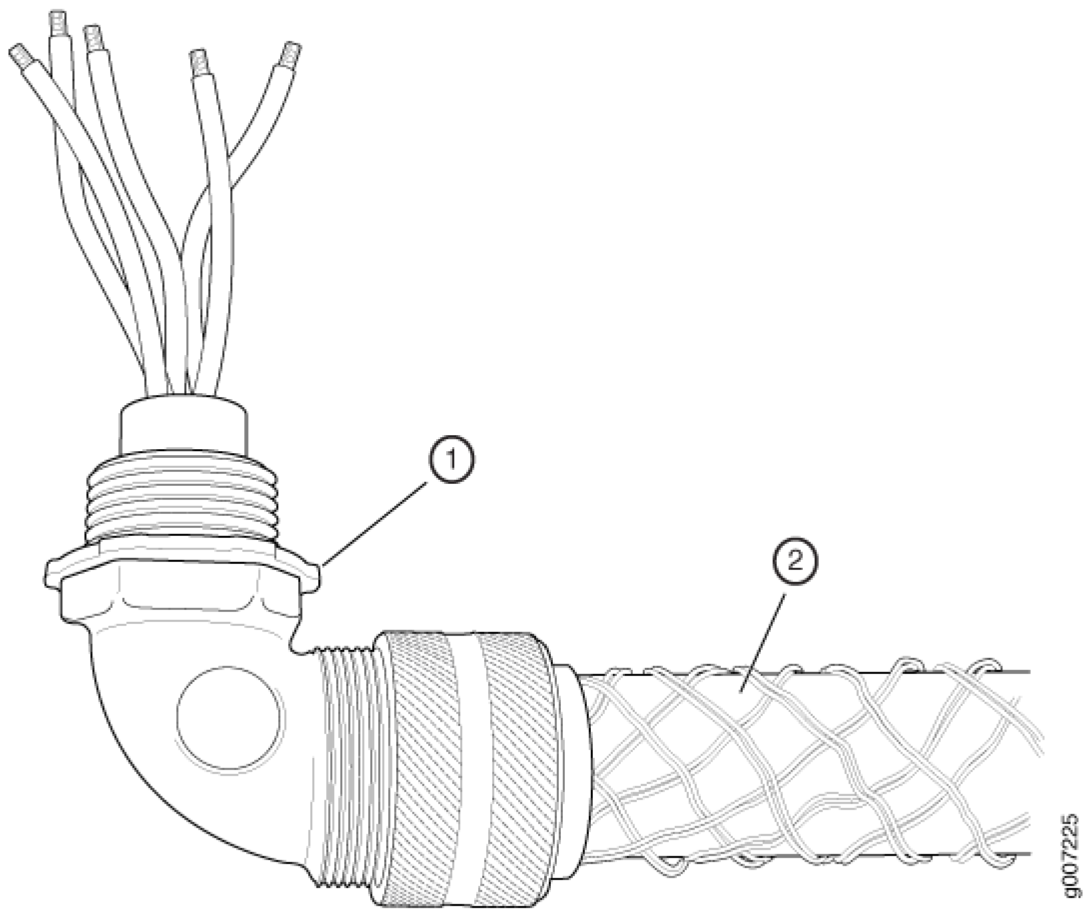
1– Top installation handle	6– Circuit breaker
2– Front installation handle	7– Input voltage LED
3– **PDU OK** LED	8– Wiring compartment

4– Power switch labeled (|) for the on position and (⏻) for the standby position.	9– Metal retaining bracket
5– Air exhaust ventilation	10– Wiring compartment door

Each High Capacity Wye AC PDU weighs approximately 63.3 lb (28.7 kg).

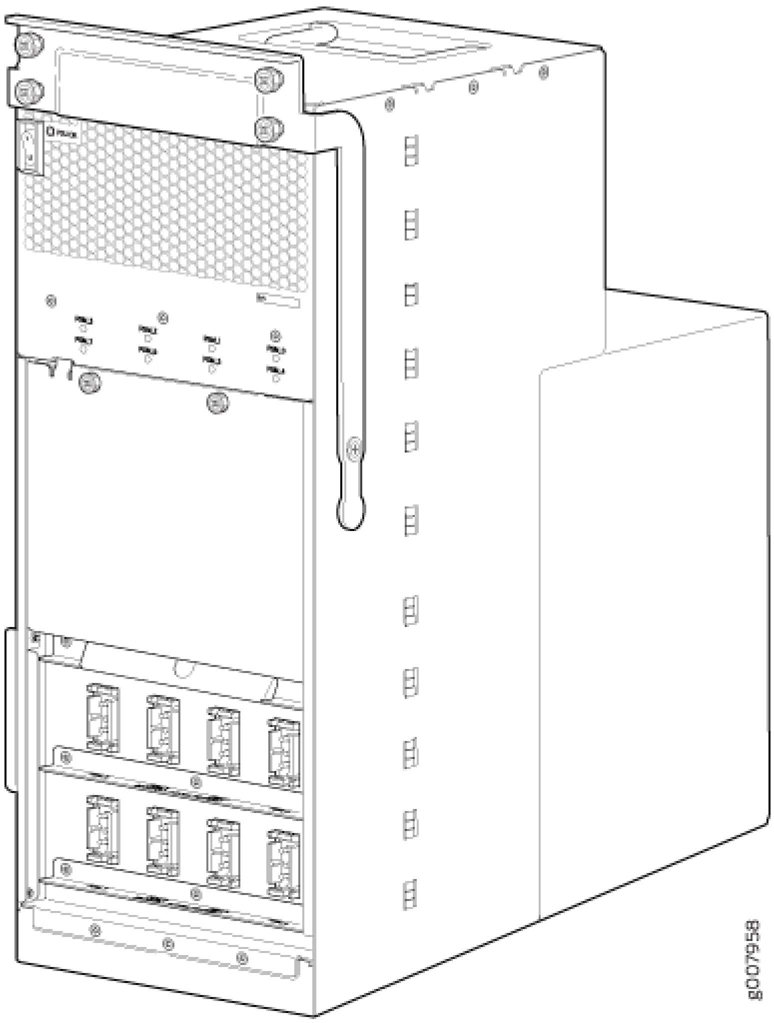
Figure 25 on page 49 shows the power cord for the High Capacity Wye AC PDU.

Figure 25: AC Power Cord



1– Retaining nut	2– AC power cord

PTX5000 High Capacity Single-Phase AC PDU



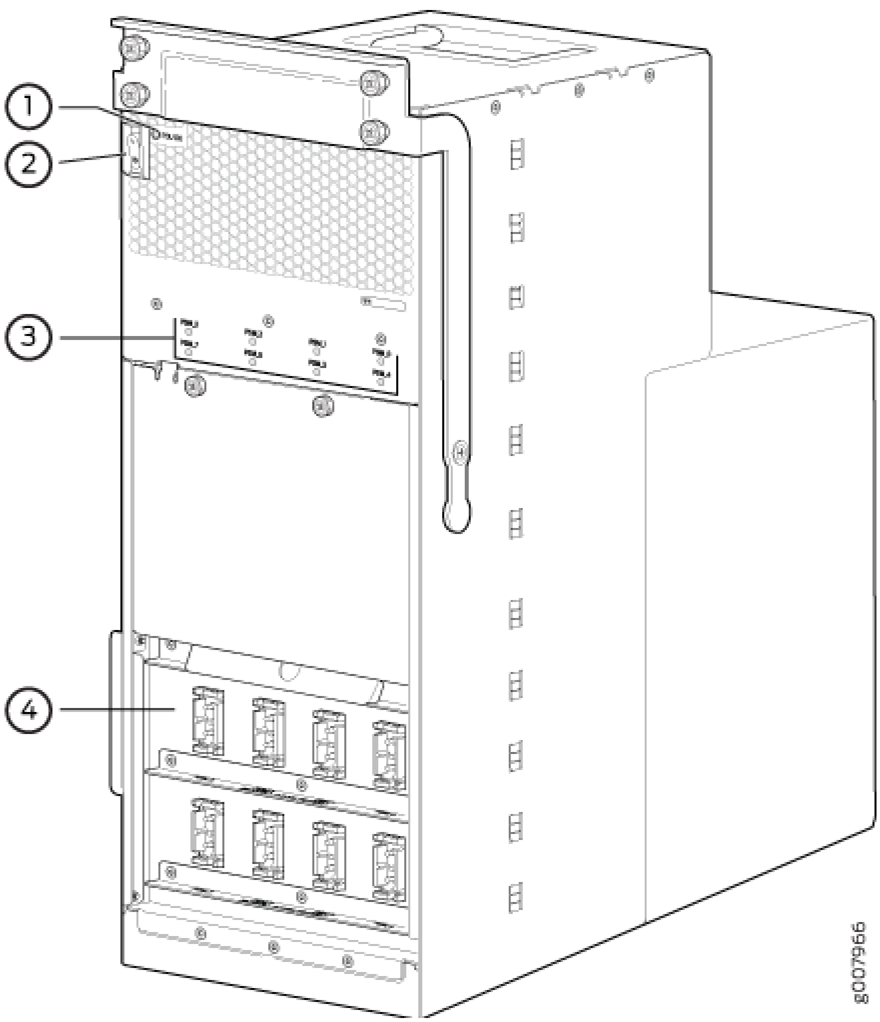
The High Capacity Single-Phase AC PDU supports the following features:

- Supports up to eight high-capacity AC PSMs, each PSM requiresone 30-A or 20-A feed.
- Slidable input bracket to cover 20-A or 30-A connectionswith an built-in switch to indicate to the system which connectionsare active (20-A or 30-A inputs).
- 30.4 KW output power with eight 30-A inputs or 23 KWoutput power with eight 20-A inputs.
- Operates from 200 VAC through 240 VAC.
- I2C bus protocol fault reporting and control.
- Front-to-back airflow direction.
- Single output enable switch to turn ON or Turn OFF theoutput of the PDU.

- Hot-pluggable and hot-removable.
- No power zoning for PSMs.

High Capacity Single-Phase AC PDU Components

Figure 26: High Capacity Single-PhaseAC PDU Components



1– PDU OK LED	3– 20-A/30-A Power cord input connectors
2– Output-Enable switch	4– PSM LEDs

Each High Capacity Single-Phase AC PDU has the following components(Figure 26 on page 51):

- Pluggable single-phase line cords (30-A or 20-A).
- Output enable switch that turns on the PSM output power.

- LED to monitor the status of the PDU.
- LEDs to monitor the status of the PSMs.
- Single 12V output power for the boards and 36V outputpower for the fan trays.

AC PSMs Supported on the PTX5000

The PTX5000 supports the AC power supply modules (PSMs) listed in Table 14 on page 52.

NOTE: Ensure that you use AC PSMs of the same model number during normal operation.

Table 14: AC PSMs Supported on the PTX5000

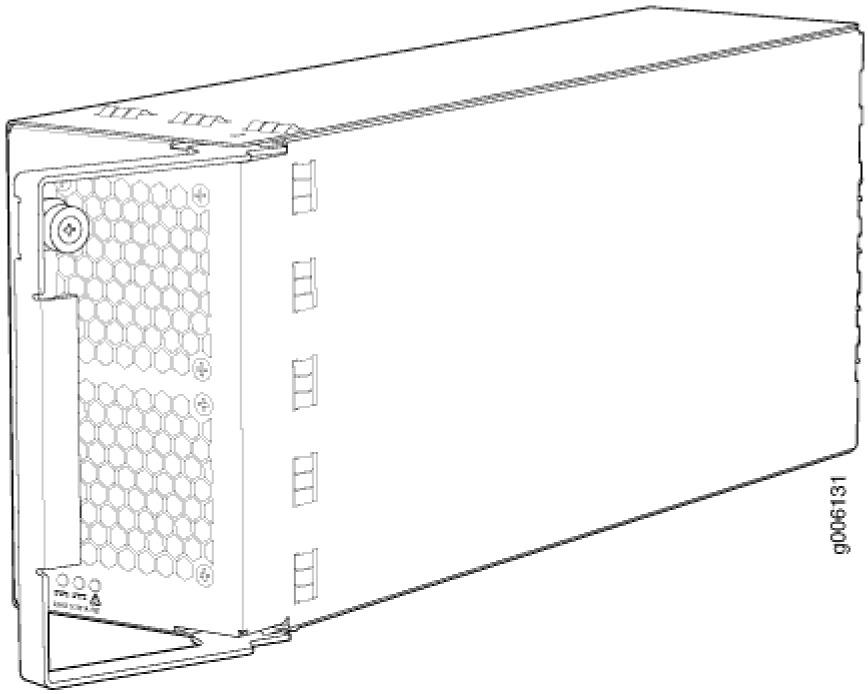
Name	Model Number	First Supported Junos OS Release
AC PSM	PSM-PTX-AC	12.3
High Capacity AC PSM	PSM2-PTX-AC	14.2

PTX5000 Normal Capacity AC PSM

Figure 27 on page 53 shows the AC PSM.

CAUTION: The AC PSMs and DC PSMs are not interchangeable. The AC PSM must be installed in the three-phase delta AC PDU or three-phase wye AC PDU. The High Capacity AC PSM must be installed in the High Capacity Delta AC PDU or High Capacity Wye AC PDU or High Capacity Single-Phase AC PDU. To avoid damaging the connectors on the back of the PSM or inside the PDU, use caution to ensure that you have an AC PSM before installing it in any high-capacity AC PDU.

Figure 27: AC PSM

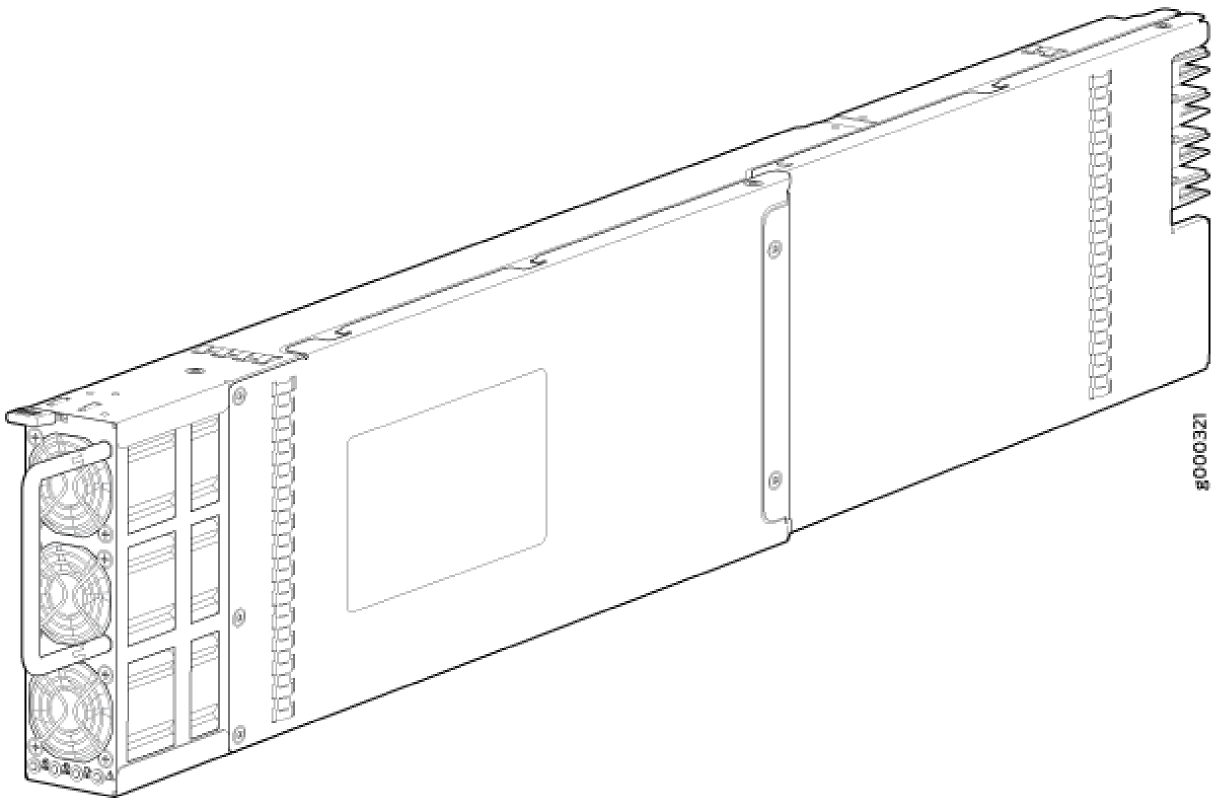


PTX5000 High Capacity AC PSM

Figure 28 on page 54 shows the High Capacity AC PSM. These PSMs are smaller than the normal-capacity PSMs, allowing up to eight PSMs to be installed per PDU, and up to 16 PSMs per chassis.

> **NOTE**: Under light load condition, the High Capacity AC PSMs do not support load balancing and might show very low or zero output current. Light load condition occurs when the average input power to the PSMs is less than 422 W.

Figure 28: High Capacity AC PSM



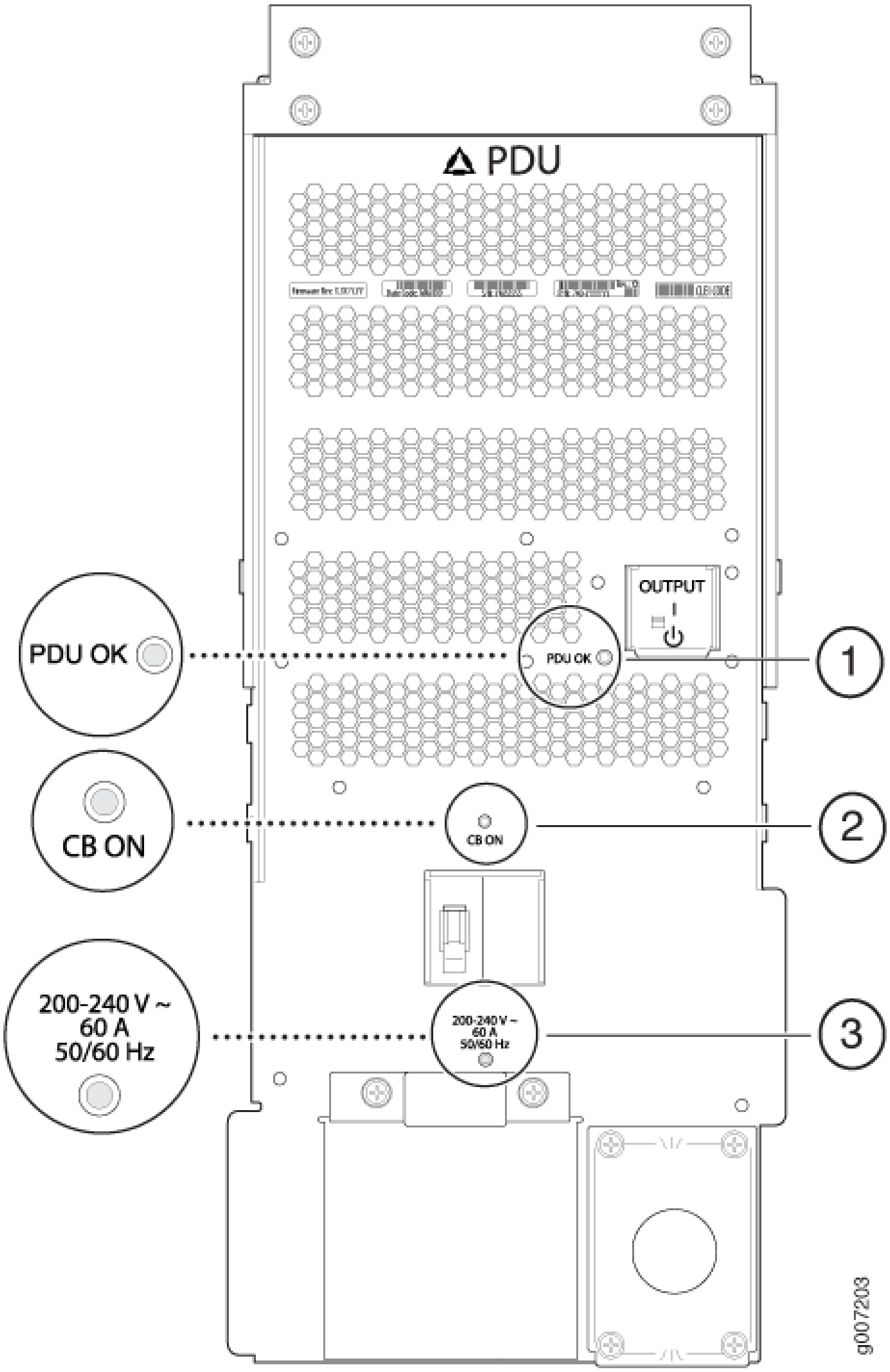
PTX5000 AC Power Distribution Unit LEDs

IN THIS SECTION

Three-Phase Delta AC PDU LEDs

Figure 29 on page 55 shows the three-phase delta AC PDU LEDs.

Figure 29: Three-Phase Delta AC PDU LEDs



1– **PDU OK** LED	3– **200-240 V 60 A 50-60 Hz** LED
2– **CB ON** LED	

Table 15 on page 56 describes the LEDs on the three-phase delta AC PDU faceplate.

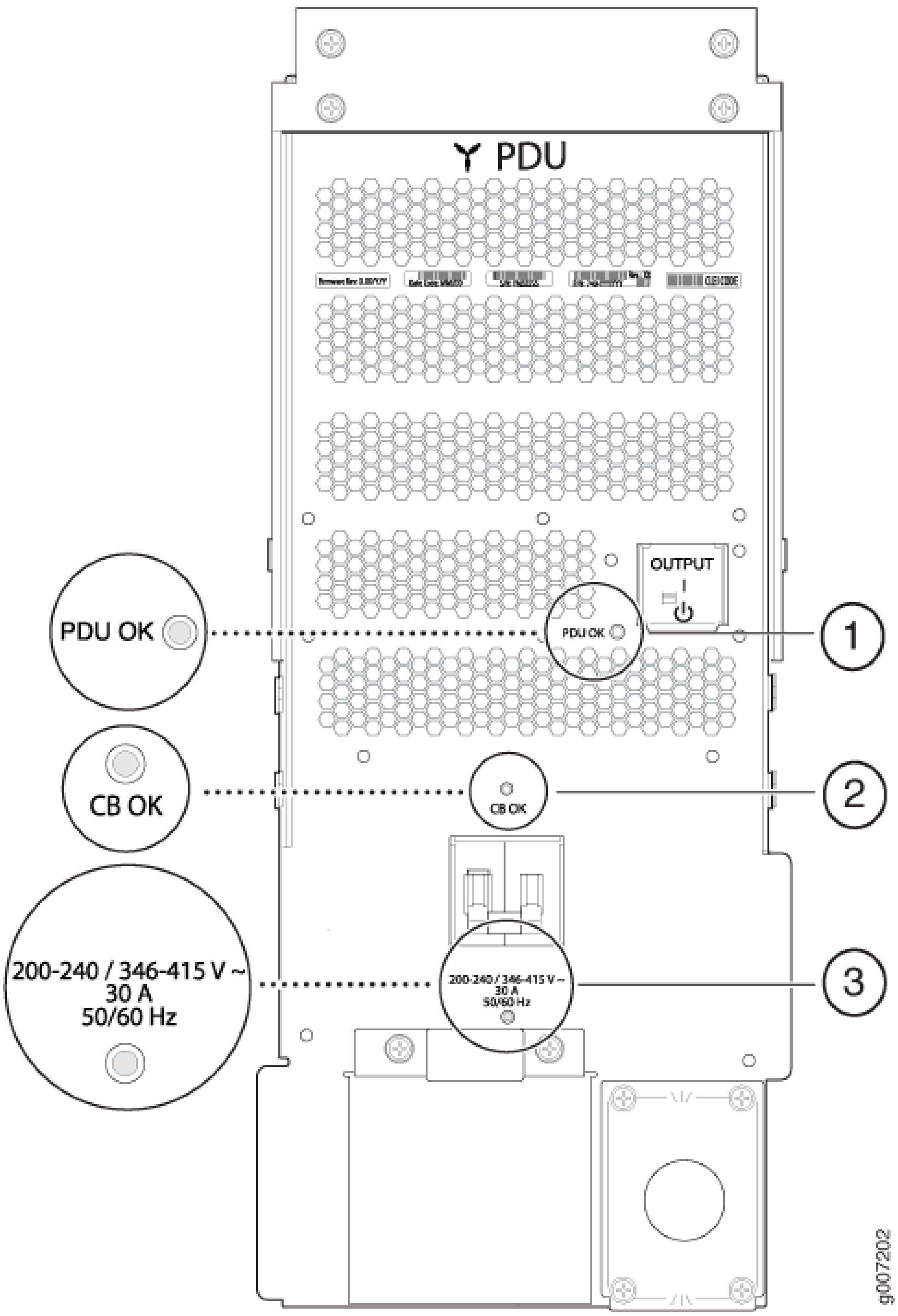
Table 15: Three-Phase Delta AC PDU LEDs

LED	Color	State	Description
PDU OK—One per power supply	Green	On steadily	PDU is functioning normally.
	Red	On steadily	PDU has failed.
	–	Off	This LED can be off for one of the following reasons: • The PDU is not receiving any input voltage. • The circuit breaker might be off. • The PDU is starting up.
200-240 V~ **60 A** **50-60 Hz**	Green	On steadily	Input is receiving voltage.
	–	Off	Input voltage is not present, or is under –100 VAC.
CB ON	Green	On steadily	Circuit breaker is powered on.
	–	Off	This LED can be off for one of the following reasons: • Circuit breaker is not powered on. The circuit breaker might have been turned off, or the host subsystem detected a failure and turned off the circuit breaker. • The PDU is not receiving any input voltage. • The circuit breaker is on but the input voltage is under –100 VAC.

Three-Phase Wye AC PDU LEDs

Figure 30 on page 57 shows the three-phase wye AC PDU LEDs.

Figure 30: Three-Phase Wye AC PDU LEDs



1– PDU OK LED	3– 220-240 V/346-415 V 30 A 50-60 Hz LED
2– CB ON LED	

Table 16 on page 58 describes LEDs on the the three-phase wye AC PDU faceplate.

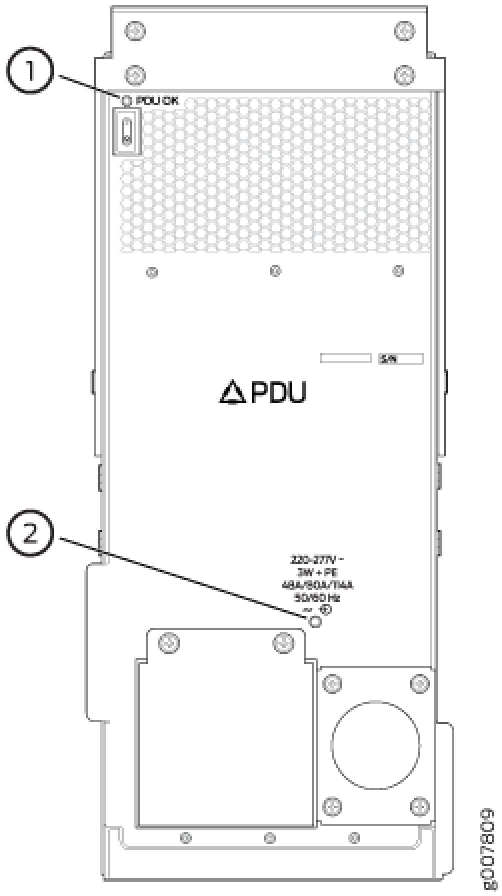
Table 16: Three-Phase Wye AC PDU LEDs

LED	Color	State	Description
PDU OK—One per power supply	Green	On steadily	PDU is functioning normally.
	Red	On steadily	PDU has failed.
	–	Off	This LED can be off for one of the following reasons: • The PDU is not receiving any input voltage. • The circuit breaker might be off. • The PDU is starting up.
220-240 V/346-415 V **30 A** **50-60 Hz**	Green	On steadily	PDU is receiving AC voltage.
	–	Off	AC input voltage is not present, or is under –100 VAC.
CB ON	Green	On steadily	Circuit breaker is powered on.
	–	Off	This LED can be off for one of the following reasons: • Circuit breaker is not powered on. The circuit breaker might have been turned off, or the host subsystem detected a failure and turned off the circuit breaker. • The PDU is not receiving any input voltage. • The circuit breaker is on but the input voltage is under –100 VAC.

High Capacity Delta AC PDU LEDs

Figure 31 on page 59 shows the High Capacity Delta AC PDU LEDs.

Figure 31: High Capacity Delta AC PDU LEDs



1– **PDU OK** LED	2– AC input (~) LED

Table 17 on page 59 describes the LEDs on the High Capacity Delta AC PDU faceplate.

Table 17: High Capacity Delta AC PDU LEDs

LED	Color	State	Description
PDU OK LED	Green	On steadily	PDU is functioning normally.
		Blinking	A 36 V converter fault has occurred, but the 36 V output remains operational.
	Red	On steadily	PDU has failed.

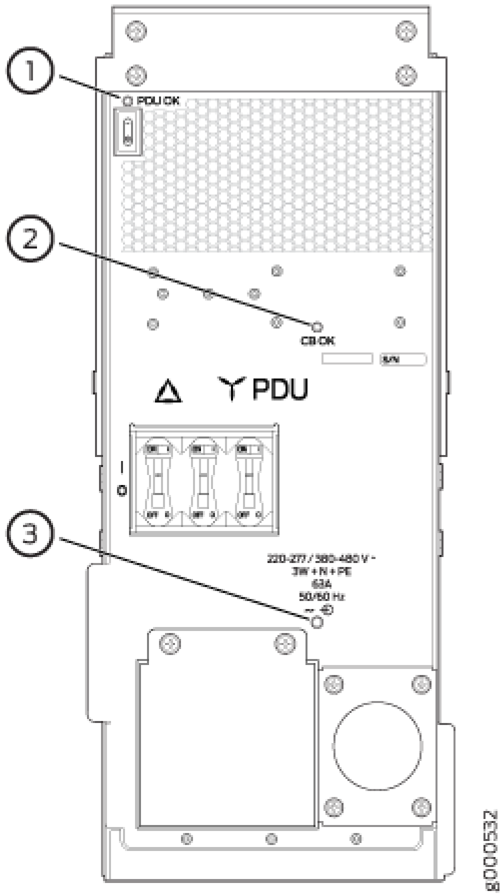
Table 17: High Capacity Delta AC PDU LEDs *(Continued)*

LED	Color	State	Description
	–	Off	This LED can be off for one of the following reasons: • The PDU is not receiving any input voltage. • The PDU is starting up.
AC input (~)	Green	On steadily	PDU is receiving AC voltage.
	–	Off	Input voltage is not present, or is under –100 VAC.

High Capacity Wye AC PDU

Figure 32 on page 61 shows the High Capacity Wye AC PDU LEDs.

Figure 32: High Capacity Wye AC PDU LEDs



1– **PDU OK** LED	3– AC input (~) LED
2– **CB OK** LED	

Table 18 on page 61 describes the LEDs on the High Capacity Wye AC PDU faceplate.

Table 18: High Capacity Wye AC PDU LEDs

LED	Color	State	Description
PDU OK	Green	On steadily	PDU is functioning normally.
		Blinking	A 36 V converter fault has occurred, but the 36 V output remains operational.
	Red	On steadily	PDU has failed.

Table 18: High Capacity Wye AC PDU LEDs *(Continued)*

LED	Color	State	Description
	–	Off	This LED can be off for one of the following reasons: • The PDU is not receiving any input voltage. • The circuit breaker might be off. • The PDU is starting up.
CB OK	Green	On steadily	Circuit breaker is powered on.
	–	Off	This LED can be off for one of the following reasons: • Circuit breaker is not powered on. The circuit breaker might have been turned off manually, or the host subsystem detected a failure and turned off the circuit breaker. • The PDU is not receiving any input voltage. • The circuit breaker is on but the input voltage is under –100 VAC.
AC input (~) LED	Green	On steadily	PDU is receiving AC voltage.
	–	Off	AC input voltage is not present, or is under –100 VAC.

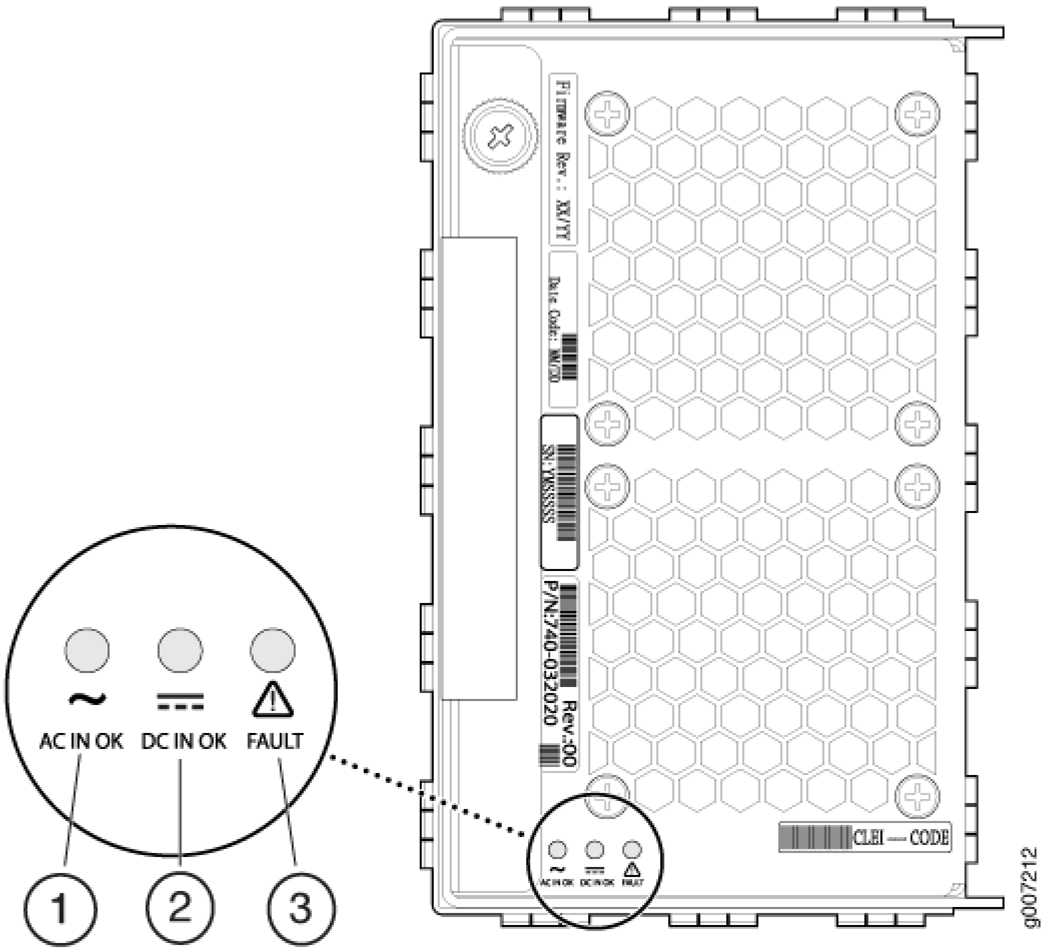
PTX5000 AC Power Supply Module LEDs

IN THIS SECTION

AC Power Supply Module LEDs

Figure 33 on page 63 describes the LEDs on the AC power supply module (PSM) faceplate.

Figure 33: AC PSM LEDs



1– **AC IN OK** LED	3– **FAULT** LED
2– **DC IN OK** LED	

Table 19: AC Power Supply Module LEDs

LED	Color	State	Description
AC IN OK	Green	On steadily	PSM is receiving voltage.

Table 19: AC Power Supply Module LEDs *(Continued)*

LED	Color	State	Description
		Blinking	PSM is receiving voltage outside the supported range.
	–	Off	Input voltage is not present.
DC OUT OK	Green	On steadily	Output is functioning normally, and input voltage is within the supported range.
		Blinking	PSM is not enabled or is in a fault condition, or the input voltage to the PSM is too low.
	–	Off	Output is not functioning normally because of a fault condition or the PSM is not receiving input voltage.
FAULT	Red	On steadily	PSM might be starting up, not properly installed, not receiving sufficient power, or not functioning properly.
	–	Off	No faults have been detected for the PSM, or the PSM is not receiving any input voltage.

High Capacity AC Power Supply Module LEDs

Table 20 on page 65 describes the LEDs on the High Capacity AC power supply module faceplate.

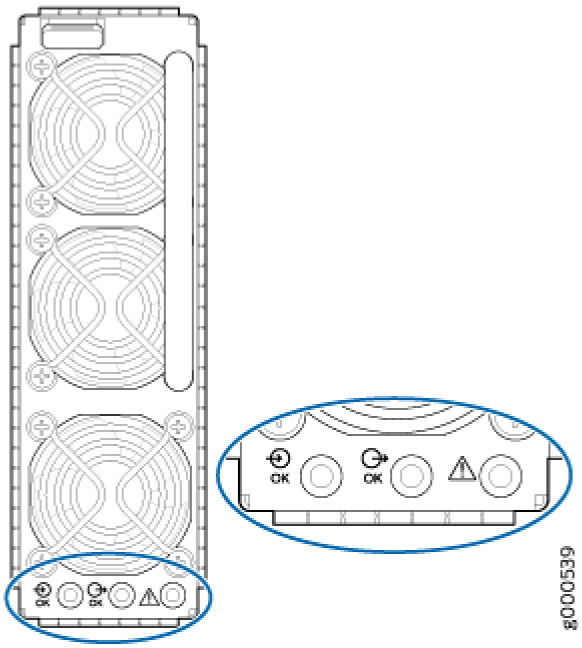


Table 20: High Capacity AC Power Supply Module LEDs

LED	Color	State	Description
AC input **OK**	Green	On steadily	PSM is receiving voltage.
		Blinking	PSM is receiving voltage outside the supported range. The supported range is 180–305 V.
	–	Off	Input voltage is not present.
AC output**OK**	Green	On steadily	Output is functioning normally, and input voltage is within the supported range.
		Blinking	PSM is not enabled or is in a fault condition, or the input voltage to the PSM is too low.
	–	Off	Output is not functioning normally because of a fault condition or the PSM is not receiving input voltage.
Fault (	Red	On steadily	PSM might be starting up, not properly installed, not receiving sufficient power, or not functioning properly.

Table 20: High Capacity AC Power Supply Module LEDs *(Continued)*

LED	Color	State	Description
⚠)	–	Off	No faults have been detected for the PSM, or the PSM is not receiving any input voltage.

PTX5000 AC Power System Specifications

Table 21 on page 66 lists the AC power system electrical specifications.

Table 21: AC Power System Electrical Specifications

Item	Specification
AC input voltage	Delta operating range: 200 through 240 VAC (line-to-line) (nominal) Wye operating range: • 200 through 240 VAC (line-to-neutral) (nominal) • 346 through 415 VAC (line-to-line) (nominal)
AC input line frequency	Delta: 50/60 Hz (nominal) Wye: 50/60 Hz (nominal)
AC system current rating	Delta: 48 A @ 200 VAC (line-to-neutral) Wye: 30 A @ 346 VAC (line-to-line)
AC system input power	Delta: 17,600 W Wye: 17,600 W

PTX5000 Three-Phase Delta AC Power Distribution Unit Specifications

Table 22 on page 67 lists the AC power distribution unit (PDU) electrical specifications.

Table 22: Three-Phase Delta AC PDU Electrical Specifications

Item	Specification
Maximum output power	17,600 W
AC input voltage	Operating range: 200 through 240 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)
AC input current rating	40 A @ 240 VAC (line-to-line) 48 A @ 200 VAC (line-to-line)
Maximum AC input	16,600 W

PTX5000 Three-Phase Wye AC Power Distribution Unit Specifications

Table 23 on page 67 lists the AC power distribution unit (PDU) electrical specifications.

Table 23: Three-Phase Wye AC PDU Electrical Specifications

Item	Specification
Maximum output power	17,600 W
AC input voltage	Operating range: 200 through 240 VAC (line-to-neutral) (nominal) Operating range: 346 through 415 VAC (line-to-line) (nominal)
AC input line frequency	50Hz/60Hz (nominal)

Table 23: Three-Phase Wye AC PDU Electrical Specifications *(Continued)*

Item	Specification
AC input current rating	25 A @ 240 VAC (line-to-neutral) 30 A @ 200 VAC (line-to-neutral)
Maximum AC input	16,600 W

PTX5000 High Capacity Delta AC Power Distribution Unit Specifications

Table 24 on page 68 lists the High Capacity Delta AC power distribution unit (PDU) electrical specifications.

Table 24: High Capacity Delta AC PDU Electrical Specifications

Item	Specification
Maximum output power	30,400 W
AC input voltage	Operating range: 200 through 277 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)
AC input current rating	• For the 60 A power cord, the maximum input current is 48 A @ 200 VAC. Output power is limited to 13.3 kW. • For the 100 A power cord, the maximum input current is 80 A @ 200 VAC. Output power is limited to 22.2 kW. • For the 150 A power cord, the maximum input current is 110 A @ 200 VAC.

PTX5000 High Capacity Wye AC Power Distribution Unit Specifications

Table 25 on page 69 lists the High Capacity Wye AC power distribution unit (PDU) electrical specifications.

Table 25: High Capacity Wye AC PDU Electrical Specifications

Item	Specification
Maximum output power	30,400 W
AC input voltage	Operating range: 200 through 240 VAC (line-to-neutral) (nominal) Operating range: 380 through 415 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)
AC input current rating	For the 63 A power cord, the maximum input current is 58 A @ 220 VAC.

PTX5000 High Capacity Single-Phase AC Power Distribution Unit Specifications

Table 26 on page 69 High Capacity Single-Phase AC power distribution unit (PDU) electrical specifications.

Table 26: High Capacity Single-Phase AC PDU Electrical Specifications

Item	Specification
Maximum output power	23 KW with 20-A inputs or 30.4 KW with 30-A inputs
AC input voltage	Operating range: 200 through 240 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)

Table 26: High Capacity Single-Phase AC PDU Electrical Specifications *(Continued)*

Item	Specification
AC input current rating	16-A maximum for 20-A inputs or 24-A maximum for 30-A inputs

PTX5000 AC Power Cord Specifications

Most sites distribute power through a main conduit that leads to frame-mounted power distribution panels, one of which can be located at the top of the rack that houses the router. An AC power cord connects the power distribution units (PDUs) to the power distribution panel. Detachable AC power cords, each 4.5 m (approximately 14.8 ft) long, are supplied with the router and power distribution units (PDUs). The plug end of the power cord fits into the power source receptacle for your geographical location.

NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.8 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Each AC PDU has a metal wiring compartment that contains the AC terminal block and ground.

- The delta AC terminal block consists of three input terminals labeled **L1**, **L2**, and **L3**, from left to right.
- The wye AC terminal block consists of four input terminals labeled **L1**, **L2**, **L3**, and **N**, from left to right.

Table 27 on page 70 provides specifications for the AC power cords.

Table 27: AC Power Cord Specifications for the Three-Phase AC Power Cords

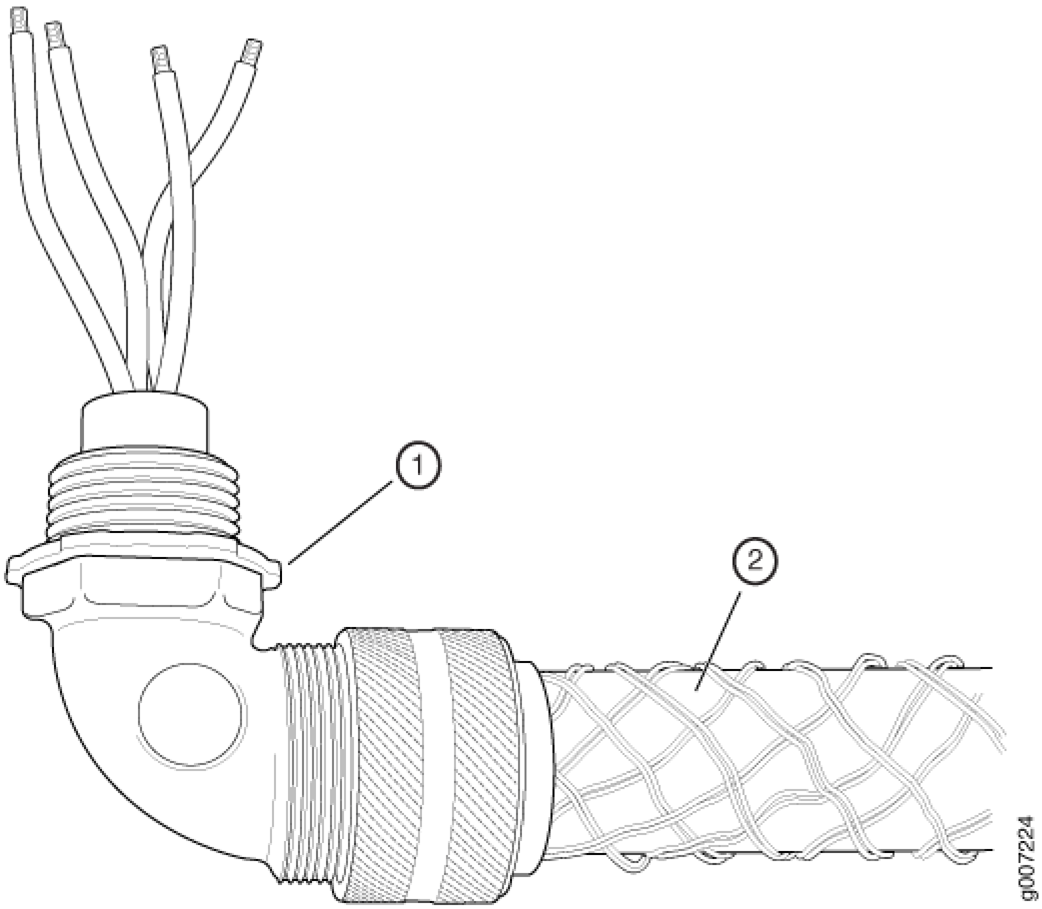
Power Cord	Region	Model Number	Electrical Specification	Plug Type	Wire	Pole
Delta	North America	CBL-PTX-AC-D	60 A @ 250 VAC	IEC60309	4 wires labeled **GND**, **L1**, **L2**, and **L3**	3-pole

Table 27: AC Power Cord Specifications for the Three-Phase AC Power Cords *(Continued)*

Power Cord	Region	Model Number	Electrical Specification	Plug Type	Wire	Pole
		CBL2-PTX-100AC-D	100 A @ 250 V			
		CBL2-PTX-150AC-D	150 A @ 250 A			
Wye	Europe	CBL-PTX-AC-W	32 A @ 400 VAC	IEC60309	5 wires labeled **GND**, **L1**, **L2**, **L3**, and **N**	4-pole
		CBL2-PTX-AC-W-S	63 A @ 400 VAC			

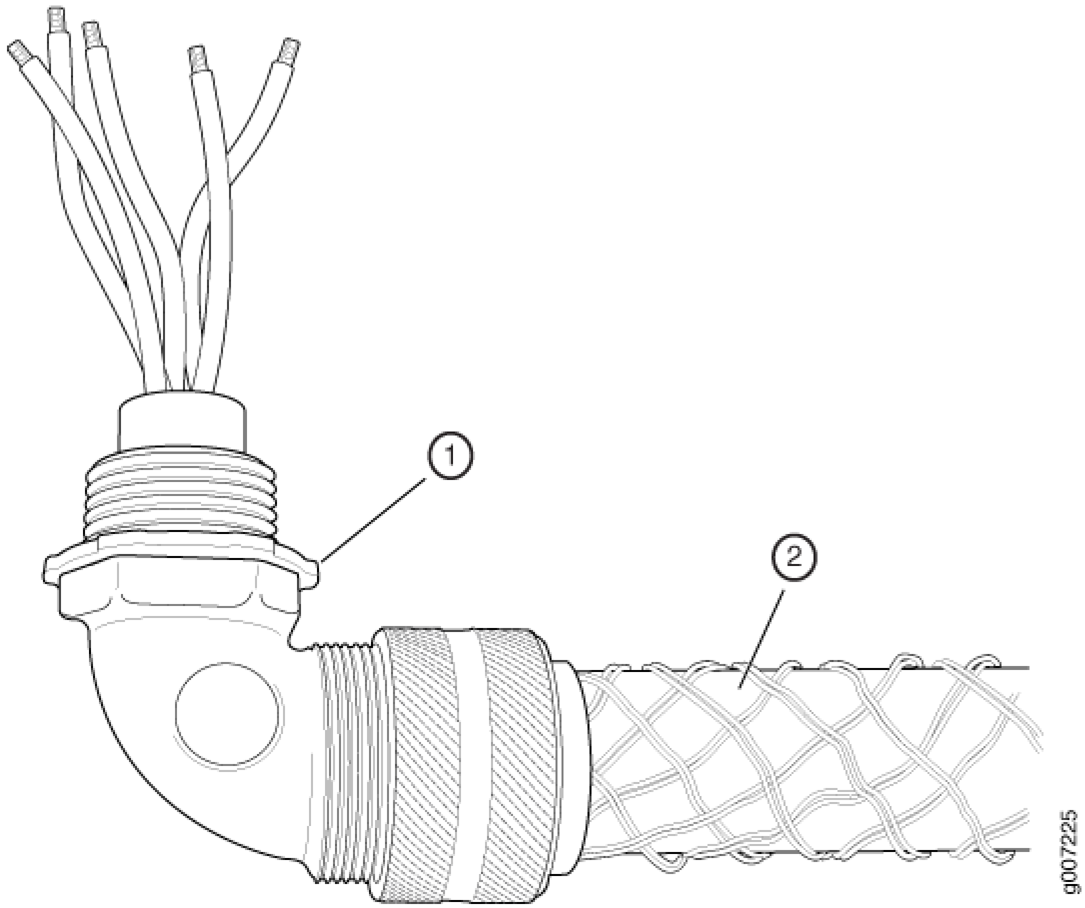
Figure 34 on page 72 and Figure 35 on page 73 show the AC power cord provided for each region supported.

Figure 34: Three-Phase Delta AC Power Cord



1– Retaining nut	2– Three-phase delta AC power cord

Figure 35: Three-Phase Wye AC Power Cord



1– Retaining nut	2– Three-phase wye AC power cord

Figure 36 on page 73 through Figure 40 on page 75 show the three-phase plugs for each region.

Figure 36: Three-Phase Delta 60-A Plug Type (North America)

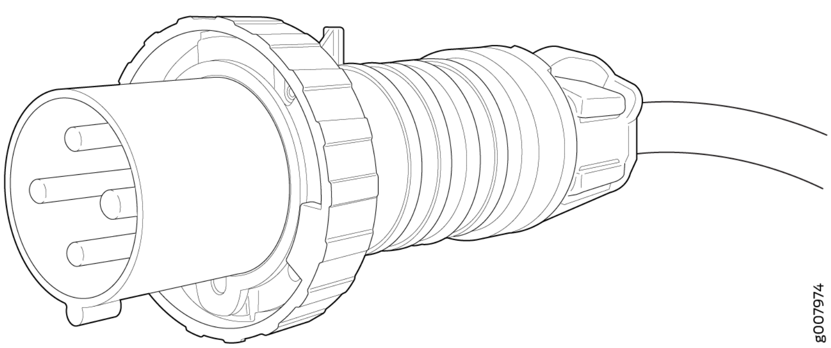


Figure 37: Three-Phase Delta 100-A Plug Type (North America)

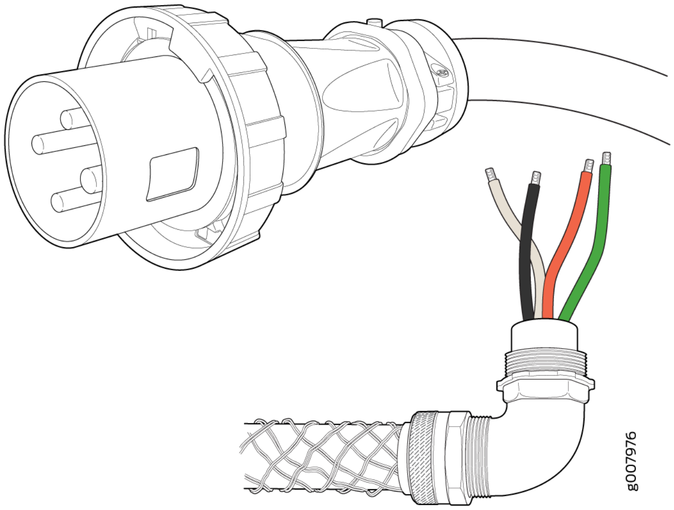


Figure 38: Three-Phase Delta 150-A Plug Type (North America)

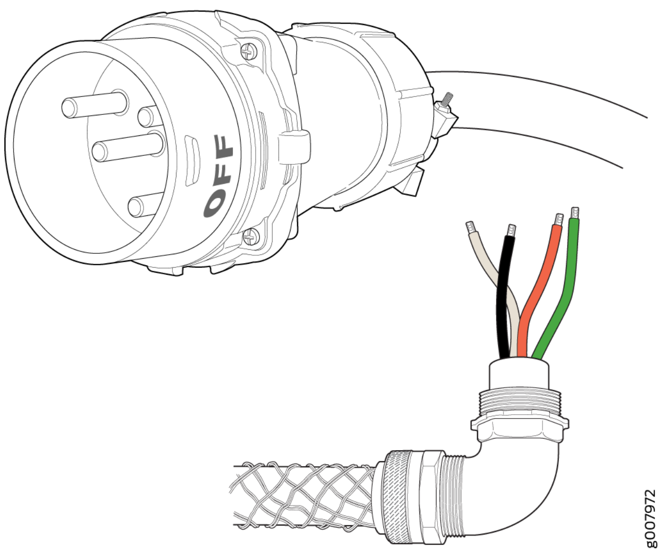


Figure 39: Three-Phase Wye 32-A Plug Type (Europe)

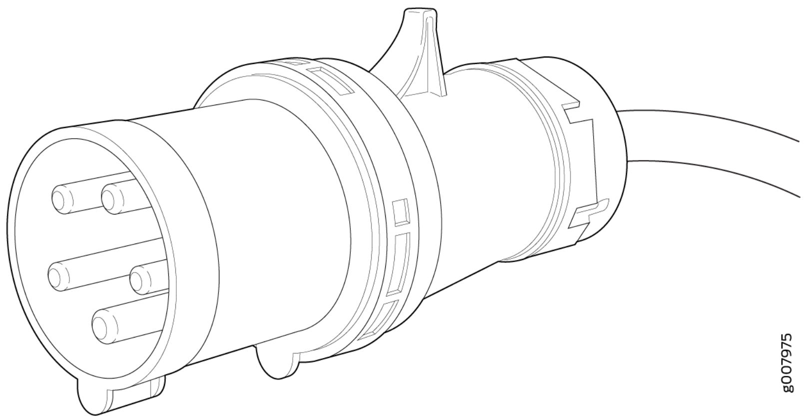
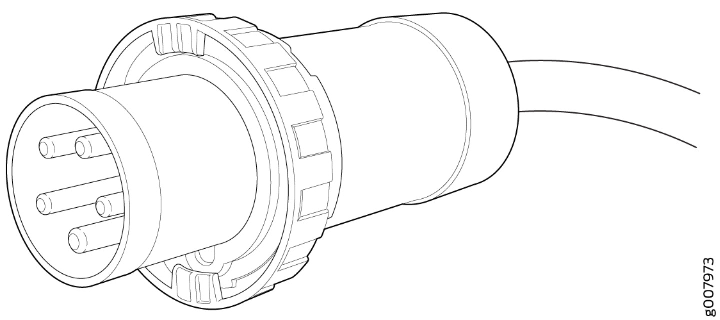


Figure 40: Three-Phase Wye 63-A Plug Type (Europe)



WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for UNC 1/4-20 ground lugs) 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.

WARNING: Power cords must not block access to device components or drape where people could trip on them.

Table 28 on page 76 provides specifications for the high-capacity single-phase AC power cords.

Table 28: AC Power Cord Specifications for the High Capacity Single-Phase AC Power Cords

Model Number	Facility Connection	Cable plug specification	Description
CBL2-PTX-SP-INTL	C-20	IEC-C20	Jumper, Plug C20 to conn C19
CBL2-PTX-SP-EU	Europe	CEE 7/7	Europe, Straight Plug to Straight C19
CBL2-PTX-SP-IT	Italy	CEI 23-50 S17	Italy, Straight Plug to Straight C19
CBL2-PTX-SP-US-N	NEMA 6-20	NEMA 6-20	US/Canada, Nema 6-20 to C19
CBL2-PTX-SP-CH	China	GB2099-CCC 16A	China, Straight Plug to Straight C19
CBL2-PTX-SP-UK	UK	BS 1363 (Type G)	UK, Right Angle Plug to Straight C19
CBL2-PTX-SP-SA	South Africa and India	BS 546, IS 1293, SABS 164-3	South Africa/India, Straight Plug to Straight C19
CBL2-PTX-SP-AU	Australia	AS/NZS 3112 (Type I)	Australia, Straight Plug to Straight C19
CBL2-PTX-SP-US-L	L6-20	NEMA L6-20	US/Canada, Straight, Nema l6-20 to c19
CBL2-PTX-SP-NA-I	North America	IEC309-250 V 16A	North America, Straight, Iec309-16a to c19
Positronic 30-A cables			
CBL2-PTX-SP-US-30A	L6-30	NEMA L6-30	US/Canada, L6-30 Plug to straight Positronic

Table 28: AC Power Cord Specifications for the High Capacity Single-Phase AC Power Cords *(Continued)*

Model Number	Facility Connection	Cable plug specification	Description
CBL2-PTX-SP-INTL30	IEC309-32A	IEC309 250V 32A	Jumper, Positronic to IEC309

Figure 41: Single-Phase 30-A Plug Type

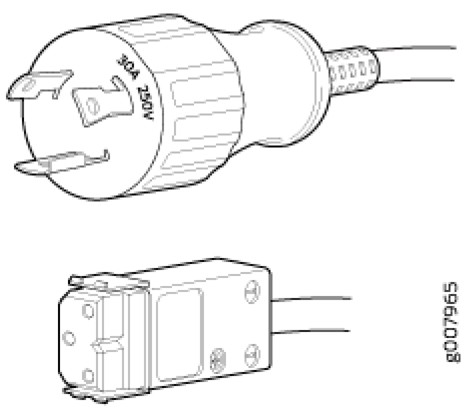
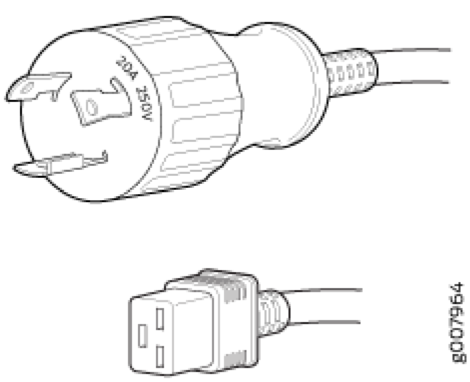


Figure 42: Single-Phase 20-A Plug Type



RELATED DOCUMENTATION

Understanding Normal-Capacity Power System Power Zones | 172
Calculating PTX5000 Power Consumption | 166

PTX5000 DC Power System

IN THIS SECTION

PTX5000 DC Power System Description

IN THIS SECTION

PTX5000 DC Power Distribution Unit

DC PDUs Supported on the PTX5000

The PTX5000 supports the DC power distribution units (PDUs) in Table 29 on page 79.

Table 29: DC PDUs Supported on the PTX5000

Name	Model Number	First Supported Junos OS Release
DC PDU (120-A feeds)	PDU-PTX-DC-120	12.1X48 12.3
DC PDU (60-A feeds)	PDU-PTX-DC-60	12.1X48R3 12.3
High Capacity DC PDU (60-A feeds)	PDU2-PTX-DC	14.1

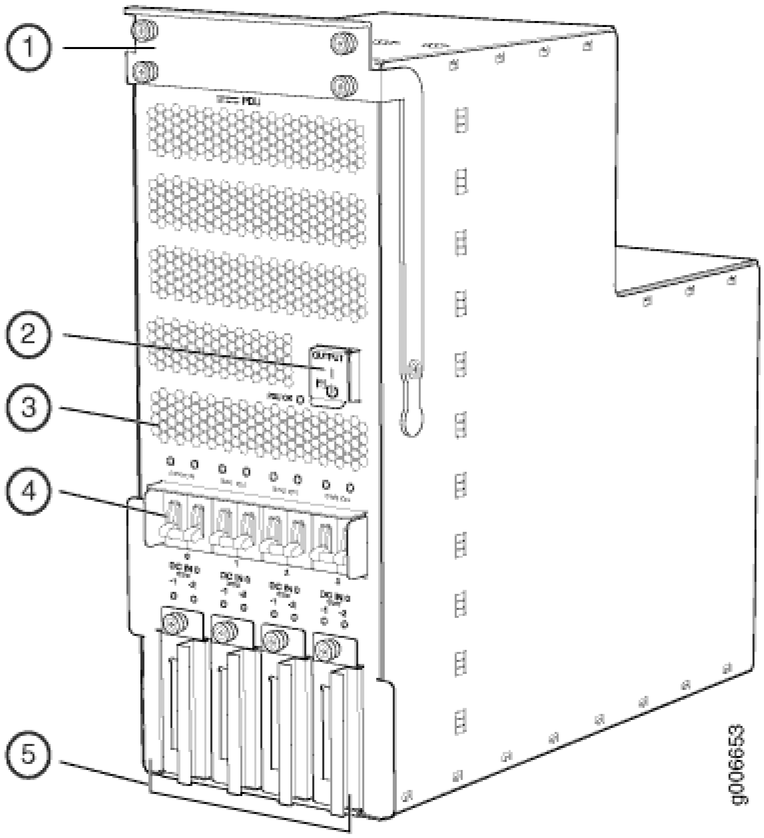
PTX5000 Normal Capacity DC PDU

Normal Capacity 60-A DC PDU Components

NOTE: The 60-A DC PDUs do not have circuit breakers.

Figure 43 on page 80 shows the 60-A DC PDU. Each 60-A DC PDU weighs approximately 60 lb (27.2 kg).

Figure 43: 60-A DC PDU



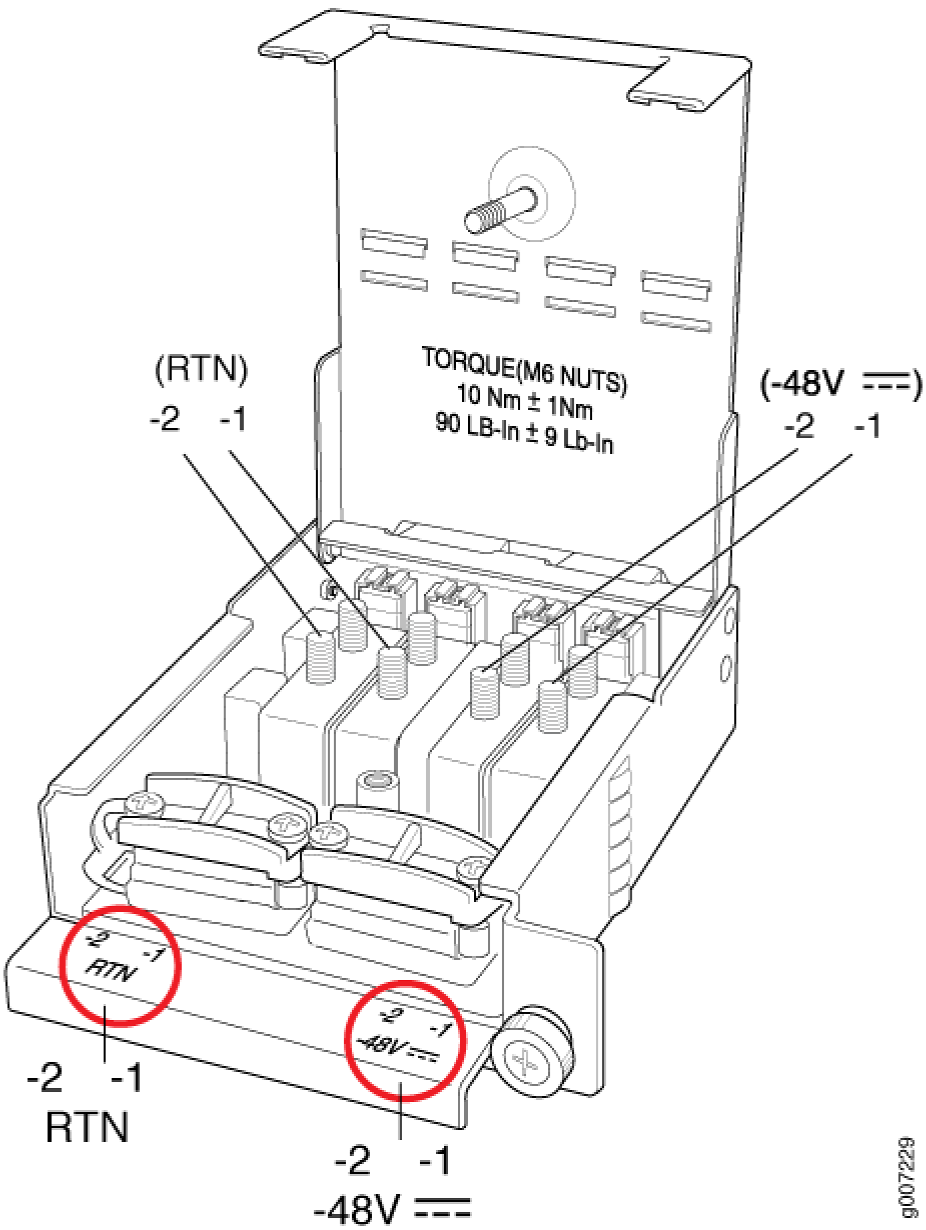
1– Metal handle	4– Input power switches
2– Power **OUTPUT** switch	5– Input power trays
3– Air exhaust ventilation	

Each 60-A DC PDU has the following components:

- Four removable input power trays, labeled **0** through **3**, from left to right. The input power trays are hot-removable and hot-insertable.

  Each 60-A input power tray weighs 1.6 lb (0.7 kg), not including cables. The input power tray has two inputs, labeled input **–2** and input **–1**. Each input is labeled **RTN** and **–48 V**. The input power switch for both inputs in each input power tray is located on the PDU above the input power tray.

Figure 44: 60-A DC Input Terminals



- LEDs to monitor the status of the PDU:

  60-A DC PDU—**PDU OK**, **SW0 ON**, **SW1 ON**, **SW2 ON**, **SW3 ON**, **DC IN 0 -1**, **DC IN 0 -2**, **DC IN 1 -1**, **DC IN 1 -2**, **DC IN 2 -1**, **DC IN 2 -2**, **DC IN 3 -1**, **DC IN 3 -2**.

- Twenty-one monitored electronic fuses for the fan trays, Control Boards, and FPCs.

NOTE: There are no mechanical fuses in the PDU to be replaced. For output voltage, current protection is provided by electronic fuses, hot-swap circuits, or ORing circuit. Electronic fuses and hot-swap circuits also provide current limitation.

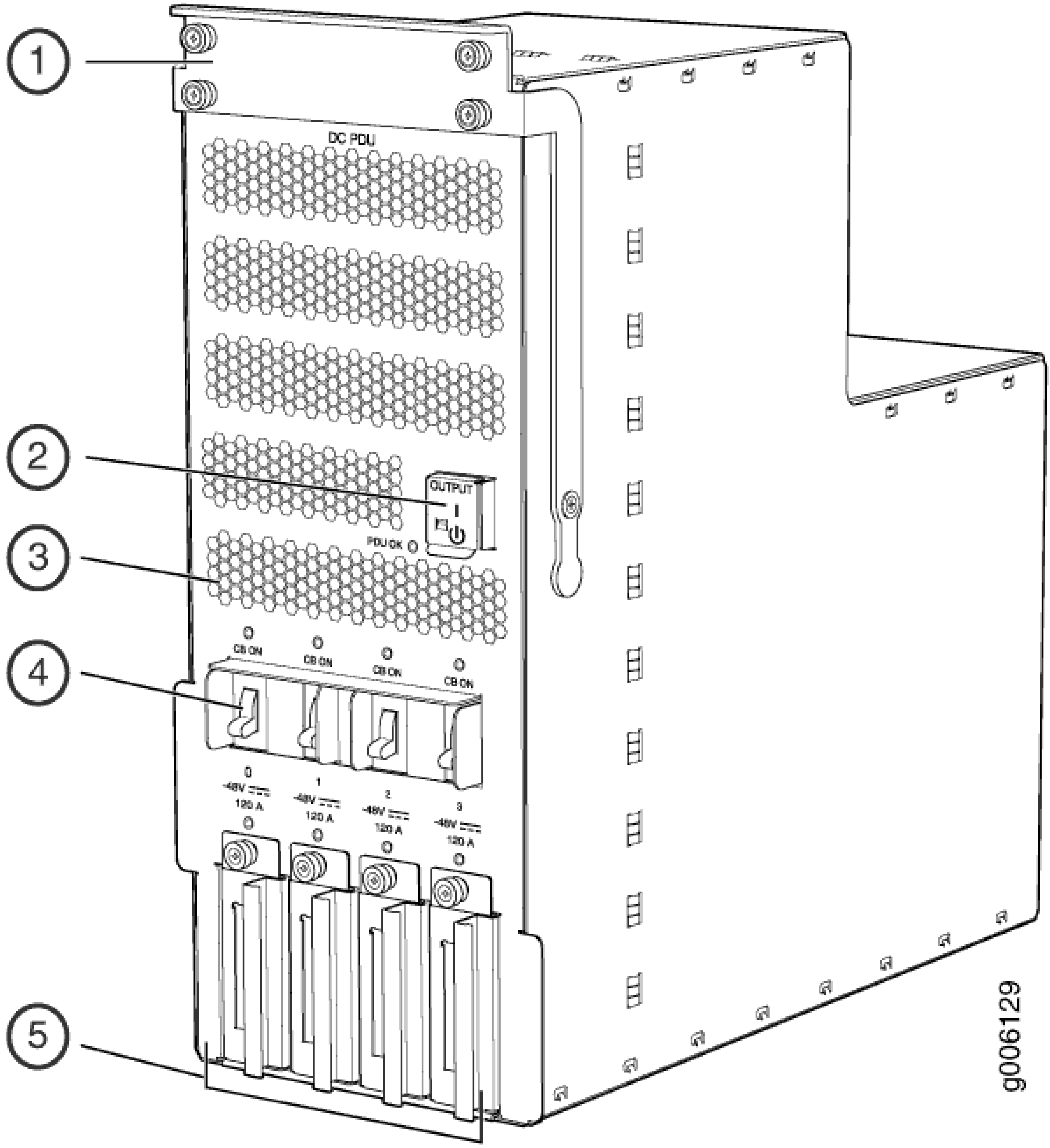
NOTE: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

120-A DC PDU Components

NOTE: The 120-A DC PDUs have circuit breakers and over current protection.

Figure 45 on page 83 shows the 120-A DC PDU. Each 120-A DC PDU weighs approximately 60 lb (27.2 kg).

Figure 45: 120-A DC PDU



1– Metal handle	4– Circuit breakers
2– Power switch	5– Input power trays
3– Air exhaust ventilation	

Each 120-A DC PDU has the following components:

- Four removable input power trays, labeled **0** through **3**, from left to right. The input power trays are hot-removable and hot-insertable.

Each 120-A input power tray weighs 1.6 lb (0.7 kg), not including cables. The input power tray has one input, labeled **RTN** and **–48 V**, from left to right, and has its own 125-A circuit breaker located on the PDU above the input power tray.

- LEDs to monitor the status of the power supply:

  120-A DC PDU—**PDU OK**, **–48 V 120 A**, and **CB ON**

- Twenty-one monitored electronic fuses for the fan trays, Control Boards, and FPCs.

  NOTE: There are no mechanical fuses in the PDU to be replaced. For output voltage, current protection is provided by electronic fuses, hot-swap circuits, or ORing circuit. Electronic fuses and hot-swap circuits also provide current limitation.

NOTE: The PDUs contain no fans, but are cooled by the fans in the power supply modules.

High Capacity DC PDU Description

The High Capacity DC PDU (60-A) provides 30.4 kW power output and you can connect a maximum of eight High Capacity PSMs to the PDU. Each DC PDU can receive up to sixteen 60-A DC input feeds from source outputs and provides two isolated outputs, a 12 V output at 2034 A maximum and a 36-V output at 167 A maximum. The 36-V output provides power to the vertical and horizontal fan trays and the 12-V output provides power to the system boards such as FPCs, SIBs, Routing Engines, and Control Boards (CBs). Additionally, the PSMs provide 5-V bias output to the PDUs. Each DC PDU can receive up to sixteen 60-A DC input feeds and weighs 64.5 lb (29.3 kg).

NOTE: You cannot mix existing PDUs with the High Capacity DC PDU.

The following is a list of some of the features of the High Capacity DC PDU :

- Supports up to eight PSMs, each PSM requires two 60-A feeds.
- Operates from 40 VDC through 72 VDC.
- I2C bus protocol fault reporting and control.
- Front-to-back airflow direction.
- Single output enable or disable switch to switch on or switch off the output of the PDU, which enables or disables the outputs from all the PSMs in the PDU.

- Reverse polarity protection—The PDU or PSMs are not damaged even if the input voltage is reversed for an indefinite period of time.
- Hot-pluggable and hot-removable.
- No power zoning for PSMs.

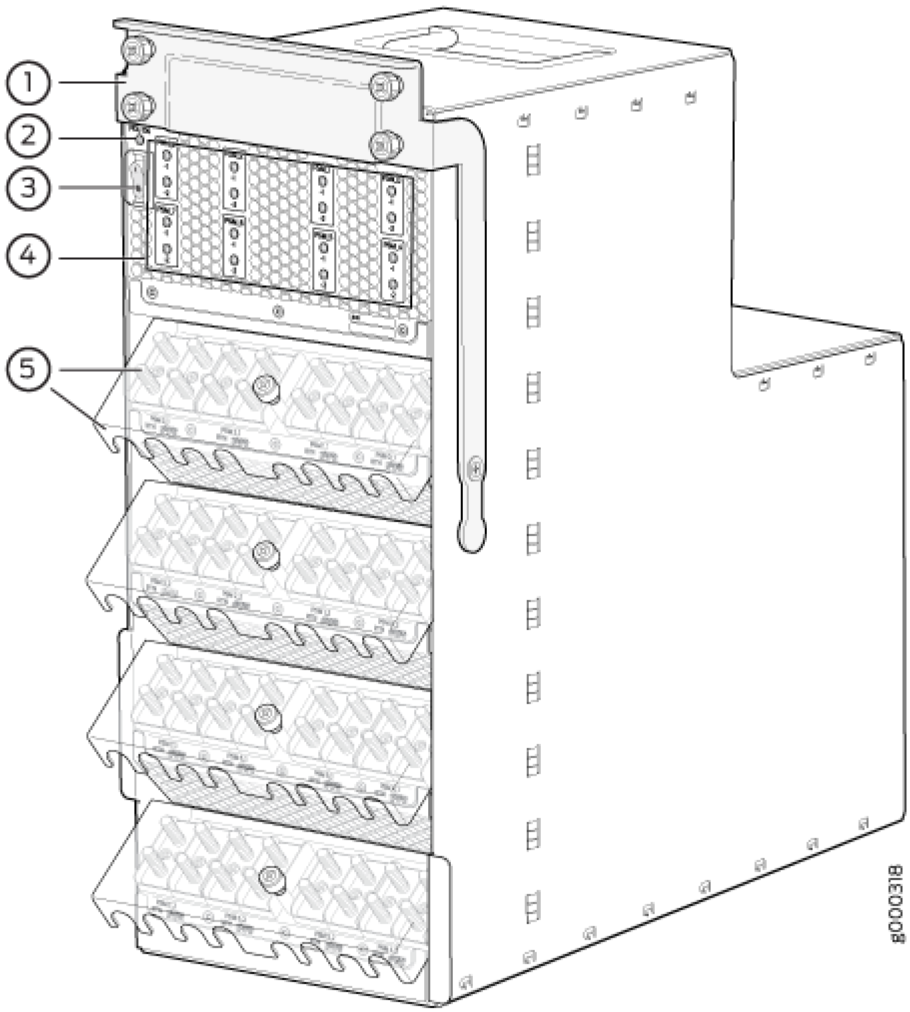
NOTE:

High Capacity DC PDU Components

NOTE: The High Capacity 60-A DC PDUs do not have circuit breakers.

Figure 46 on page 86 shows the High Capacity 60-A DC PDU. Each 60-A DC PDU weighs approximately 64.5 lb (29.3 kg).

Figure 46: High Capacity DC PDU



1– Metal handle	4– PSM LEDs
2– PDU OK LED	5– Input power terminals and safety cover
3– Power switch	

Each High Capacity DC PDU has the following components:

- Four fixed power input terminal blocks stacked vertically. Each terminal has inputs for each PSM—for example, **PSM0_1**— indicates the first input terminal for **PSM0**. Each input is also labeled **RTN** and **–48 V/60A** (see Figure 47 on page 87 and Figure 48 on page 88).

Figure 47: High Capacity DC Input Terminals

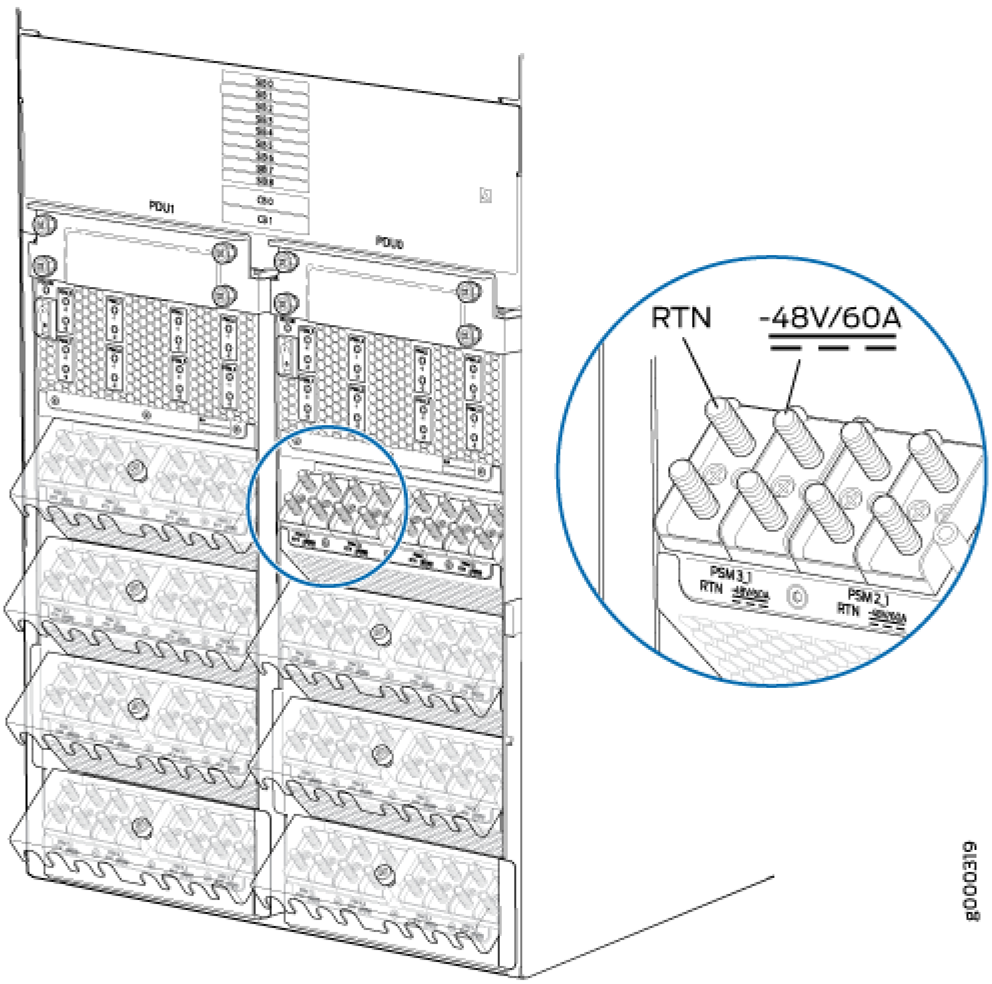
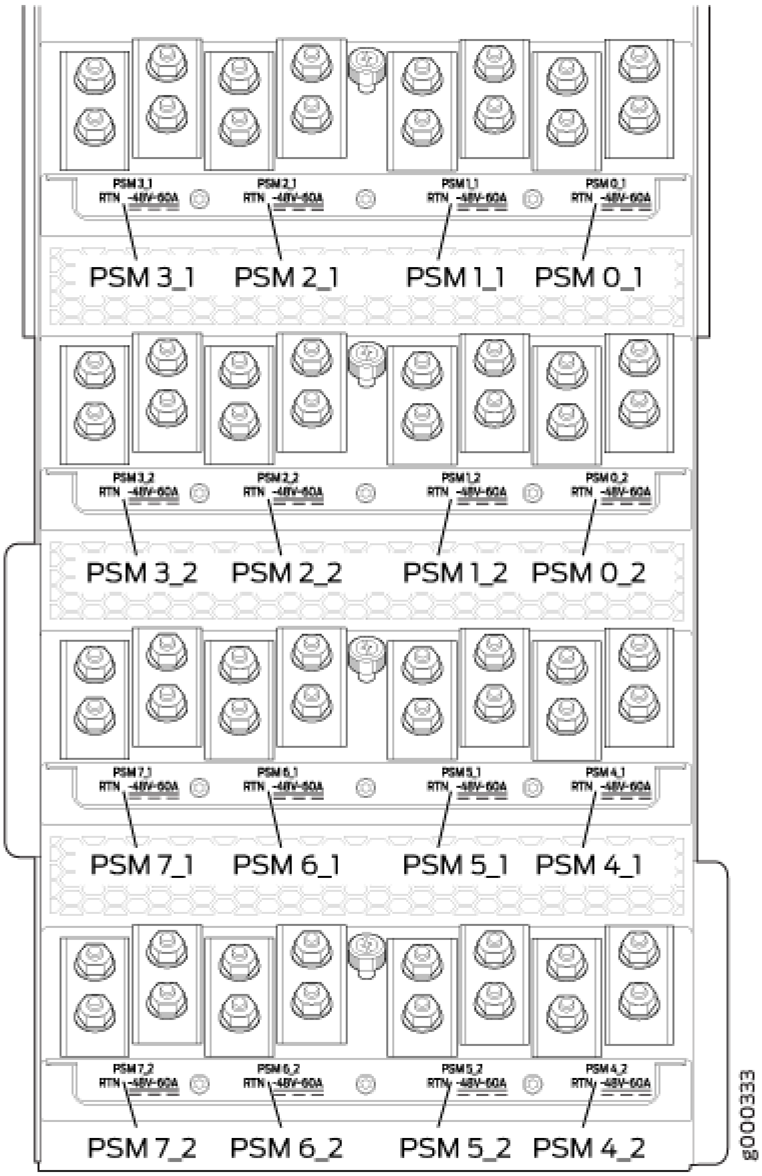


Figure 48: High Capacity DC Input Terminal Positions



- Sixteen LEDs to monitor the status of the PDU—See "PTX5000 DC Power Distribution Unit LEDs" on page 91 for details.
- Air exhaust ventilation

PTX5000 DC Power Supply Module

DC PSMs Supported on the PTX5000

The PTX5000 supports the DC power supply modules (PSMs) in Table 30 on page 89.

Table 30: DC PSMs Supported on the PTX5000

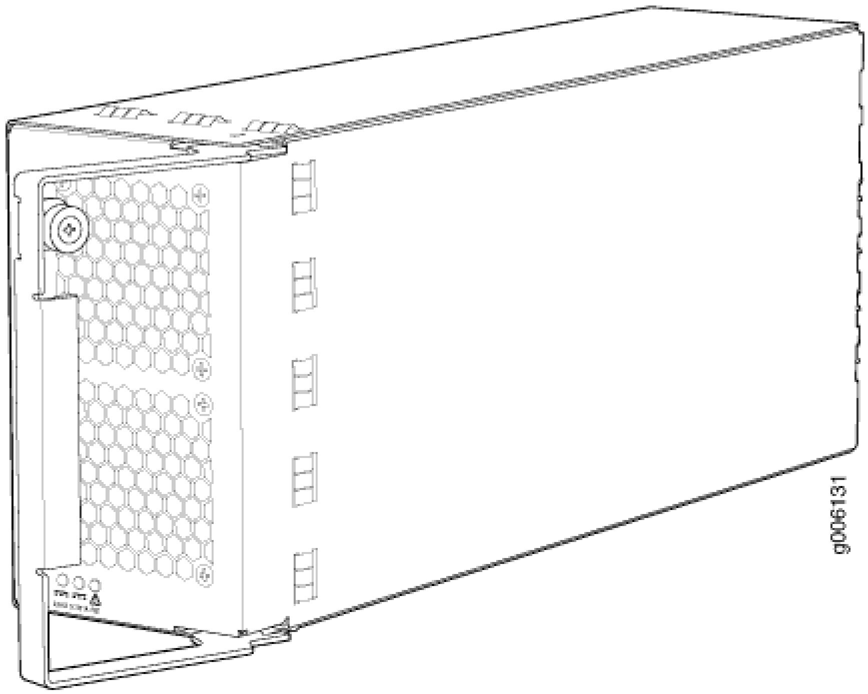
Name	Model Number	First Supported Junos OS Release
DC PSM (120-A)	PSM-PTX-DC-120	12.1X48 12.3
DC PSM (60-A)	PSM-PTX-DC-60	12.1X48R3 12.3
High Capacity DC PSM (60-A)	PSM2-PTX-DC	14.1

PTX5000 Normal Capacity DC PSM

Figure 49 on page 90 shows both the normal-capacity 60-A DC PSM and 120-A DC PSM. Each DC PSM weighs approximately 10.6 lb (4.8 kg).

CAUTION: The 60-A DC PSM and 120-A DC PSM are not interchangeable. The 60-A DC PSM must be installed in the 60-A DC PDU. The 120-A DC PSM must be installed in the 120-A DC PDU. The faceplate of both DC PSM looks the same. To avoid damaging the connectors on the back of the PSM or inside the PDU, use caution to ensure that you have the correct PSM before installing it in the PDU.

Figure 49: 60-A DC PSM and 120-A DC PSM



PTX5000 High Capacity DC PSM

Each High Capacity DC PSM has 3.8 kW output and accepts two 60-A input feeds. These PSMs are smaller than the 60-A DC and 120-A DC PSMs, allowing up to eight PSMs to be installed per PDU, and up to 16 PSMs per chassis. The following is a list of some of the features of the High Capacity DC PSM:

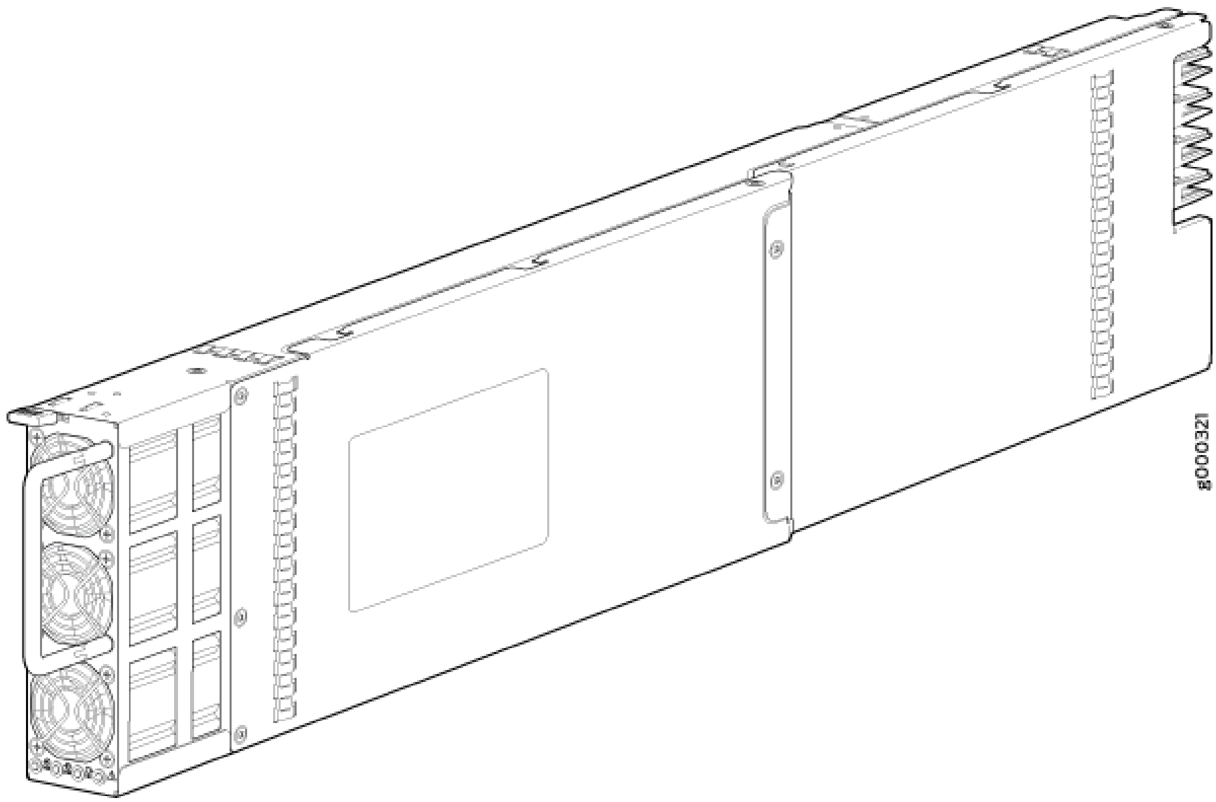
- Single non-isolated output: 12 V @ 3800 W
- Two 40 VDC–72 VDC inputs, up to 60 A maximum each

> **NOTE**: Both inputs are required for the PSM to function.

- One bias output voltage: +5 V at 2.4-A maximum
- Hot-swappable
- Self-cooled with monitored, variable-speed fans
- I2C fault reporting and control

Figure 50 on page 91 shows the High Capacity DC PSM.

Figure 50: High Capacity DC PSM



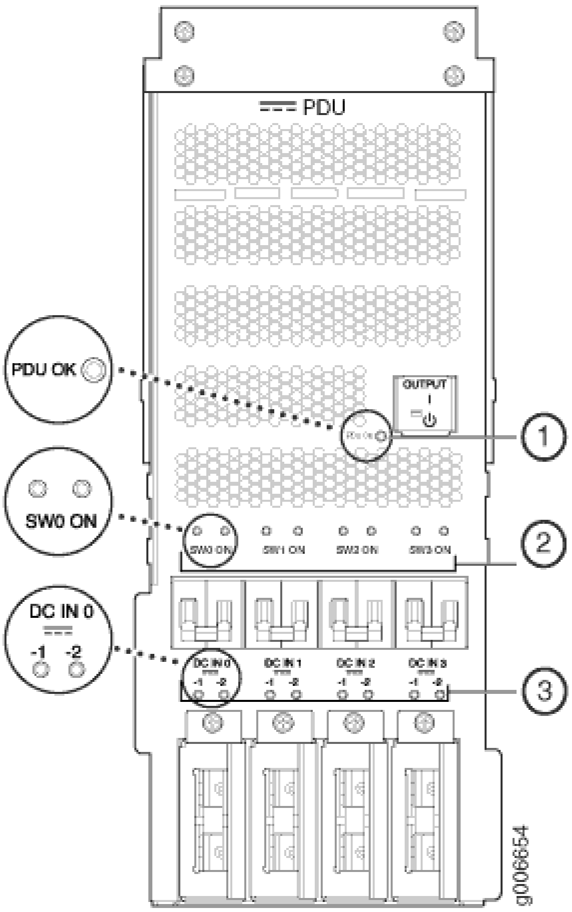
PTX5000 DC Power Distribution Unit LEDs

IN THIS SECTION

60-A DC PDU LEDs

Figure 51 on page 92 shows the 60-A DC PDU LEDs.

Figure 51: 60-A DC PDU



1– **PDU OK** LED	3– **DC IN** LEDs
2– **SW ON** LEDs	

Table 31 on page 92 describes the LEDs on the 60-A DC PDU faceplate.

Table 31: 60-A DC PDU LEDs

LED	Color	State	Description
PDU OK—One per power supply	Green	On steadily	PDU is functioning normally.
	Red	On steadily	PDU has failed.
	–	Off	PDU might be starting up or not receiving any input voltage.

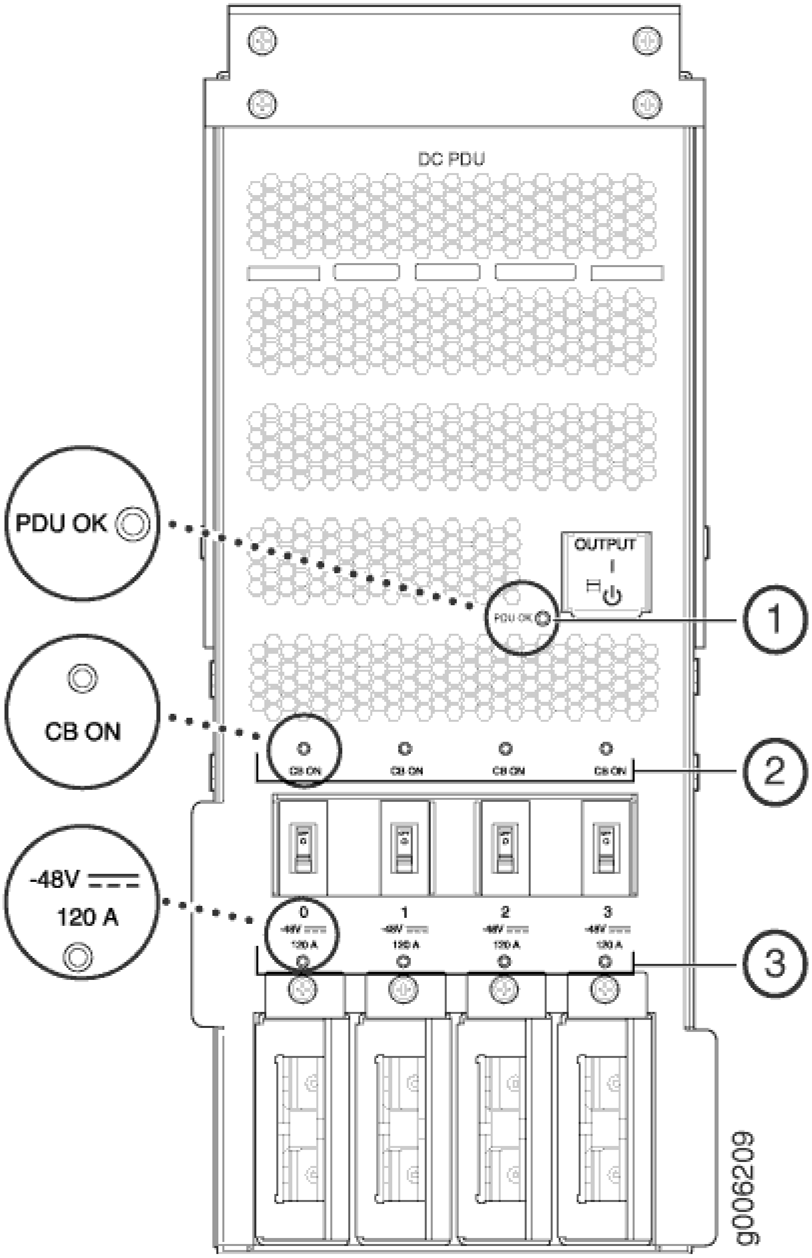
Table 31: 60-A DC PDU LEDs *(Continued)*

LED	Color	State	Description
DC IN—One per input	Green	On steadily	Input is receiving voltage.
	–	Off	Input voltage is not present, or is under –40 V.
SW ON—One per input power tray	Green	On steadily	The input power switch is powered on.
	–	Off	The LED might be off for one of the following reasons: • The input power switches might be off or the host subsystem detected a failure and turned off the input power switch. • The input power switch is on but at least one input is under –40 V. The input is not receiving any voltage.

120-A DC PDU LEDs

Figure 52 on page 94 shows the 120-A DC PDU LEDs.

Figure 52: 120-A DC PDU LEDs



1– **PDU OK** LED	3– **–48 V 120 A** LED
2– **CB ON** LED	

Table 32 on page 95 describes the LEDs on the 120-A DC PDU faceplate.

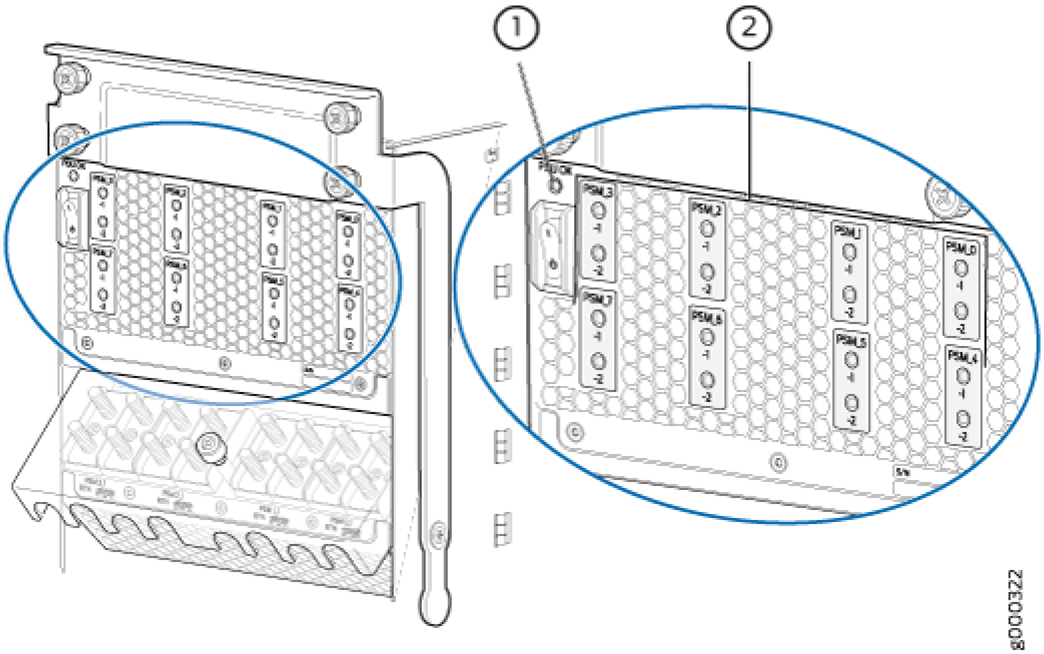
Table 32: 120-A DC PDU LEDs

LED	Color	State	Description
PDU OK—One per power supply	Green	On steadily	PDU is functioning normally.
	Red	On steadily	PDU has failed.
	–	Off	PDU might be starting up or not receiving any input voltage. The circuit breakers might be off.
–48 V 120 A—One per input	Green	On steadily	Input is receiving voltage.
	–	Off	Input voltage is not present, or is under –40 V.
CB ON—One per input	Green	On steadily	Circuit breaker is powered on.
	–	Off	Circuit breaker is not powered on, or the circuit breaker is on but the input is under –40 V. The circuit breaker might have been turned off, the host subsystem detected a failure and turned off the circuit breaker, or the power supply is not receiving any input voltage.

High Capacity DC PDU LEDs

Figure 53 on page 96 shows the High Capacity DC PDU LEDs.

Figure 53: High Capacity DC PDU LEDs



1— **PDU OK** LED	2— **PSM_0** through **PSM_7** LEDs—There are two LEDs—**-1** and **-2**— that indicate the status of the two inputs for each PSM, that is, input **-1** and **-2**.

Table 33 on page 96 describes the LEDs on the High Capacity DC PDU faceplate.

Table 33: High Capacity DC PDU LEDs

LED	Color	State	Description
PDU OK—One per power supply	Green	On steadily	PDU is functioning normally.
		Blinking	A 36 V converter fault has occurred, but the 36 V output remains operational.
	Red	On steadily	PDU has failed.

Table 33: High Capacity DC PDU LEDs *(Continued)*

LED	Color	State	Description
	–	Off	This LED can be off for one of the following reasons: • The PDU is not receiving any input voltage. • The PDU is starting up.
PSM_0 through **PSM_7**, for the eight PSMs per PDU. **NOTE**: There are two LEDs labeled **-1** and **-2**, indicating the two DC inputs for each PSM.	Green	On steadily	Input voltage is normal and less than –43 V.
	–	Off	Input voltage is not present, or is less than –20 V.
	Green	Blinking	Input is receiving voltage and voltage is between –20 V and –43 V.
	Red	On steadily	Connection is reversed.

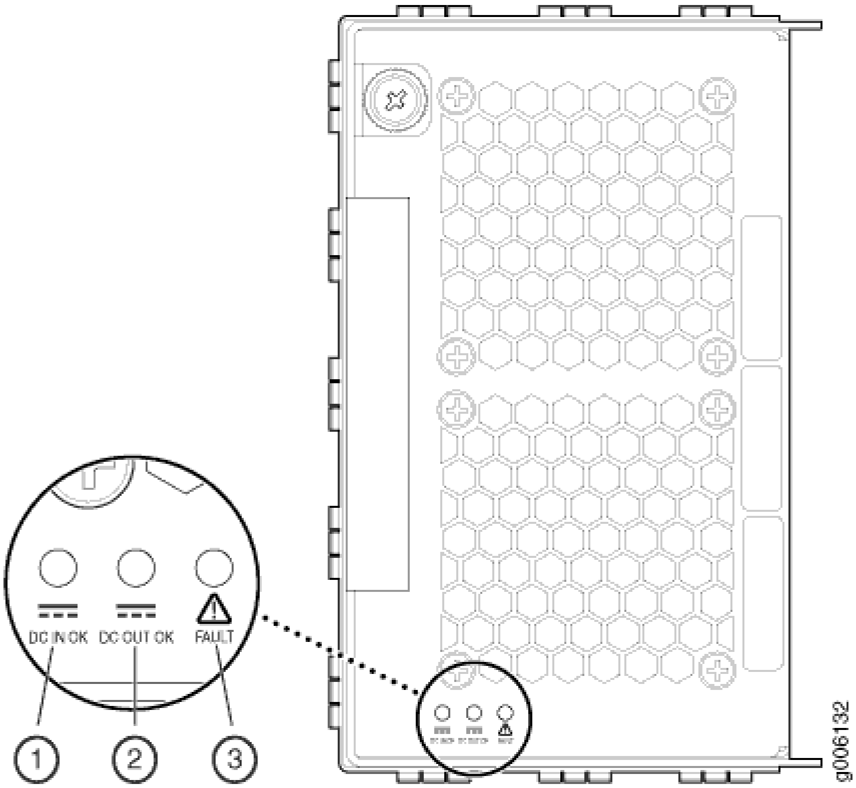
PTX5000 DC Power Supply Module LEDs

IN THIS SECTION

60-A and 120-A DC Power Supply Module LEDs

Table 34 on page 98 describes the DC power supply module LEDs on the faceplate. The 60-A PSM and 120-A PSM have the same LEDs.

Figure 54: DC PSM LEDs



1– **DC IN OK** LED	3– **FAULT** (⚠) LED
2– **DC OUT OK** LED	

Table 34: DC Power Supply Module LEDs

LED	Color	State	Description
DC IN OK	Green	On steadily	PSM is receiving voltage.
		Blinking	PSM is receiving voltage outside the range of –40 V through –72 V.
	–	Off	Input voltage is not present.

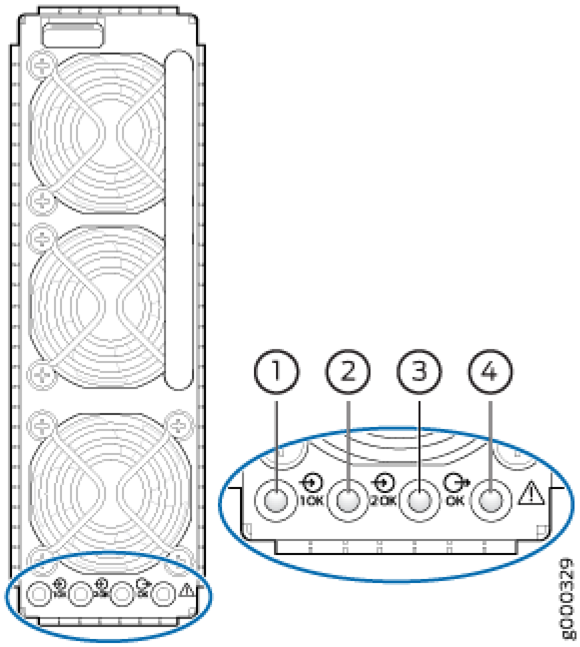
Table 34: DC Power Supply Module LEDs *(Continued)*

LED	Color	State	Description
DC OUT OK	Green	On steadily	Output is functioning normally, and input voltage is within the range of the range of –40 V through –72 V.
		Blinking	PSM is not enabled or is in a fault condition, or the input voltage to the PSM is too low.
	–	Off	Output is not functioning normally because of a fault condition or the PSM is not receiving input voltage.
FAULT (⚠)	Red	On steadily	PSM might be starting up, not properly installed, not receiving sufficient power, or not functioning properly.
	–	Off	No faults have been detected for the PSM, or the PSM is not receiving any input voltage.

High Capacity DC Power Supply Module LEDs

Figure 55 on page 100 shows the High Capacity DC power supply module LEDs and Table 35 on page 100 describes the LEDs.

Figure 55: High Capacity DC PSM LEDs



1– Input 1 OK LED	3– Output OK LED
2– Input 2 OK LED	4– Fault (⚠) LED

Table 35: High Capacity DC Power Supply Module LEDs

LED	Color	State	Description
Input 1 OK	Green	On steadily	Input 1 is present, the PSM is receiving voltage between –40 V and –72 V.
		Blinking	PSM is receiving voltage outside –40 V and –72 V.
	–	Off	Input voltage is not present on input 1.
Input 2 OK	Green	On steadily	Input 2 is present, the PSM is receiving voltage between –40 V and –72 V.
		Blinking	PSM is receiving voltage outside –40 V and –72 V.

Table 35: High Capacity DC Power Supply Module LEDs *(Continued)*

LED	Color	State	Description
	–	Off	Input voltage is not present on input 2.
Output **OK**	Green	On steadily	Power supply output is functioning normally.
		Blinking	PSM is not enabled or is in a fault condition, or the input voltage to the PSM is too low.
	–	Off	Output is not functioning normally because of a fault condition or the PSM is not receiving input voltage.
Fault (⚠)	Red	On steadily	PSM might be starting up, not properly installed, not receiving sufficient power, or not functioning properly.
	–	Off	No faults have been detected for the PSM, or the PSM is not receiving any input voltage.

PTX5000 DC Power System Electrical Specifications

Table 36 on page 101 lists the DC power system electrical specifications.

Table 36: Power System Electrical Specifications

Item	Specification
DC input voltage	Operating range: –40.0 to –72.0 VDC
DC system current rating	372 A @ –48 VDC (nominal) (17,856 W)

Table 36 on page 101 lists the High Capacity DC power system electrical specifications.

Table 37: High Capacity Power System Electrical Specifications

Item	Specification
DC input voltage	Operating range: –40.0 to –72.0 VDC
DC system current rating	704 A @ –48 VDC (nominal) (30,400 W)

For details on circuit breakers, see "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156.

PTX5000 DC Power Distribution Unit Specifications

Table 38 on page 102, Table 39 on page 102, and Table 40 on page 103 list the electrical specifications for each DC power distribution unit (PDU).

For circuit breaker requirement, see "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 or as required by local code.

Table 38: 60-A DC PDU Electrical Specifications

Item	Specification
DC input voltage	Nominal –48 VDC, –60 VDC Operating range: –40.0 to –72.0 VDC
Input DC current rating	51 A @ –48 VDC (nominal) (2444 W) per input

Table 39: 120-A PDU Electrical Specifications

Item	Specification
DC input voltage	Nominal –48 VDC, –60 VDC Operating range: –40.0 to –72.0 VDC
Input DC current rating	92.5 A @ –48 VDC (nominal) (4440 W) per input

Table 40: High Capacity PDU Electrical Specifications

Item	Specification
DC input voltage	Nominal –48 VDC, –60 VDC Operating range: –40.0 to –72.0 VDC
Input DC current rating	44.2 A @ –48 VDC (nominal) (2120 W) per input

To allow for future growth so that you can operate the PTX5000 in any hardware configuration without upgrading the power infrastructure, we recommend that you provision the following:

- 60-A DC PDU: 51 A @ –48 VDC per input.
- 120-A DC PDU: 92.5 A @ –48 VDC per input.
- High Capacity DC PDU: 44.2 A @ –48 VDC per input.

Although the power requirements for each input might vary, we recommend that you provision the same amount of power for each input. Actual power consumption will be less than the recommended amount provisioned.

PTX5000 DC Power Cable and Lugs Specifications

IN THIS SECTION

DC Power Cables

You must supply the DC power cables which meet the specifications in Table 41 on page 104, or as required by the local code, laws, and standards.

Table 41: Power Cable Specifications

60-A DC PDU	6-AWG (13.3 mm^2) minimum 4-AWG (21.2 mm^2) maximum
120-A DC PDU	0-AWG (53 mm^2)
High Capacity DC PDU	6-AWG (13.3 mm^2) minimum 4-AWG (21.2 mm^2) maximum

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

WARNING: DC power cables must not block access to PTX5000 components or drape where people could trip on them.

CAUTION: Before PTX5000 installation begins, a licensed electrician must attach a cable lug to the power cables that you supply. A cable with an incorrectly attached lug can damage the PTX5000.

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

DC Power Lugs

The accessory box shipped with the PTX5000 includes 0-AWG and 4-AWG cable lugs . The cable lugs are dual hole, and sized to fit 1/4-20 UNC terminal studs at 15.86-mm (0.625-in.) center line. Table 42 on page 105 indicates the cable lug specifications for each type of PDU.

You attach these cable lugs to the DC terminal studs of each input power tray of the 60-A and 120-A PDUs and to the terminal studs (16 for eight PSMs) in the front of the High Capacity DC PDU. The 0-AWG cable lug is also used for grounding the PTX5000.

Table 42: DC Power Cable Specifications

PDU	Cable Lugs
60-A	6-AWG (13.3 mm ^{2}) minimum 4-AWG (21.2 mm^2) maximum See Figure 57 on page 106.
120-A	0-AWG (53 mm^2), See Figure 56 on page 105.
High Capacity (60-A)	6-AWG (13.3 mm ^{2}) minimum 4-AWG (21.2 mm^2) maximum See Figure 57 on page 106.

NOTE:

Figure 56: 0-AWG DC Power Cable Lug

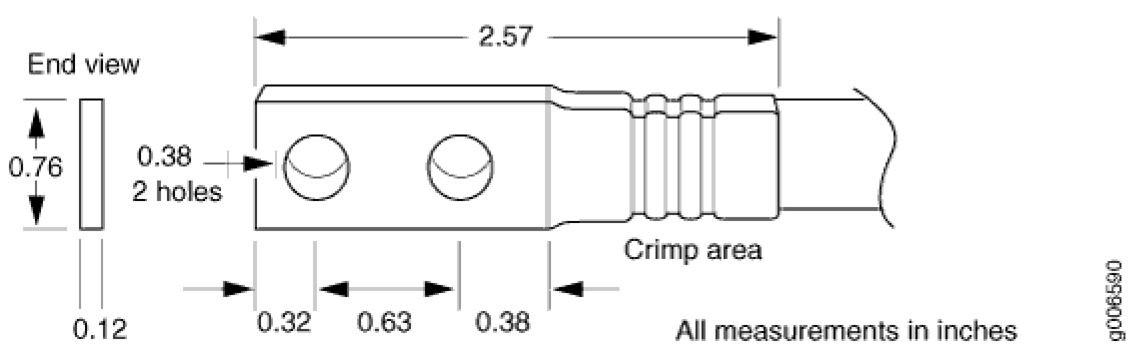
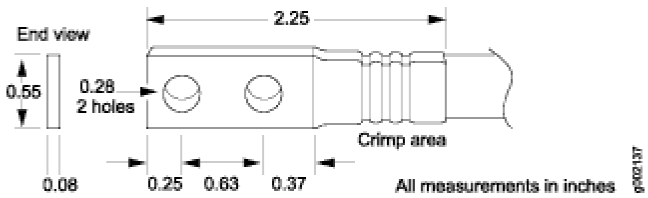


Figure 57: 4-AWG DC Power Cable Lug



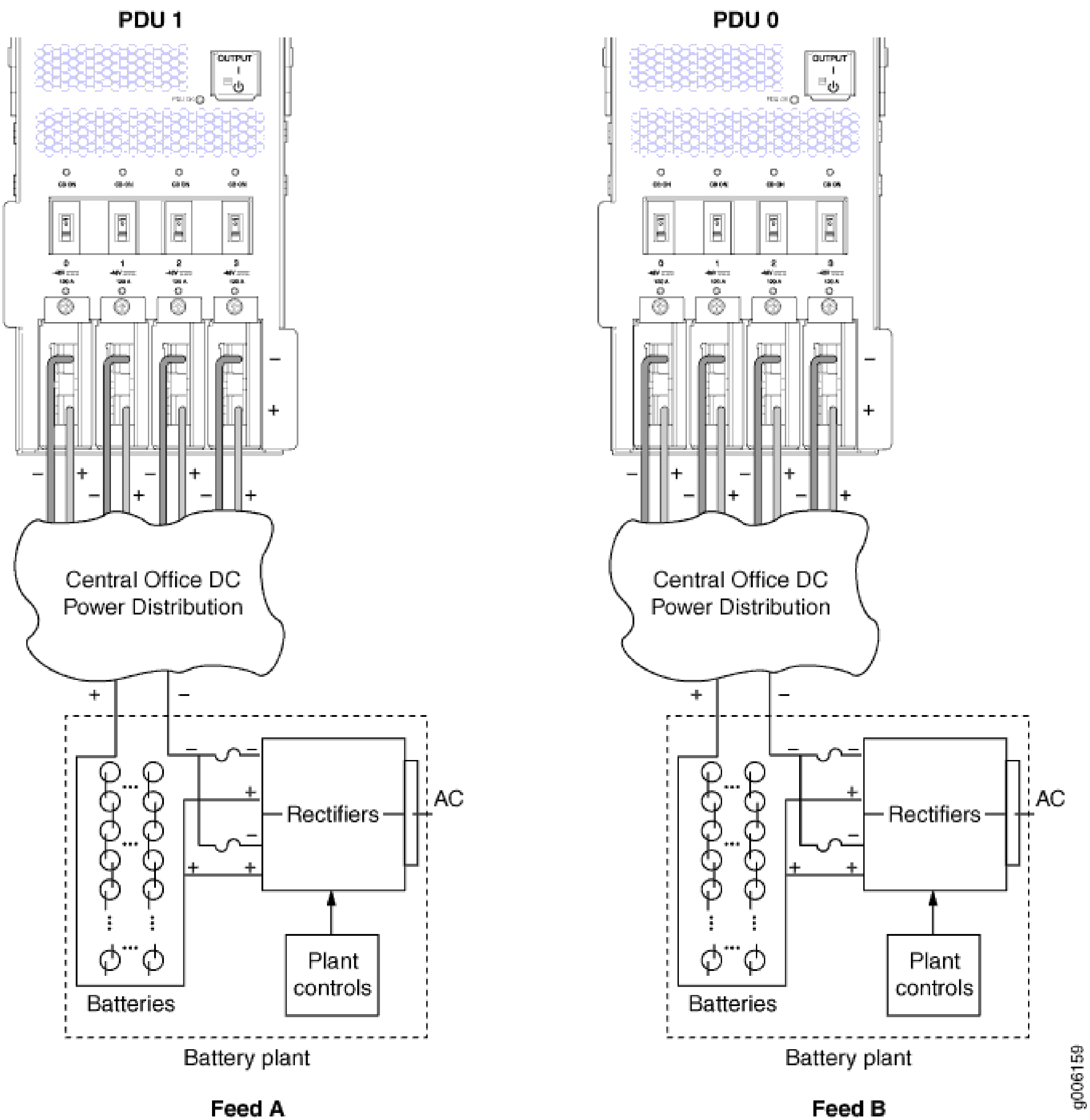
PTX5000 DC Power Distribution

Most sites distribute DC power through a main conduit that leads to frame-mounted DC power distribution panels, one of which might be located at the top of the rack that houses the PTX5000. A pair of cables (one input and one return) connects each set of terminal studs to the power distribution panel.

> **NOTE**: All inputs on the DC PDU in slot 0 must be powered by dedicated power feeds derived from feed B, and all inputs on the DC PDU in slot 1 must be powered by dedicated power feeds derived from feed A. This configuration provides the commonly deployed A/B feed redundancy for the system.

Figure 58 on page 107 shows a typical DC source cabling arrangement and two 120-A DC PDUs. The source cabling distribution for 60-A DC PDUs would be similar.

Figure 58: Typical DC Source Cabling to the PTX5000



RELATED DOCUMENTATION

Understanding Normal-Capacity Power System Power Zones | 172

Calculating PTX5000 Power Consumption | 166

Connecting the PTX5000 to DC Power | 245

Powering the PTX5000 On and Off | 279

Maintaining the PTX5000 DC Power System | 398
Troubleshooting the PTX5000 Power System | 568

PTX5000 Host Subsystem

IN THIS SECTION

PTX5000 Host Subsystem Description

The PTX5000 host subsystem is comprised of a Routing Engine and Control Board working together as a unit. The host subsystem provides the routing and system management functions of the PTX5000. You can install one or two host subsystems. To operate, each host subsystem functions as a unit; the Routing Engine requires the corresponding Control Board, and vice versa.

NOTE: We recommend that you install two host subsystems for redundant protection.

Each host subsystem has three LEDs, located on the upper left of the craft interface, which display the status of the host subsystem. In addition, there are LEDs on each Routing Engine and Control Board.

SEE ALSO

PTX5000 Craft Interface LEDs | 22

PTX5000 Routing Engine Description

IN THIS SECTION

Routing Engine Slots

You can install one or two Routing Engines in the PTX5000. The Routing Engines install into the Control Boards labeled **CB0** and **CB1**. If two Routing Engines are installed, one functions as the primary and the other acts as the backup. If the primary Routing Engine fails or is removed and the backup is configured appropriately, the backup restarts and becomes the primary.

Routing Engine Functions

The Routing Engine handles all routing protocol processes, as well as the software processes that control the PTX5000 router's interfaces, the chassis components, system management, and user access to the PTX5000. The routing and software processes run on top of a kernel that interacts with the Packet Forwarding Engine.

The Routing Engine constructs and maintains one or more routing tables. From the routing tables, the Routing Engine derives a table of active routes, called the forwarding table, which is then copied into the Packet Forwarding Engine. The design of the ASICs allows the forwarding table in the Packet Forwarding Engine to be updated without interrupting forwarding performance.

The Routing Engine includes the following functions and features:

- Processing of routing protocol packets—The Routing Engine handles all packets that concern routing protocols, freeing the Packet Forwarding Engine to handle only packets that represent Internet traffic.
- Software modularity—Because each software process is devoted to a different function and uses a separate process space, the failure of one process has little or no effect on the others.

- In-depth Internet functionality—Each routing protocol is implemented with a complete set of Internet features and provides full flexibility for advertising, filtering, and modifying routes. Routing policies are set according to route parameters (for example, prefix, prefix lengths, and BGP attributes).

- Scalability—Junos OS routing tables have been designed to hold all the routes in current networks with ample capacity for expansion. Additionally, Junos OS can efficiently support large numbers of interfaces and virtual circuits.

- Management interface—Different levels of system management tools are provided, including the Junos OS command-line interface (CLI), the Junos XML management protocol, the craft interface, and SNMP.

- Storage and change management—Configuration files, system images, and microcode can be held and maintained in primary and secondary storage systems, permitting local or remote upgrades.

- Monitoring efficiency and flexibility—The PTX5000 supports functions such as alarm handling and packet counting on every port, without degrading packet-forwarding performance.

RE-DUO-C2600-16G Routing Engine Components

Each Routing Engine (shown in Figure 59 on page 110) consists of the following components:

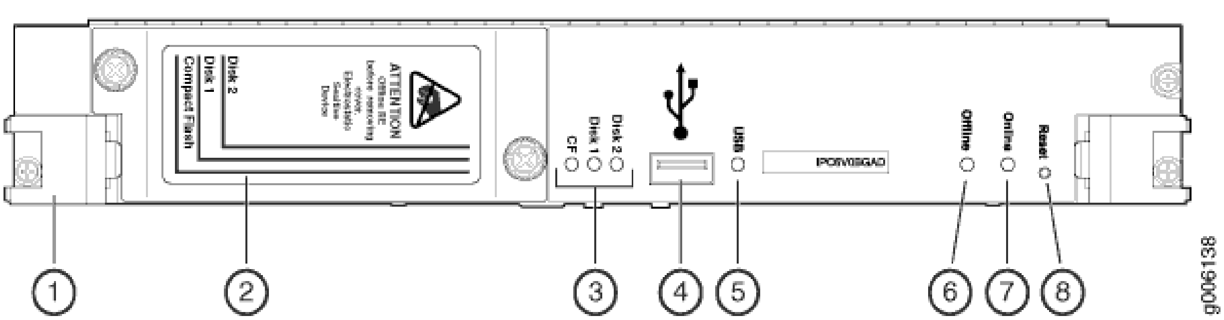
- CPU—Runs Junos OS to maintain the routing tables and routing protocols.

- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.

- EEPROM—Stores the serial number of the Routing Engine.

- Interfaces for management access—Provide information about Routing Engine status to the external management devices (console, laptop, or terminal server) connected to the management ports on the Control Board.

Figure 59: RE-DUO-C2600 Routing Engine



1– Extractor clips	5– USB LED

2– SSD and CompactFlash card slot cover	6– Offline button
3– LEDs—**DISK1, DISK2,** and **CF**	7– Online LED
4– USB port	8– Reset button

The faceplate of the Routing Engine contains the following:

- USB port **USB**—Provides a removable media interface through which you can install Junos OS manually. Junos OS supports USB versions 2.0 and 1.1.
- CompactFlash card slot —Provides primary storage for software images, configuration files, and microcode.
- Two solid-state disk slots **Disk 1** and **Disk 2**—Provide secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.

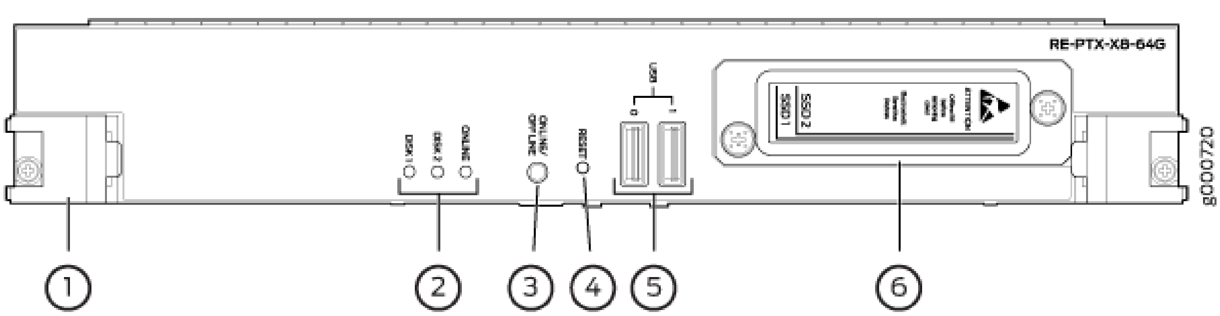
  > **NOTE**: **Disk 2** is not currently supported.

- **Reset** button—Reboots the Routing Engine when pressed.
- **Offline** button—Takes the Routing Engine offline when pressed.
- Extractor clips—Control the locking system that secures the Routing Engine.
- LEDs—"PTX5000 Routing Engine LEDs" on page 114 describes the functions of these LEDs.

> **NOTE**: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.

RE-PTX-X8-64G Routing Engine Components

Figure 60: RE-PTX-X8-64G Routing Engine Components



1– Extractor clips	4– **RESET** button
2– LEDs—**DISK1**, **DISK2**, and **ONLINE**	5– **USB0** and **USB1** ports
3– **ONLINE/OFFLINE** button	6– SSD card slot cover

Each Routing Engine (shown in Figure 60 on page 111) consists of the following components:

- CPU—Runs Junos OS to maintain the routing tables and routing protocols. The CPU is an eight-core CPU with core frequency of 2.3 GHz.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- EEPROM—Stores the serial number of the Routing Engine.

The faceplate of the Routing Engine contains the following:

- Two USB ports **USB0** and **USB1**—Provide a removable media interface through which you can install Junos OS manually. Junos OS supports USB versions 3.0, 2.0, and 1.1.
- Two solid-state drive slots for the primary SSD **SSD1** and the secondary SSD **SSD2**—Provide storage for software images, configuration files, microcode, log files, and memory dumps. The Routing Engine reboots the system from **SSD2** when booting from **SSD1** fails.
- **RESET** button—Reboots the Routing Engine when pressed.
- **ONLINE/OFFLINE** button—Takes the Routing Engine offline or brings it online when pressed.

  > **NOTE**: The **ONLINE/OFFLINE** button must be pressed for a minimum of 4 seconds for the power off or power on to occur.

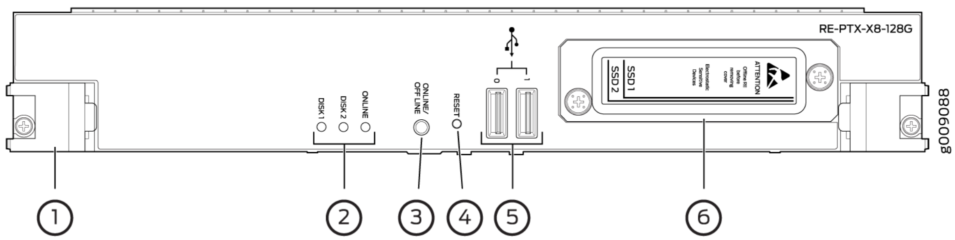
- Extractor clips—Control the locking system that secures the Routing Engine.
- LEDs—"PTX5000 Routing Engine LEDs" on page 114 describes the functions of these LEDs.

> **NOTE**: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.

RE-PTX-X8-128G Routing Engine Components

The RE-PTX-X8-128G Routing Engine has increased memory and storage to support virtualization. The Routing Engine is equipped with an 8 Core 2.3 GHz processor, 128GB Memory, and two 200GB SSDs. It also supports Secure Boot for enhanced boot security.

Figure 61: RE-PTX-X8-128G Routing Engine Components



1– Extractor clips	4– **RESET** button
2– LEDs—**DISK1**, **DISK2**, and **ONLINE**	5– **USB0** and **USB1** ports
3– **ONLINE/OFFLINE** button	6– SSD card slot cover

Each Routing Engine (shown in Figure 61 on page 113) consists of the following components:

- CPU—Runs Junos OS to maintain the routing tables and routing protocols. The CPU is an eight-core CPU with core frequency of 2.3 GHz.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- EEPROM—Stores the serial number of the Routing Engine.

The faceplate of the Routing Engine contains the following:

- Two USB ports **USB0** and **USB1**—Provide a removable media interface through which you can install Junos OS manually. Junos OS supports USB versions 3.0, 2.0, and 1.1.
- Two solid-state drive slots for the primary SSD **SSD1** and the secondary SSD **SSD2**—Provide storage for software images, configuration files, microcode, log files, and memory dumps. The Routing Engine reboots the system from **SSD2** when booting from **SSD1** fails.
- **RESET** button—Reboots the Routing Engine when pressed.
- **ONLINE/OFFLINE** button—Takes the Routing Engine offline or brings it online when pressed.

> **NOTE**: The **ONLINE/OFFLINE** button must be pressed for a minimum of 4 seconds for the power off or power on to occur.

- Extractor clips—Control the locking system that secures the Routing Engine.
- LEDs—"PTX5000 Routing Engine LEDs" on page 114 describes the functions of these LEDs.

NOTE: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.

Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device (if present), the CompactFlash card **CF** (if present), the disk (if present) in slot 1 **Disk1**, and then the LAN.

NOTE: **Disk2** is not currently supported on RE-DUO-C2600-16G but is supported on RE-PTX-X8-64G.

There is no support for the CompactFlash card in RE-PTX-X8-64G and RE-PTX-X8-128G.

Booting in an RE-PTX-X8-64G and RE-PTX-X8-128G Routing Engines follows this sequence—the USB device, SSD1, SSD2, and LAN. SSD1 is the primary boot device. The boot sequence is tried twice for SSD1 and SSD2.

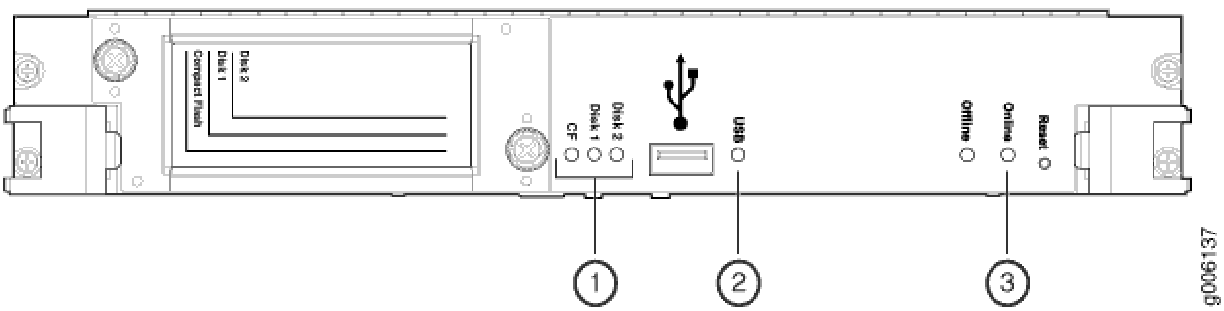
PTX5000 Routing Engine LEDs

IN THIS SECTION

Routing Engine LEDs (RE-DUO-C2600-16G)

Three LEDs—**Online**, **CF**, and **Disk1**—indicate the status of the Routing Engine (see Figure 62 on page 115).

Figure 62: RE-DUO-C2600-16G Routing Engine LEDs



1– **CF** and **Disk1** LEDs. **Disk 2** is not used.	3– **Online** LED
2– **USB** LED	

NOTE: The LEDs on the Routing Engine do not necessarily indicate routing-related activity.

Table 43: Routing Engine LEDs

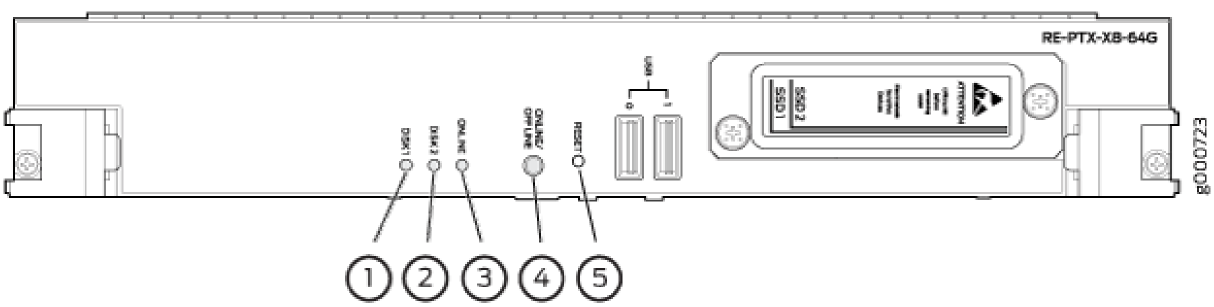
Label	Color	State	Description
Online	Green	On steadily	Routing Engine is functioning normally.
	Red	On steadily	Routing Engine is not functioning normally.
	–	Off	Routing Engine is not online or not functioning normally.
Disk1	Green	On steadily	An SSD is installed in the **Disk1** slot in the Routing Engine.
		Blinking	Indicates disk activity.
	–	Off	There is no disk activity.
Disk2	–	Off	**NOTE**: This LED is not used.
CF	Green	On steadily	A CompactFlash card is installed in the Routing Engine.

Table 43: Routing Engine LEDs *(Continued)*

Label	Color	State	Description
		Blinking	Indicates activity for the CompactFlash card.
	–	Off	There is no activity for the CompactFlash card.
USB	Yellow	On steadily	A USB device connected to the Routing Engine.
	–	Off	There is no USB device connected to the Routing Engine.

Routing Engine LEDs (RE-PTX-X8-64G and RE-PTX-X8-128G)

Figure 63: RE-PTX-X8-64G Routing Engine LEDs



1– **DISK1** LED	4– **ONLINE/OFFLINE** button
2– **DISK2** LED	5– **RESET** button
3– **ONLINE** LED	

Table 44: RE-PTX-X8-64G and RE-PTX-X8-128G Routing Engine LEDs

Label	Color	State	Description
ONLINE	Green	On steadily	Routing Engine is functioning normally.
	Green	Blinking slowly	Routing Engine is in the process of booting BIOS and the host OS.

Table 44: RE-PTX-X8-64G and RE-PTX-X8-128G Routing Engine LEDs *(Continued)*

Label	Color	State	Description
		Blinking rapidly	Routing Engine is in the process of booting Junos OS.
	–	Off	Routing Engine is not online or not functioning normally
DISK1	Green	Blinking	Indicates the presence of disk activity.
	–	Off	There is no disk activity.
DISK2	Green	Blinking	Indicates the presence of disk activity.
	–	Off	There is no disk activity.

Routing Engines Supported on PTX Series Routers

IN THIS SECTION

The following tables list the Routing Engines that each PTX Series router supports and the Routing Engine specifications.

PTX1000 Routing Engines

Table 45 on page 118 lists the Routing Engine supported on the PTX1000.

NOTE: The PTX1000 supports 64-bit Junos OS only.

Table 45: PTX1000 Routing Engines

Model Number	Name in CLI Output	First Supported Junos OS Release	Management Ethernet Interface	Internal Ethernet Interface
Built-in Routing Engine	`RE-PTX1000`	• 16.1X65-D30 • 17.2R1	em0	bme0 em1

PTX3000 Routing Engines

Table 46 on page 118 lists the Routing Engines supported on the PTX3000.

NOTE: The PTX3000 supports 64-bit Junos OS only.

Table 46: PTX3000 Routing Engines

Model Number	Name in CLI Output	First Supported Junos OS Release	Management Ethernet Interface	Internal Ethernet Interface
RE-DUO-C2600-16G	`RE-DUO-2600`	13.2R2	em0	ixgbe0 ixgbe1
RCB-PTX-X6-32G	`RE-PTX-2X00x6`	16.1R4 17.1R1 This Routing Engine does not support Junos OS Release 16.2.	em0	ixlv0 ixlv1

PTX5000 Routing Engines

Table 47 on page 119 lists the Routing Engines supported on the PTX5000.

NOTE:

- PTX5000 supports 64-bit Junos OS only.

- The PTX5000 router supports two midplanes. The midplane identified as `Midplane-8S` in the CLI output is supported in Junos OS releases, 12.1X48, 12.3, and 13.2. The enhanced midplane, identified as `Midplane-8SeP` is supported from Junos OS release 14.1 onwards.

  The RE-DUO-2600 routing engine with Junos OS 13.2 or earlier is not supported on the PTX5000BASE2 midplane.

Table 47: PTX5000 Routing Engines

Model Number	Name in CLI Output	First Supported Junos OS Release	Management Ethernet Interface	Internal Ethernet Interface
RE-DUO-C2600-16G	`RE-DUO-2600`	12.1X48 12.3 13.2 **NOTE**: The PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.	em0	ixgbe0 ixgbe1
RE-PTX-X8-64G	`RE-PTX-2X00x8`	15.1F4 16.1R1	em0	ixlv0 ixlv1 em1
RE-PTX-X8-128G	`RE-PTX-2X00x8-128G`	18.1R1	em0	ixlv0 ixlv1 em1

PTX10008 and PTX10016 Routing Engines

Table 48 on page 120 lists the Routing Engines supported on the PTX10008 and PTX10016 routers.

Table 48: PTX10008 and PTX10016 Routing Engines

Model Number	Name in CLI Output	First Supported Junos OS Release	Management Ethernet Interface	Internal Ethernet Interface
JNP10K-RE0	`RE-PTX-2X00x4`	17.2R1	em0, em1	bme0 bme1
JNP10K-RE1 JNP10K-RE1-LT	`RE X10`	18.2R1	em0, em1	bme0 bme1
JNP10K-RE1-128	`RE X10 128`	18.3R1	em0, em1	bme0 bme1

PTX Series Routing Engine Specifications

Table 49 on page 120 lists the current specifications for Routing Engines supported on the PTX Series.

> **NOTE**: The memory listed in Table 49 on page 120 indicates the amount of total memory. To determine the amount of available memory, issue the `show chassis routing-engine` CLI command.

Table 49: PTX Series Routing Engine Specifications

Model Number	Processor	Memory	Connection to Packet Forwarding Engines	Disk	Media
RE-DUO-C2600-16G	2.6 GHz	16 GB	Gigabit Ethernet	SSD	4-GB CompactFlash card

Table 49: PTX Series Routing Engine Specifications *(Continued)*

Model Number	Processor	Memory	Connection to Packet Forwarding Engines	Disk	Media
RE-PTX-X8-64G (PTX5000 only)	2.3 GHz	64 GB	10-Gigabit Ethernet	Dual SSD	–
RE-PTX-X8-128G (PTX5000 only)	2.3 GHz	128 GB	10-Gigabit Ethernet	Dual SSD	–
RCB-PTX-X6-32G (PTX3000 only)	2.0 GHz	32 GB	10-Gigabit Ethernet **NOTE**: Each link can operate at 10-Gbps or 1-Gbps depending on the capability of the FPC. Some FPCs operate only at 1-Gbps. When there is a mix of RE-DUO-C2600-16G and RCB-PTX-X6-32G the links operate at 1- Gbps.	Dual SSD	–
PTX1000 built-in Routing Engine	2.5 GHz	16 GB	10-Gigabit Ethernet	Dual SSD	–
JNP10K-RE0	2.5 GHz	32 GB	10-Gigabit Ethernet	Dual SSD	–
JNP10K-RE1 JNP10K-RE1-LT	2.3 GHz	64 GB	10-Gigabit Ethernet	Dual SSD	–
JNP10K-RE1-128G	2.3 GHz	128 GB	10-Gigabit Ethernet	Dual SSD	–

SEE ALSO

Understanding Internal Ethernet Interfaces

Understanding Management Ethernet Interfaces

PTX5000 Control Board Description

IN THIS SECTION

Control Board Slots

You can install up to two Control Boards in the PTX5000. Control Boards install into the rear of the chassis in the slots labeled **CB0** and **CB1**. A Routing Engine installs directly into a slot on each Control Board. The Control Boards cannot function if a Routing Engine is not present.

If the PTX5000 contains a redundant host subsystem, one host subsystem functions as the primary and the other as its backup. If the primary fails or is removed, the backup becomes the primary. The backup becomes the primary automatically only if graceful Routing Engine switchover (GRES) is enabled. Otherwise, manual intervention is required for a host subsystem to acquire primary role.

Control Board Function

Each Control Board works with the Routing Engine to provide the following control and monitoring functions for the PTX5000:

- Determining Routing Engine primary role
- Controlling power and reset for the other PTX5000 components
- Monitoring and controlling fan speed
- Monitoring system status

Control Board CB-PTX Components

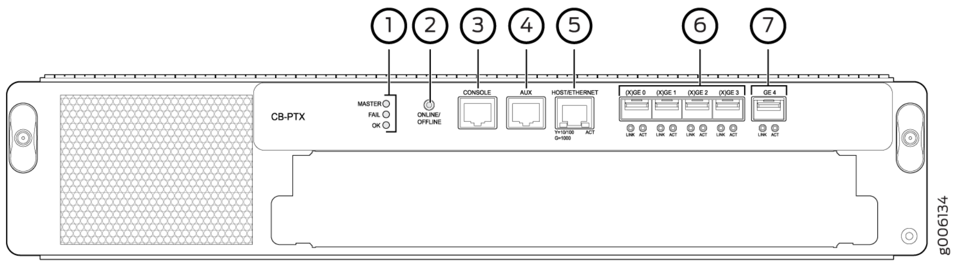
Each Control Board consists of the following components :

- Ethernet switch used for intermodule communication
- PCI bus to the Routing Engines

- Switch Processor Mezzanine Board (SPMB)

Figure 64 on page 123 shows the Control Board faceplate.

Figure 64: Control Board



1– **MASTER**, **FAIL**, and **OK** status LEDs	5– **HOST/ETHERNET** port
2– **ONLINE/OFFLINE** button	6– 10-Gigabit Ethernet ports labeled **(X)GE 0** **(X)GE 3**
3– **CONSOLE** port	7– Gigabit Ethernet port labeled **GE 4**
4– **AUX** port	

The following components are located on the Control Board faceplate:

- A slot for installation of the Routing Engine.
- Three status LEDs—**MASTER**, **FAIL**, and **OK**—indicate the status of the Control Board.
- **ONLINE/OFFLINE** button, located to the right of the status LEDs.
- Three RJ-45 management ports for connecting the Routing Engine to external management devices. The management ports on each Control Board connect to the Routing Engine installed into that Control Board. From these management devices, you can use the CLI to configure and manage the PTX5000. Each Control Board includes the following ports:
  - **HOST/ETHERNET**—10/100/1000-Mbps Ethernet port for connecting to a management network. This port connects the Routing Engine through a copper 10/100/1000BASE-T Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for management of the PTX5000. The port uses an autosensing RJ-45 connector to support 10-Mbps, 100-Mbps, or 1-Gbps connections. Two small LEDs on the bottom edge of the port indicate the port speed and traffic on the port. The left LED is labeled **Y=10/100 G=1000**, and the right LED is labeled **ACT**.
  - **CONSOLE**—One copper 9600 baud port for connecting the Routing Engine to a system console through a copper cable with RJ-45 connectors.

- **AUX**— One copper 9600 baud port for connecting the Routing Engine to a laptop, modem, or other auxiliary device through a copper cable with RJ-45 connectors.

> **NOTE**: If a PTX5000 contains two host subsystems, connect both Control Boards to your external management network.

- Four 10-Gigabit Ethernet SFP+ fiber-optic ports— labeled **(X)GE0** through **(X)GE3**—located to the right of the management ports.

  Two port LEDs—labeled **LINK** and **ACT**—located below the 10-Gigabit Ethernet ports port indicate the port speed and activity.

> **NOTE**: These ports are reserved for future use.

- Gigabit Ethernet SFP fiber-optic or copper port— labeled **GE4**—located to the right of the 10-Gigabit Ethernet ports.

> **NOTE**: This port is reserved for future use.

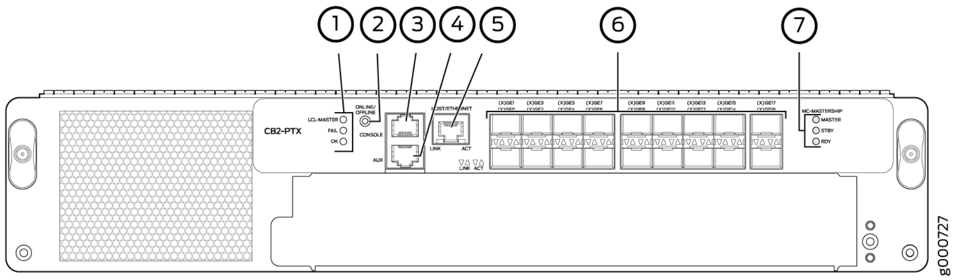
Control Board CB2-PTX Components

Each Control Board consists of the following components:

- Ethernet switch used for intermodule communication
- PCI Express switch to connect to the SIBs
- Switch Processor Mezzanine Board (SPMB)

Figure 65 on page 125 shows the Control Board faceplate.

Figure 65: Control Board (CB2-PTX)



1– **LCL-MASTER**, **FAIL**, and **OK** status LEDs	5– **HOST/ETHERNET** port
2– **ONLINE/OFFLINE** button	6– Gigabit Ethernet ports labeled **(X)GE 0** through **(X)GE 17**
3– **CONSOLE** port	7– **MASTER**, **STBY**, and **RDY** status LEDs
4– **AUX** port	

The following components are located on the Control Board faceplate:

- A slot for installation of the Routing Engine.
- Three status LEDs—**LCL-MASTER**, **FAIL**, and **OK**—indicate the status of the Control Board.
- **ONLINE/OFFLINE** button, located to the right of the status LEDs.
- Three RJ-45 management ports for connecting the Routing Engine to external management devices. The management ports on each Control Board connect to the Routing Engine installed into that Control Board. From the external management devices, you can use the CLI to configure and manage the PTX5000. Each Control Board includes the following ports:
  - **HOST/ETHERNET**—10/100/1000-Mbps Ethernet port for connecting to a management network. This port connects the Routing Engine through a copper 10/100/1000BASE-T Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for management of the PTX5000. The port uses an autosensing RJ-45 connector to support 10-Mbps, 100-Mbps, or 1-Gbps connections. Two small LEDs on the bottom edge of the port indicate the port speed and traffic on the port. The left LED is labeled **LINK**, and the right LED is labeled **ACT** to indicate port speed and activity.
  - **CONSOLE**—One 9600-baud-rate console port for connecting the Routing Engine to a system console through a copper cable with RJ-45 connectors.
  - **AUX**— One 9600-baud-rate console port for connecting the Routing Engine to a laptop, modem, or other auxiliary device through a copper cable with RJ-45 connectors.

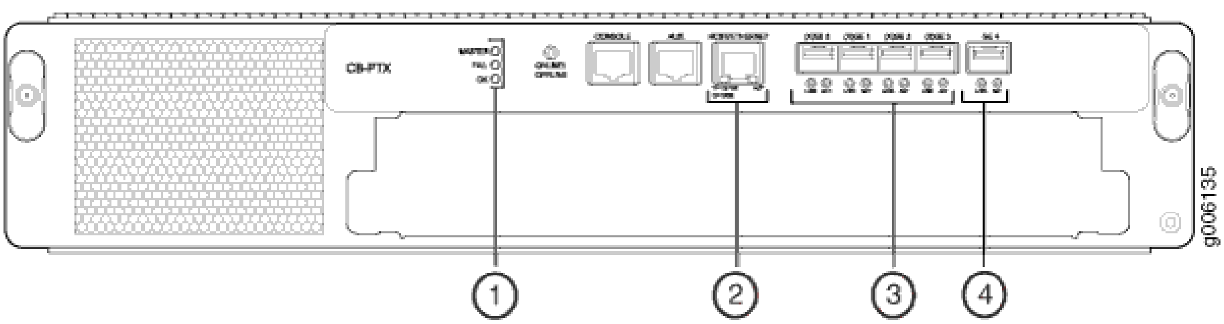
NOTE: If a PTX5000 contains two host subsystems, connect both Control Boards to your external management network.

- Eighteen 10-Gigabit Ethernet SFP+ fiber-optic ports—labeled **(X)GE0** through **(X)GE17**—located to the right of the management ports. These ports are reserved for future use. However, **(X)GE14** and **(X)GE15** are configured as 1-Gigabit Ethernet ports.
- **MASTER**, **STBY**, and **RDY** LEDs—For multichassis applications. These LEDs are reserved for future use.

PTX5000 Control Board LEDs

Three LEDs located to the left of the online/offline button indicate the status of the Control Board. Table 50 on page 126 and Table 52 on page 128 describes the functions of the Control Board LEDs.

Figure 66: Control Board CB-PTX LEDs



1– **MASTER**, **FAIL**, and **OK** status LEDs	3– **LINK** and **ACT** LEDs for the 10-Gigabit Ethernet ports labeled **(X)GE 0 (X)GE 3**
2– **Y=10/100 G=1000** and **ACT** LEDs for the **HOST/ETHERNET** port	4– **LINK** and **ACT** LEDs for the Gigabit Ethernet port labeled **GE 4**

Table 50: Control Board CB-PTX LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	Control Board is functioning as the primary.

Table 50: Control Board CB-PTX LEDs *(Continued)*

Label	Color	State	Description
	–	Off	Control Board is functioning as the backup.
FAIL	Yellow	On steadily	Control Board has failed.
	–	Off	No faults have been detected on the Control Board.
OK	Green	On steadily	Control Board is online and is functioning normally.
	–	Off	Control Board is offline.

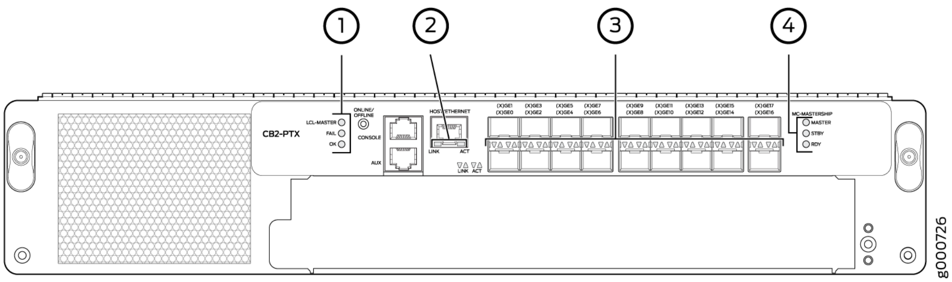
Table 51: Control Board CB-PTX Port LEDs

Port	Label	Color	State	Description
HOST/ETHERNET	**Y=10/100 G=1000**	Green	On steadily	1-Gbps connection.
		Yellow	On steadily	10/100-Mbps connection.
		–	Off	Control Board is offline.
	ACT	Green	On steadily	Traffic is passing through the port.
		–	Off	No traffic is passing through the port.
(X)GE0 through **(X)GE3**	**LINK**	Green	–	**NOTE**: These ports are reserved for future use.
	ACT	Green	–	**NOTE**: These ports are reserved for future use.
GE4	**LINK**	Green	–	**NOTE**: This port is reserved for future use.

Table 51: Control Board CB-PTX Port LEDs *(Continued)*

Port	Label	Color	State	Description
	ACT	Green	–	**NOTE**: This port is reserved for future use.

Figure 67: Control Board CB2-PTX LEDs



1– **LCL-MASTER**, **FAIL**, and **OK** status LEDs	3– Link and activity LEDs for the Gigabit Ethernet ports labeled **(X)GE 0** through **(X)GE 17**
2– **LINK** and **ACT** LEDs for the **HOST/ ETHERNET** port	4– **MASTER**, **STBY**, and **RDY** status LEDs. These LEDs are reserved for future use for multichassis applications.

Table 52: Control Board CB2-PTX LEDs

Label	Color	State	Description
LCL-MASTER	Blue	On steadily	Control Board is functioning as the primary.
	–	Off	Control Board is functioning as the backup.
FAIL	Yellow	On steadily	Control Board has failed.
	–	Off	No faults are detected on the Control Board.
OK	Green	On steadily	Control Board is online and is functioning normally.

Table 52: Control Board CB2-PTX LEDs *(Continued)*

Label	Color	State	Description
	–	Off	Control Board is offline.
MC-MASTERSHIP LEDs			
MASTER		Off	These LEDs are reserved for future use for multichassis applications.
STBY		Off	
RDY		Off	

Table 53: Control Board CB2-PTX Port LEDs

Port	Label	Color	State	Description
HOST/ETHERNET	**LINK**	Green	On steadily	1-Gbps connection.
		Yellow	On steadily	100-Mbps connection.
		–	Off	10-Mbps connection (If the**ACT** LED is blinking green)
		–	Off	Offline
	ACT	Green	Blinking	Indicates activity. 1-Gbps connection.
		Green	Off	Indicates no activity.
(X)GE0 through **(X)GE17**	**LINK**	Green	On steadily	**NOTE**: These ports are reserved for future use. **(X)GE14** and **(X)GE15** are configured as 1-Gigabit Ethernet ports.

Table 53: Control Board CB2-PTX Port LEDs *(Continued)*

Port	Label	Color	State	Description
	ACT	Green	Blinking	**NOTE**: These ports are reserved for future use. **(X)GE14** and **(X)GE15** are configured as 1-Gigabit Ethernet ports.

RELATED DOCUMENTATION

PTX5000 Craft Interface LEDs | **22**

Connecting the PTX5000 to a Management Console or Auxiliary Device | **265**

Connecting the PTX5000 to a Management Ethernet Device | **266**

Maintaining the PTX5000 Host Subsystem | **440**

Troubleshooting the PTX5000 Host Subsystem | **582**

Troubleshooting the PTX5000 Routing Engines | **584**

Troubleshooting the PTX5000 Control Boards | **588**

PTX5000 Switch Interface Boards

IN THIS SECTION

PTX5000 Switch Interface Board Description

IN THIS SECTION

SIB Slots

The PTX5000 Switch Interface Boards (SIBs) form the switch fabric for the router. Each PTX5000 contains nine SIBs located at the center rear of the chassis in the slots labeled **SIB0** through **SIB8** (top to bottom). SIBs are hot-insertable and hot-removable.

SIB Function

SIBs create the switch fabric for the PTX5000.

SIBs Supported on the PTX5000

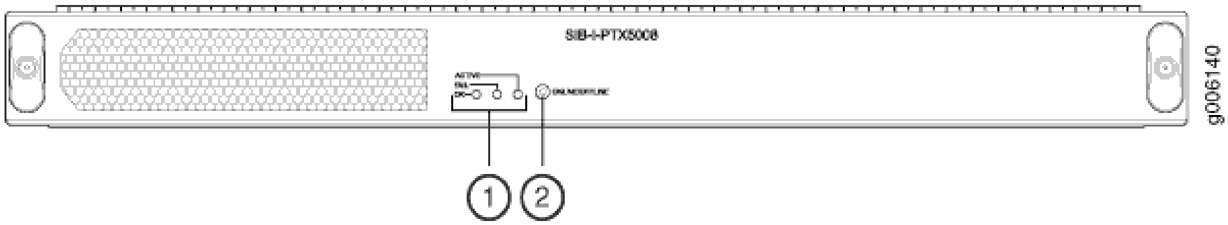
The PTX5000 supports the following SIBs:

- SIB-I-PTX5008
- SIB2-I-PTX5K
- SIB3-I-PTX5K

SIB Components

Figure 68 on page 132 ,Figure 69 on page 132 , and Figure 70 on page 132 show the supported SIBs. Each SIB weighs 6 lb (2.7 kg).

Figure 68: SIB-I-PTX5008 SIB

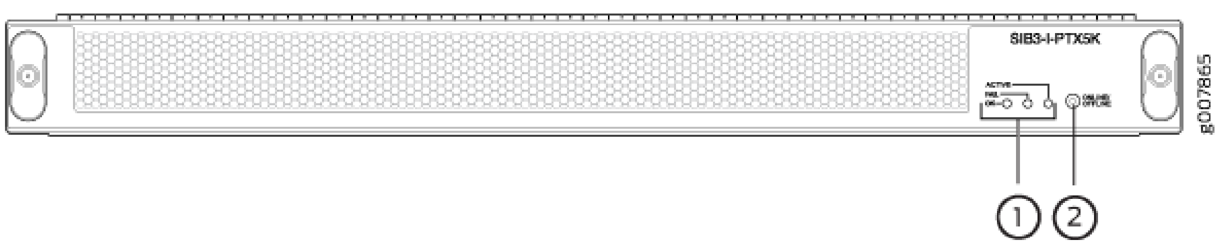


1– **OK**, **FAIL**, and **ACTIVE** LEDs	2– **ONLINE/OFFLINE** button

Figure 69: SIB2-I-PTX5K SIB

1– **OK**, **FAIL**, and **ACTIVE** LEDs	2– **ONLINE/OFFLINE** button

Figure 70: SIB3-I-PTX5K SIB



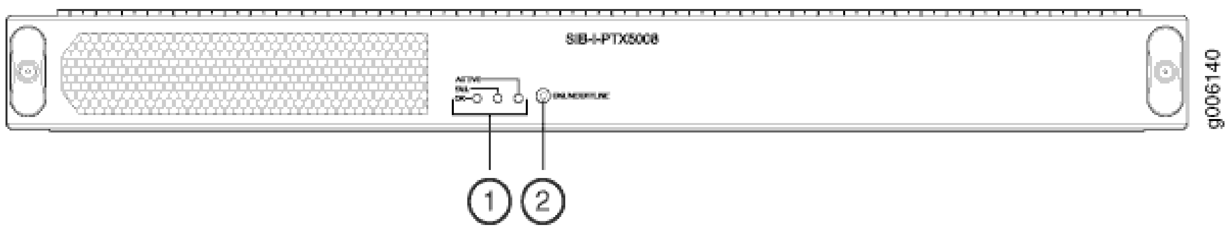
1– **OK**, **FAIL**, and **ACTIVE** LEDs	2– **ONLINE/OFFLINE** button

Each SIB consists of the following components:

- Switch fabric ASICs.
- High-speed links to each FPC.
- SIB **ONLINE/OFFLINE** button, located on the SIB faceplate.
- Three LEDs located on the SIB faceplate that display the status of the SIB. The **OK** and **ACT** LEDs are replicated on the craft interface.

PTX5000 Switch Interface Board LEDs

Figure 71: SIB LEDs



1– OK, FAIL, and ACTIVE LEDs	2– ONLINE/OFFLINE button

The status LEDs are located to the left of the **ONLINE/OFFLINE** buttons. Table 54 on page 133 describes the functions of these LEDs.

Table 54: SIB LEDs

Label	Color	State	Description
ACTIVE	Green	On steadily	SIB is actively passing traffic.
	–	Off	SIB is either offline or not actively passing traffic.
OK	Green	On steadily	SIB is functioning normally.
	–	Off	SIB is offline or not seated properly.
FAIL	Yellow	On steadily	SIB has failed.
	–	Off	No faults have been detected for the SIB.

RELATED DOCUMENTATION

Maintaining the PTX5000 Switch Interface Boards | 484
Troubleshooting the PTX5000 Switch Interface Boards | 593

PTX5000 Interface Modules

IN THIS SECTION

PTX5000 FPC Description

IN THIS SECTION

FPC Slots

Up to eight FPCs install vertically in the front of the PTX5000. The FPC slots are numbered **FPC0** through **FPC7**, left to right. If a slot is not occupied by an FPC, an FPC blank panel must be installed to shield the empty slot and to allow cooling air to circulate properly through the PTX5000.

FPC Function

FPCs house the PICs that connect the PTX5000 to network media. The main function of an FPC is to connect the PICs installed in it to the other chassis components. The Packet Forwarding Engine receives incoming packets from the PICs installed on the FPC and forwards them through the switch planes to the appropriate destination port.

When you install an FPC into a functioning PTX5000, the Routing Engine downloads the FPC software, the FPC runs its diagnostics, and the PICs housed on the FPC are enabled. Forwarding on other FPCs continues uninterrupted during this process.

FPC Components

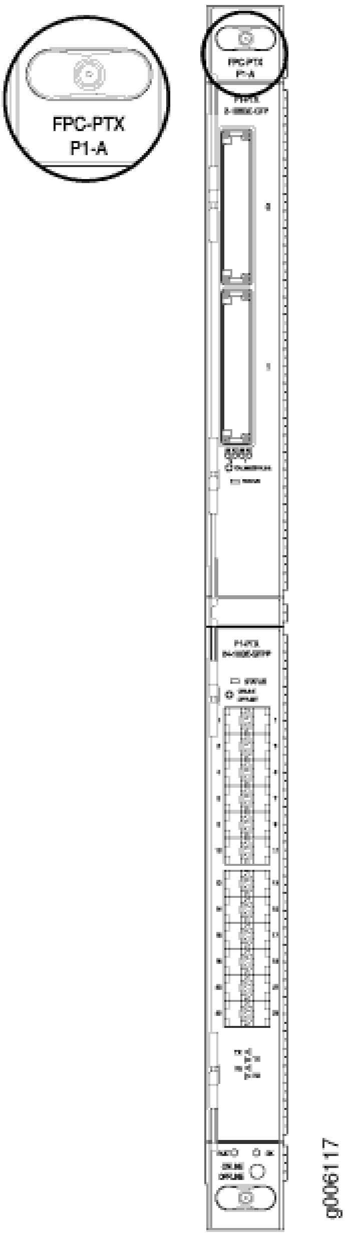
Each FPC consists of the following components:

- FPC card carrier
- Packet Forwarding Engines, consisting of Lookup ASICs and the Queuing and Memory Interface ASICs
- Processor Mezzanine Board (PMB), which includes a 1.2-GHz CPU, 4 GB of SDRAM, and two Fast Ethernet interfaces
- Two LEDs on the FPC that display the status of the FPC
- FPC online/offline button

Identifying the FPCs

Check the label on the faceplate to identify the FPC, as shown in Figure 72 on page 136.

Figure 72: Identifying the FPCs



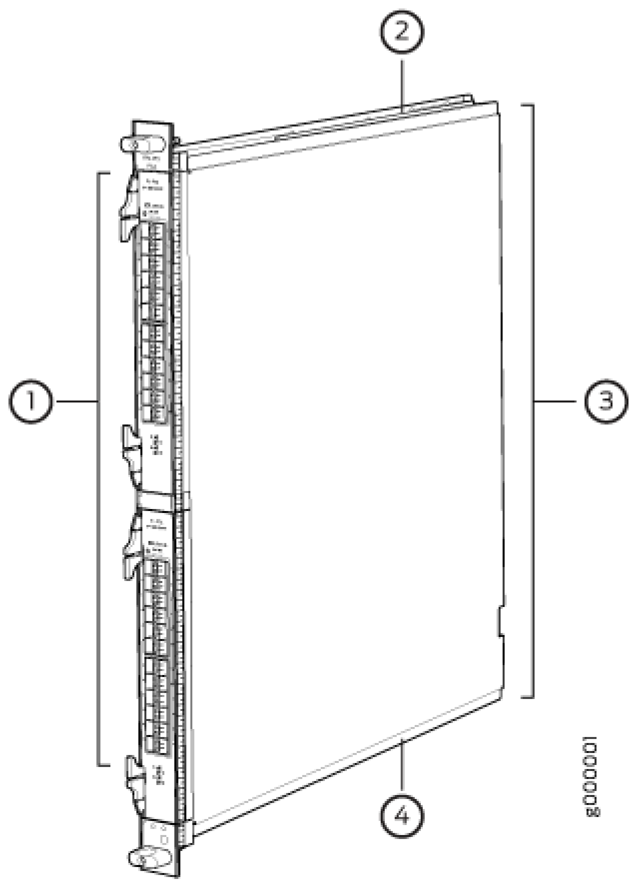
FPC Terminology

Regardless of whether you are holding an FPC vertically or horizontally, this document uses the same terms for all four edges of the FPC (see Figure 73 on page 137):

- Faceplate—Edge of the FPC that has slots into which you insert the PICs
- Connector edge—Edge opposite the faceplate; this edge has the connectors that attach to the midplane

- Top edge—Edge at the top of the FPC when it is vertical
- Bottom edge—Edge at the bottom of the FPC when it is vertical

Figure 73: FPC Edges



1– Faceplate	3– Connector edge
2– Top edge	4– Bottom edge

FPCs Supported on the PTX5000

Table 55 on page 138 lists the FPCs supported on the PTX5000. The First Junos OS Release Supported column indicates the first release that the FPC is supported on the PTX5000.

NOTE: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

Table 55: FPCs Supported on the PTX5000

FPC Generation	FPC Model Number	Maximum Throughput per FPC	First Junos OS Release Supported
First generation	FPC-PTX-P1-A	480 Gbps	12.1X48 12.3
Second generation	FPC2-PTX-P1A	960 Gbps	14.1
Third generation	FPC3-PTX-U2	2 Tbps **NOTE**: A 1 Tbps license (FPC3-PTX-U1 license model number) is also available for this FPC. You can later upgrade to a 2 Tbps license if you desire.	15.1F3
Third generation	FPC3-PTX-U3	3 Tbps **NOTE**: A 1.5 Tbps license is also available for this FPC. You can later upgrade to a 3 Tbps license if you desire.	15.1F3

NOTE: To use the advance features provided by third-generation FPCs, you must have `enhanced-mode` configured on the chassis.

PTX5000 FPC LEDs

Each FPC has two LEDs—labeled **FAULT** and **OK**. Table 56 on page 139 describes the functions of the PTX5000 FPC LEDs.

Table 56: PTX5000 FPC LEDs

Label	Color	State	Description
OK	Green	On steadily	FPC is online and is functioning normally.
		Blinking	FPC is booting up.
FAULT	Red	On steadily	FPC has failed.
	–	Off	FPC is offline .

PTX5000 PIC Description

IN THIS SECTION

PTX5000 PIC Slots

Each FPC has two PIC slots. Blank PICs resemble other PICs but do not provide any physical connection or activity. When a PIC slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system. PICs are hot-removable and hot-insertable.

PTX5000 PIC Function

PICs provide the physical connection to various network media types, receiving incoming packets from the network and transmitting outgoing packets to the network. During this process, each PIC performs framing and line-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs.

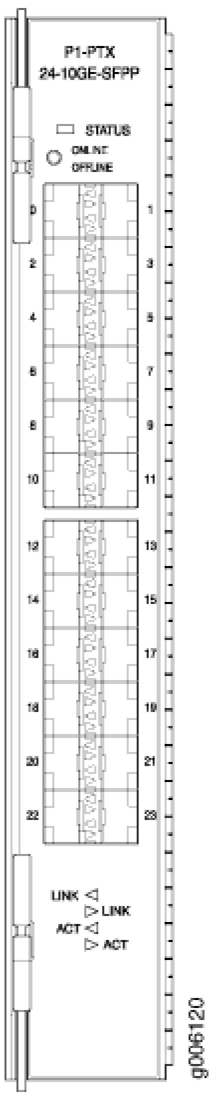
PICs Supported on the PTX5000

See *PICs Supported on the PTX Series* for a complete list of PICs supported on the PTX5000.

PTX5000 PIC Components

Figure 74 on page 140 shows an example of a PIC supported on the PTX5000. PICs have an upper ejector handle and a lower ejector handle.

Figure 74: PIC Faceplate



PICs Supported on the PTX Series

Table 57 on page 141 lists the PICs supported on the PTX Series and the first Junos OS release that supports each PIC.

See *PTX Series PIC/FPC Compatibility* for information about supported FPC and PIC combinations.

NOTE: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

Table 57: PICs Supported on the PTX Series

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
10-Gigabit Ethernet				
10-Gigabit Ethernet PIC with SFP+ (PTX Series)	24	P1-PTX-24-10GE-SFPP	13.2R2	12.1X48 12.3R1 13.2R1
10-Gigabit Ethernet LAN/WAN OTN PIC with SFP + (PTX Series)	24	P1-PTX-24-10G-W-SFPP	13.2R2	12.3R2 13.2R1
10-Gigabit Ethernet/40-Gigabit Ethernet				
10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)	12	P2-10G-40G-QSFPP	15.1F6 16.1R2 17.1R1	14.1R2
24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)	24	P3-24-U-QSFP28	15.1F6 16.1R2 17.1R1	15.1F3 16.1R2 17.1R1
40-Gigabit Ethernet				

Table 57: PICs Supported on the PTX Series *(Continued)*

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
40-Gigabit Ethernet PIC with CFP (PTX Series)	2	P1-PTX-2-40GE-CFP	13.2R2	12.1X48 12.3R1 13.2R1
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet				
10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)	10	P3-10-U-QSFP28	16.1R3 17.1R1 **NOTE**: The P3-10-U-QSFP28 PIC is supported on PTX3000 on a service release version of Junos OS 15.1F6-S2.	17.1R1
15-Port 10-Gigabit, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)	15	P3-15-U-QSFP28	Not supported	15.1F5 16.1R2 17.1R1
100-Gigabit Ethernet				
100-Gigabit Ethernet PIC with CFP (PTX Series)	2	P1-PTX-2-100GE-CFP	13.2R2	12.1X48 12.3R1 13.2R1
100-Gigabit Ethernet PIC with CFP2 (PTX Series)	4	P2-100GE-CFP2	Not supported	14.1R1

Table 57: PICs Supported on the PTX Series *(Continued)*

PIC Family and Type	Ports	Model Number	PIC First Supported on PTX3000	PIC First Supported on PTX5000
100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)	4	P2-100GE-OTN	15.1F6 16.1R2 17.1R1	14.1R2
100-Gigabit DWDM OTN				
100-Gigabit DWDM OTN PIC (PTX Series)	2	P1-PTX-2-100G-WDM	13.3R1	13.2R1
100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)	5	PTX-5-100G-WDM	15.1F6 17.1R1	15.1F6 17.1R1

PTX Series PIC/FPC Compatibility

IN THIS SECTION

Table 58 on page 144 and Table 59 on page 146 list the PICs supported on each PTX Series router, the FPCs that support each PIC, and the first Junos OS release that supports each PIC and FPC combination.

NOTE: PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.

PTX3000 PIC/FPC Compatibility

Table 58 on page 144 describes PIC/FPC compatibility for the PTX3000.

Table 58: PTX3000 PIC/FPC Compatibility

PIC Family and Type	Model Number	PIC First Supported on FPC-SFF-PTX-P1	PIC First Supported on FPC-SFF-PTX-T	PIC First Supported on FPC3-SFF-PTX
10-Gigabit Ethernet				
10-Gigabit Ethernet PIC with SFP+ (PTX Series)	P1-PTX-24-10GE-SFPP	13.2R2	14.1R1	Not supported
10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)	P1-PTX-24-10G-W-SFPP	13.2R2	14.1R1	15.1F6 16.1R2 17.1R1
10-Gigabit Ethernet/40-Gigabit Ethernet				
10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)	P2-10G-40G-QSFPP	Not supported	Not supported	15.1F6 16.1R2 17.1R1
24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP + (PTX Series)	P3-24-U-QSFP28	Not supported	Not supported	15.1F6 16.1R2 17.1R1
40-Gigabit Ethernet				
40-Gigabit Ethernet PIC with CFP (PTX Series)	P1-PTX-2-40GE-CFP	13.2R2	14.1R1	Not supported
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet				

Table 58: PTX3000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-SFF-PTX-P1	PIC First Supported on FPC-SFF-PTX-T	PIC First Supported on FPC3-SFF-PTX
10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)	P3-10-U-QSFP28	Not supported	Not supported	16.1R3 17.1R1 **NOTE**: The P3-10-U-QSFP28 PIC is supported on PTX3000 on a service release version of Junos OS 15.1F6-S2.
100-Gigabit Ethernet				
100-Gigabit Ethernet PIC with CFP (PTX Series)	P1-PTX-2-100GE-CFP	13.2R2	14.1R1	Not supported
100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)	P2-100GE-OTN	Not supported	Not supported	15.1F6 16.1R2 17.1R1
100-Gigabit DWDM OTN				
100-Gigabit DWDM OTN PIC (PTX Series)	P1-PTX-2-100G-WDM	13.3R1	14.1R1	Not supported
100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)	PTX-5-100G-WDM	Not supported	Not supported	15.1F6 17.1R1

PTX5000 PIC/FPC Compatibility

Table 59 on page 146 describes PIC/FPC compatibility for the PTX5000.

Table 59: PTX5000 PIC/FPC Compatibility

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
10-Gigabit Ethernet					
10-Gigabit Ethernet PIC with SFP+ (PTX Series)	P1-PTX-24-10GE-SFPP	12.1X48 12.3 13.2	14.1R1	Not supported	Not supported
10-Gigabit Ethernet LAN/WAN OTN PIC with SFP+ (PTX Series)	P1-PTX-24-10G-W-SFPP	12.3R2 12.3 13.2	14.1R1	15.1F5	15.1F5
10-Gigabit Ethernet/40-Gigabit Ethernet					
10-Gigabit Ethernet/40-Gigabit Ethernet LAN/WAN OTN PIC with QSFP+ (PTX Series)	P2-10G-40G-QSFPP	Not supported	14.1R2	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
24-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet PIC with QSFP+ (PTX Series)	P3-24-U-QSFP28	Not supported	Not supported	15.1F3 16.1R2 17.1R1	15.1F3 16.1R2 17.1R1
40-Gigabit Ethernet					
40-Gigabit Ethernet PIC with CFP (PTX Series)	P1-PTX-2-40GE-CFP	12.1X48 12.3 13.2	14.1R2	Not supported	Not supported

Table 59: PTX5000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet					
10-Port 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)	P3-10-U-QSFP28	Not supported	Not supported	17.1R1	17.1R1
15-Port 10-Gigabit, 40-Gigabit Ethernet, 100-Gigabit Ethernet PIC with QSFP28 (PTX Series)	P3-15-U-QSFP28	Not supported	Not supported	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
100-Gigabit Ethernet					
100-Gigabit Ethernet PIC with CFP (PTX Series)	P1-PTX-2-100GE-CFP	12.1X48 12.3 13.2	14.1R2	Not supported	Not supported
100-Gigabit Ethernet PIC with CFP2 (PTX Series)	P2-100GE-CFP2	Not supported	14.1R1	Not supported	Not supported
100-Gigabit Ethernet OTN PIC with CFP2 (PTX Series)	P2-100GE-OTN	Not supported	14.1R2	15.1F5 16.1R2 17.1R1	15.1F5 16.1R2 17.1R1
100-Gigabit DWDM OTN					

Table 59: PTX5000 PIC/FPC Compatibility *(Continued)*

PIC Family and Type	Model Number	PIC First Supported on FPC-PTX-P1-A	PIC First Supported on FPC2-PTX-P1A	PIC First Supported on FPC3-PTX-U2	PIC First Supported on FPC3-PTX-U3
100-Gigabit DWDM OTN PIC (PTX Series)	P1-PTX-2-100G-WDM	13.2R1	14.1R1	Not supported	Not supported
100-Gigabit DWDM OTN PIC with CFP2-ACO (PTX Series)	PTX-5-100G-WDM	Not supported	Not supported	15.1F6 17.1R1	15.1F6 17.1R1

RELATED DOCUMENTATION

Maintaining PTX5000 Interface Modules | **487**
Troubleshooting the PTX5000 FPCs | **597**
Troubleshooting the PTX5000 PICs and PIC Transceivers | **602**

2

CHAPTER

Site Planning, Preparation, and Specifications

Overview of Preparing the Site for the PTX5000

To prepare a site for PTX5000 installation:

1. Verify that environmental factors such as temperature and humidity do not exceed PTX5000 tolerances.

   See "PTX5000 Environmental Specifications" on page 152.
2. Verify that the site and installation plan meets all safety guidelines and requirements.

   See *General Site Guidelines* and *General Safety Guidelines and Warnings*.
3. Locate sites for connection of system grounding.

   See "PTX5000 Chassis Grounding Cable and Lug Specifications" on page 154.
4. Calculate the power consumption and requirements.

   Measure the distance between external power sources and the PTX5000 installation site.

   For an AC-powered PTX5000

   - See "PTX5000 AC Power Electrical Safety Guidelines" on page 667
   - See "PTX5000 AC Power System Specifications" on page 66
   - See "PTX5000 Three-Phase Delta AC Power Distribution Unit Specifications" on page 67
   - See "PTX5000 Three-Phase Wye AC Power Distribution Unit Specifications" on page 67
   - See "Calculating PTX5000 Power Consumption" on page 166
   - See "PTX5000 AC Power Cord Specifications" on page 70

   For a DC-powered PTX5000:

   - See "PTX5000 DC Power Electrical Safety Guidelines" on page 670
   - See "PTX5000 DC Power System Electrical Specifications" on page 101
   - See "PTX5000 DC Power Distribution Unit Specifications" on page 102
   - See "Calculating PTX5000 Power Consumption" on page 166
   - See "PTX5000 DC Power Cable and Lugs Specifications" on page 103
   - See "PTX5000 DC Power Distribution" on page 106
5. Plan rack location, including required space clearances.

   - "PTX5000 Clearance Requirements for Airflow and Hardware Maintenance" on page 157
   - "PTX5000 Physical Specifications" on page 159

6. Verify that the plan for power installation meets all electrical safety guidelines.

   See *Site Electrical Wiring Guidelines* and *General Electrical Safety Guidelines and Warnings*.

7. Verify that your rack meets the minimum requirements for the installation of the PTX5000.

   - "Rack Requirements for the PTX5000" on page 164
   - "PTX5000 Chassis Description" on page 14

8. Plan to secure the rack to the floor and building structure.

   See "Rack Requirements for the PTX5000" on page 164.

9. Acquire cables and connectors:

   - Determine the number of cables and type of cable needed based on your planned configuration.
     - The PTX Series Interface Module Reference describes the PICs supported on PTX Series routers.
     - **TIP**: You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.
   - Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.
     - *Calculating Power Budget and Power Margin for Fiber-Optic Cables*
     - *Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion*

10. Plan the cable routing and management.

    - "PTX5000 Cable Management System" on page 18
    - "Maintaining the PTX5000 PIC Cables" on page 504

RELATED DOCUMENTATION

Overview of Installing the PTX5000 | **186**

PTX5000 Site Guidelines and Requirements

IN THIS SECTION

PTX5000 Environmental Specifications

Table 60 on page 152 specifies the environmental specifications required for normal PTX5000 operation. In addition, the site should be as dust-free as possible.

Table 60: PTX5000 Environmental Specifications

Description	Value
Altitude	No performance degradation to 10,000 ft (3048 m)
Relative humidity	Normal operation ensured in relative humidity range of 5% to 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32°F (0°C) to 104°F (40°C) Nonoperating storage temperature in shipping crate: –40°F (–40°C) to 158°F (70°C)
Seismic	Designed to meet Telcordia Technologies Zone 4 earthquake requirements

Table 60: PTX5000 Environmental Specifications *(Continued)*

Description	Value
Maximum thermal output	• Normal-capacity AC and 60A DC power: 68,200 BTU/hour (20,000 W) • Normal-capacity 120A DC power: 62,000 BTU/hour (18,182 W) • High-capacity AC and DC power: 115,182 BTU/hour (33,778 W)

NOTE: Install the PTX5000 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.

SEE ALSO

Routine Maintenance Procedures for the PTX5000 | **298**

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.

PTX5000 Chassis Grounding Cable and Lug Specifications

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the PTX5000 must be adequately grounded before power is connected.

Two pairs of threaded inserts (PEM nuts) are provided on the right rear of the chassis for connecting the packet transport to earth ground. The top pair of grounding points fits M6 screws (European), and the bottom pair fits UNC 1/4–20 screws (American). The grounding points are spaced at 0.625-in. (15.86-mm) centers.

The accessory kit shipped with the PTX5000 includes:

- Two UNC 1/4–20 screws used to secure the grounding cable to the bottom grounding points.
- Depending on your configuration:
  - 60-A DC PDU—4-AWG (21.2 mm^2) cable lugs for connecting DC power and grounding the PTX5000 (see Figure 76 on page 155).
  - 120-A DC PDU—0-AWG (53 mm^2) cable lugs for connecting DC power and grounding the PTX5000 (see Figure 75 on page 155).
  - High Capacity DC PDU—4-AWG (21.2 mm^2) cable lugs for connecting DC power and grounding the PTX5000 (see Figure 76 on page 155).

CAUTION: Before device installation begins, a licensed electrician must attach a cable lug to the grounding cable that you supply. A cable with an incorrectly attached lug can damage the PTX5000.

NOTE: You must install the PTX5000 in a restricted-access location and ensure that the chassis is always properly grounded. The PTX5000 has a two-hole protective grounding terminal provided on the chassis. Under all circumstances, use this grounding connection to ground the chassis. For AC-powered systems, you must also use the grounding wire in the AC power cord along with the two-hole grounding lug connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

Figure 75: 0-AWG Grounding Cable Lug

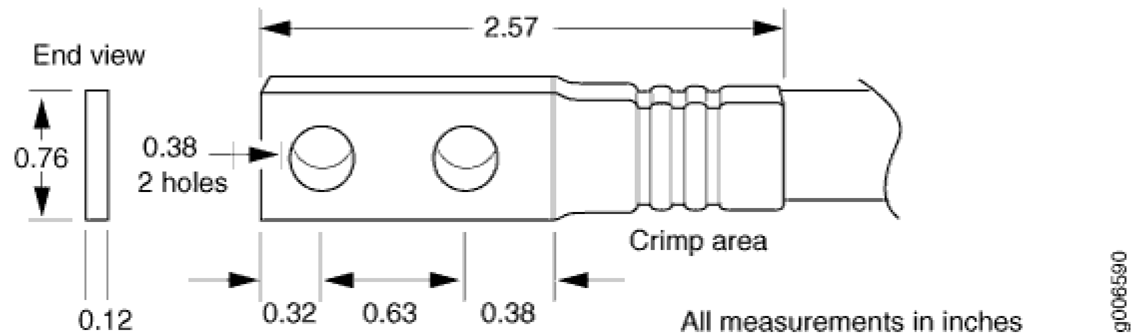
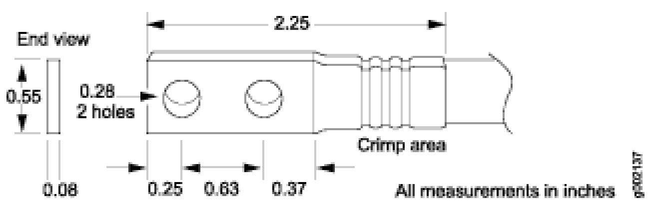


Figure 76: 4-AWG Grounding Cable Lug



You must supply a grounding cable. Table 61 on page 155 summarizes the specifications for the grounding cable and lug.

Table 61: Grounding Cable Specifications

Item	Specification
Grounding cable	The grounding cable must be equivalent in size or larger—have a greater current-carrying capacity—than the power cables connected to the PDUs.
Grounding connector	Cable lug; dual hole, sized to fit 1/4-20 UNC terminal studs at 15.86-mm (0.625-in.) center line.

In addition, GR1089-CORE requires the following:

- The grounding conductor must be copper.
- Bare conductors shall be coated with an antioxidant before crimp connections are made.
- Plated areas that are electrically connected to the grounding conductor shall be cleaned and free of contaminants before the connection is made.

SEE ALSO

Tools and Parts Required to Ground the PTX5000 | 211

Connecting the PTX5000 to Earth Ground | 211

PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications

Table 62 on page 156 lists the AC PDU electrical and external circuit breaker specifications.

Table 62: PTX5000 AC PDU Electrical and External Circuit Breaker Specifications

PDU	Maximum Current Drawn	Cable Amp Rating	External Circuit Breaker/ Fuse	Operational Voltage	Feeds per PDU	Plug Rating
Normal Capacity Three-phase AC Delta PDU (PDU-PTX-AC-D)	48 A	60 A	60 A	200 V–240 V	1	60 A
Normal Capacity Three-phase AC Wye PDU (PDU-PTX-AC-W)	32 A	32 A	32 A	200 V–240 V	1	32 A
High Capacity Delta AC PDU (PDU2-PTX-AC-D) with 60 A power cord	48 A	60 A	60 A	200 V–240 V	1	60 A
High Capacity Delta AC PDU (PDU2-PTX-AC-D) with 100 A power cord	80 A	80 A	80 A	200 V–240 V	1	100 A
High Capacity Delta AC PDU (PDU2-PTX-AC-D) with 150 A power cord	114 A	120 A	120 A	200 V–240 V	1	150 A

Table 62: PTX5000 AC PDU Electrical and External Circuit Breaker Specifications *(Continued)*

PDU	Maximum Current Drawn	Cable Amp Rating	External Circuit Breaker/ Fuse	Operational Voltage	Feeds per PDU	Plug Rating
High Capacity Wye AC PDU (PDU2-PTX-AC-W)	56 A	63 A	63 A	200 V–240 V	1	63 A

Table 63 on page 157 lists the DC PDU electrical and external circuit breaker specifications.

Table 63: PTX5000 DC PDU Electrical and External Circuit Breaker Specifications

PDU	Maximum Current Drawn	Cable Amp Rating	External Circuit Breaker/Fuse	Operational Voltage	Feeds per PDU	Plug Rating
Normal Capacity 60-A DC PDU (PDU-PTX-DC-60)	48 A	NA	48 A–60 A	48 V–60 V	8	NA
Normal Capacity 120-A DC PDU (PDU-PTX-DC-120)	93 A	NA	93 A–120 A	48 V–60 V	4	NA
High Capacity DC PDU (PDU2-PTX-DC)	48 A	NA	48 A–60 A	48 V–60 V	16	NA

PTX5000 Clearance Requirements for Airflow and Hardware Maintenance

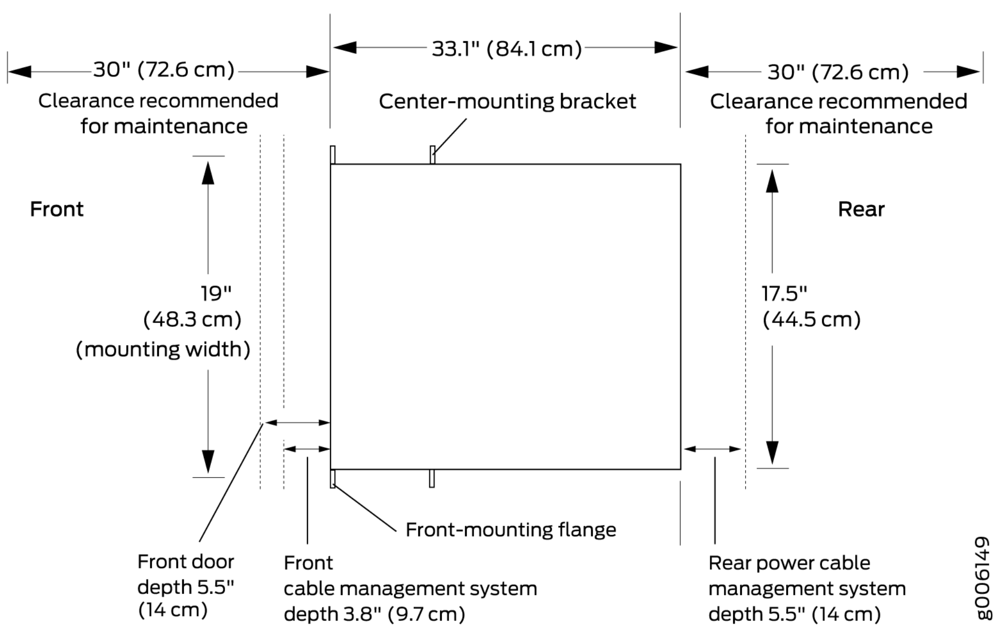
When planning the installation site, allow sufficient clearance around the rack (see Figure 77 on page 158):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted.

NOTE: If you mount the chassis in a cabinet, be sure that ventilation is sufficient to prevent overheating.

- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the chassis. At least 24 in. (61.0 cm) are required both in front of and behind the PTX5000. NEBS GR-63 recommends that you allow at least 30 in. (72.6 cm) behind the rack.
- Additional clearance is required to accommodate the depth of the following components:
  - Front cable management system—3.8 in. (9.7 cm) additional depth in the front of the chassis.
  - Front door—5.5 in. (14 cm) additional depth in the front of the chassis.
  - Rear cable management system—5.5 in. (14 cm) additional depth in the rear of the chassis.

Figure 77: Chassis Dimensions and Clearance Requirements



SEE ALSO

PTX5000 Installation Safety Guidelines | 187

PTX5000 Cooling System | 31

PTX5000 Physical Specifications

Table 64 on page 159 lists the physical specifications for the PTX5000 chassis and components.

Table 64: Physical Specifications

Description	Weight	Height	Width	Depth
Chassis with midplane, power shelf, and cable management system	324 lb (147 kg)	62.5 in. (158.8 cm)	17.5 in. (44.5 cm) (excluding the mounting flanges or brackets)	33.1 in. (84.1 cm) (from front-mounting flange to chassis rear)
Craft interface	2.6 lb (1.2 kg)	3.5 in. (8.9 cm)	17.4 in. (44.3 cm)	1.4 in. (3.6 cm)
CCG	1.8 lb (0.8 kg)	1.3 in. (3.2 cm)	5.8 in. (14.6 cm)	10.7 in. (27.2 cm)
Horizontal fan tray	FAN-PTX-H: 16.3 lb (7.4 kg)	2.2 in. (5.6 cm)	14.7 in. (37.3 cm)	21.2 in. (53.8 cm)
	FAN3-PTX-H: 19.8 lb (9 kg)			
Vertical fan tray (including the vertical air filter tray and air filter)	26.8 lb (12.2 kg)	26.4 in. (67 cm)	3.4 in. (8.7 cm)	21.9 in. (55.5 cm)
Horizontal air filter tray (including the air filter)	7.1 lb (3.2 kg)	7.4 in. (18.7 cm)	14 in. (35.6 cm)	18.6 in. (47.2 cm)
Vertical air filter tray (including the air filter)	7.6 lb (3.5 kg)	26.4 in. (67 cm)	3.4 in. (8.7 cm)	11.3 in. (28.6 cm)
Control Board	CB-PTX: 10 lb (4.5 kg)	3.4 in. (8.5 cm)	17.1 in (43.4 cm)	11.7 in (29.8 cm)

Table 64: Physical Specifications *(Continued)*

Description	Weight	Height	Width	Depth
	CB2-PTX: 10 lb (4.5 kg)	3.4 in. (8.5 cm)	17.1 in (43.4 cm)	11.7 in (29.8 cm)
Routing Engine	RE-DUO-C2600-16G: 2.8 lb (1.3 kg)	1.7 in. (4.4 cm)	10.3 in. (26.2 cm)	6.9 in. (17.5 cm)
	RE-PTX-X8-64G: 2.6 lb (1.2 kg)	1.6 in (4.1 cm)	10.3 in (26.2 cm)	6.9 in (17.5 cm)
FPC	FPC-PTX-P1-A: 24.5 lb (11.1 kg)	25.2 in. (64 cm)	1.7 in. (4.2 cm)	21.9 in. (55.7 cm)
	FPC2-PTX-P1A: 38.5 lb (17.5 kg)			
	FPC3-PTX-U2: 34 lb (15.4 kg)	24.4 in. (62 cm)	1.7 in. (4.2 cm)	21.9 in. (55.7 cm)
	FPC3-PTX-U3: 37 lb (16.8 kg)	24.4 in. (62 cm)	1.7 in. (4.2 cm)	21.9 in. (55.7 cm)
PIC	P1-PTX-24-10GE-SFPP: 3.7 lb (1.7 kg)	11.1 in. (28.2 cm)	1.7 in. (4.3 cm)	7.8 in. (19.8 cm)
	P1-PTX-24-10G-W-SFPP: 2.5 lb (1.1 kg)			
	P1-PTX-2-40GE-CFP: 3.5 lb (1.6 kg)			
	P2-10G-40G-QSFPP: 4.3 lb (2 kg)			

Table 64: Physical Specifications *(Continued)*

Description	Weight	Height	Width	Depth
	P3-15-U-QSFP28: 4 lb (1.8 kg)			
	P3-24-U-QSFP28: 4.3 lb (2 kg)			
	P1-PTX-2-100GE-CFP: 3.5 lb (1.6 kg)			
	P2-100GE-CFP2: 3.9 lb (1.8 kg)			
	P2-100GE-OTN: 4.4 lb (2 kg)			
	P1-PTX-2-100G-WDM: 5.5 lb (2.5 kg)			
AC PDU	PDU-PTX-AC-D: 51.2 lb (23.2 kg)	18.5 in. (46.9 cm)	7.5 in. (19.1 cm)	17.7 in. (45 cm)
	PDU-PTX-AC-W: 51.2 lb (23.2 kg)			
High Capacity AC PDU	PDU2-PTX-AC-D: 63.3 lb (28.7 kg)	18.5 in. (46.9 cm)	7.5 in. (19.1 cm)	17.7 in. (45 cm)
	PDU2-PTX-AC-W: 63.3 lb (28.7 kg)			
	PDU2-PTX-AC-SP: 60.5 lb (27.4 kg)			

Table 64: Physical Specifications *(Continued)*

Description	Weight	Height	Width	Depth
AC PSM	10.5 lb (4.8 kg)	5.7 in. (14.5 cm)	3.4 in. (8.7 cm)	14.1 in. (35.9 cm)
DC PDU	PDU-PTX-DC-120: 60 lb (27.2 kg)	18.5 in. (46.9 cm)	7.5 in. (19.1 cm)	17.7 in. (45 cm)
	PDU-PTX-DC-60: 60 lb (27.2 kg)			
DC PSM	10.6 lb (4.8 kg)	5.7 in. (14.5 cm)	3.4 in. (8.7 cm)	14.1 in. (35.9 cm)
High Capacity DC PDU	64.5 lb (29.3 kg)	18.5 in. (46.9 cm)	7.5 in. (19.1 cm)	17.7 in. (45 cm)
High Capacity DC PSM	10.1 lb (4.6 kg)	5.7 in. (14.5 cm)	1.7 in. (4.3 cm)	21.7 in. (55.2 cm)
SIB	SIB-I-PTX5008: 6 lb (2.7 kg)	1.7 in. (4.2 cm)	15.9 in. (40.3 cm)	10.7 in. (27.2 cm)
	SIB2-I-PTX5K: 7 lb (3.2 kg)			
	SIB3-I-PTX5K: 10.4 lb (4.7 kg)			

SEE ALSO

PTX5000 Installation Safety Guidelines | 187

Site Electrical Wiring Guidelines

Table 65 on page 163 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 65: 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.

Rack Requirements for the PTX5000

IN THIS SECTION

Rack Size and Strength

The PTX5000 is designed for installation in a rack that complies with either of the following standards:

- A 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Components Industry Association (http://www.ecianow.org/).
- 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 mounting brackets, which measure 19 in. (48.3 cm) from outer edge to outer edge. Use approved wing devices to narrow the opening between the rails as required.
- A 23-in. rack using appropriate 23-in. to 19-in. rack adapters and an appropriate installation shelf which supports the chassis at the correct vertical position to properly line up the rack mount holes. Juniper Networks does not supply this hardware, but consideration for the size and weight of the chassis is important for a safe installation. Juniper recommends the use of single-sided panel adapters of at least 10 U in height, using as many as needed to fully overlap the chassis rack mount bracket for this type of installation.

The rack rails must be spaced widely enough to accommodate the chassis's external dimensions: 62.5 in. (158.8 cm) high, 33.1 in. (84.1 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the mounting brackets extend the width to 19 in. (48.3 cm). The front cable management system adds 3.8 in. (9.7 cm) to the depth. If the front door is used, this adds 5.5 in. (14 cm) to the depth of the chassis. The rear cable management system adds 5.5 in. (14 cm) to the depth of the chassis.

The spacing of rails and adjacent racks must also allow for the clearances around the chassis and rack that are specified in "PTX5000 Clearance Requirements for Airflow and Hardware Maintenance" on page 157.

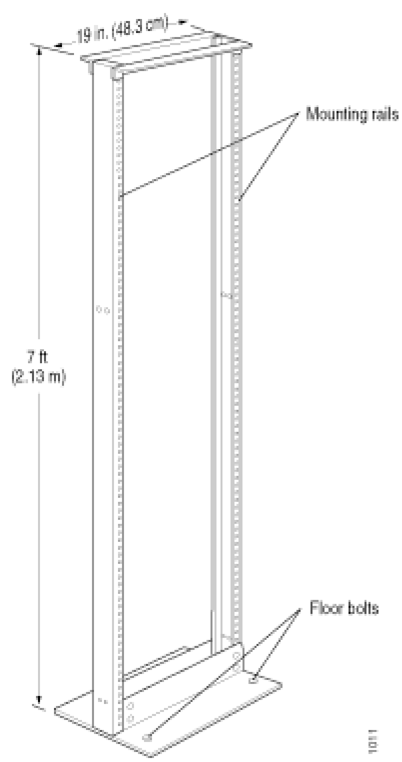
For instructions about installing the mounting hardware, see "Installing the PTX5000 Mounting Hardware for a Four-Post Rack or Cabinet" on page 195.

The chassis height of 62.5 in. (158.8 cm) high is approximately 35.7 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association. You can install one chassis in a rack that has at least 35.7 U of usable vertical space.

The rack must be strong enough to support the weight of the fully configured PTX5000, up to about 1,200 lb (544.3 kg).

NOTE: In an open-frame rack, center-mounting is required because the more even distribution of weight provides greater stability. For center-mounting, you use the mounting brackets attached to the center of the chassis for rack mounting.

Figure 78: Typical Open-Frame Rack



Spacing of Mounting Bracket and Flange Holes

The holes in the mounting brackets and front-mount flanges used to attach the chassis to a rack are spaced at 3 U (5.25 in. or 13.3 cm). The PTX5000 can be mounted in any rack that provides holes spaced at those distances.

Connection to Building Structure

Always secure the rack to the structure of the building. If your geographical area is subject to earthquakes, bolt the rack to the floor. For maximum stability, also secure the rack to ceiling brackets.

SEE ALSO

PTX5000 Installation Safety Guidelines | 187
PTX5000 Chassis Description | 14
PTX5000 Physical Specifications | 159

PTX5000 Power Planning

IN THIS SECTION

Calculating PTX5000 Power Consumption

IN THIS SECTION

Use the information in this topic to determine the power consumption for your router.

NOTE: Starting in Junos OS Release 14.1, new power management features in Junos OS for PTX5000 ensure that the chassis power requirements do not exceed the power available to the PTX5000.

- Power management ensures that high-priority FPCs continue to receive power when the system does not have sufficient power to keep all the FPCs online.
- If a power supply fails, Junos OS can bring low-priority FPCs offline to allow high-priority FPCs to remain online.

For more information about configuring power management on the PTX5000, see *Understanding Power Management on the PTX5000* in the Chassis-Level User Guide.

Power Requirements for PTX5000 Components

Table 1 describes the output power requirements for the required and optional FRUs for the PTX5000. The power requirements vary depending on the ambient air temperature for your installation.

NOTE: The power requirements listed below are accurate for estimating typical power consumption at different ambient temperatures. However, Junos OS reserves additional power in the power budget for base system components—the host subsystem, the fan trays, and the SIBs. When planning for the minimum required PSMs, this power reserve must be included.

You can use the interactive Power Calculator application at https://pathfinder.juniper.net/power-calculator/ to determine the number of PSMs required to support your system configuration. The Power Calculator application requires Juniper.net login credentials.

Table 66: Power Requirements for PTX5000 Components

Component	25° C (77° F) Ambient Temperature	40° C (104° F) Ambient Temperature
Host subsystem with RE-DUO-C2600-16G Routing Engine, CB-PTX Control Board, and CCG	130 W	150 W
Host subsystem with RE-PTX-X8-64G Routing Engine, CB2-PTX Control Board, and CCG	182 W	187 W
FAN-PTX-V vertical fan tray	80 W	370 W
FAN-PTX-H horizontal fan tray	240 W	950 W
FAN3-PTX-H horizontal fan tray	330 W	900 W
SIB-I-PTX5008 SIBs (total power requirements for 9 SIBs)	380 W	450 W
SIB2-I-PTX5K SIBs (total power requirements for 9 SIBs)	450 W	510 W
SIB3-PTX5K SIBs (total power requirements for 9 SIBs)	1170 W	1170 W
FPCs		
FPC-PTX-P1-A	420 W	500 W
FPC2-PTX-P1A	820 W	900 W
FPC3-PTX-U2	494 W	511 W
FPC3-PTX-U3	754 W	777 W
PICs		

Table 66: Power Requirements for PTX5000 Components *(Continued)*

Component	25° C (77° F) Ambient Temperature	40° C (104° F) Ambient Temperature
P1-PTX-24-10GE-SFPP	60 W	66 W
P1-PTX-24-10G-W-SFPP	82 W	100 W
P2-10G-40G-QSFPP	100 W	115 W
P3-24-U-QSFP28	131 W	134 W
P1-PTX-2-40GE-CFP	27 W	32 W
P3-15-U-QSFP28	119 W	123 W
P1-PTX-2-100GE-CFP	70 W	73 W
P2-100GE-CFP2	60 W	70 W
P2-100GE-OTN	135 W	160 W
P1-PTX-2-100G-WDM	250 W	264 W

Calculating Power Consumption for your Configuration

By using the information provided in Table 1, you can calculate the power consumption for your configuration.

1. Determine the ambient temperature for your installation—25° C (77° F) or 40° C (104° F).
2. Determine the output power in watts by adding together the power requirements for all the components in your chassis. The configuration must include:
   - One or two host subsystems
   - One vertical fan tray
   - Two horizontal fan trays

- SIBs

> **NOTE**: Table 1 lists the total power requirements for nine SIBs.

- Any FPCs or PICs specific to your configuration

3. Determine the power consumption in watts by dividing the total output power requirements by the power efficiency:

   - PTX5000 AC and DC normal-capacity power supply module (PSM) efficiency is approximately 88% at full load and nominal voltage.

   - PTX5000 AC and DC high capacity PSM efficiency is approximately 90% at full load and nominal voltage.

The examples below show the power requirement calculations for different types of configurations:

> **NOTE**: All the examples below use RE-PTX-X8-64G Routing Engines, CB2-PTX Control Boards, FAN3-PTX-H horizontal fan trays, and SIB3-PTX5K SIBs.

- This example shows the calculation for a non-redundant base configuration with no FPCs or PICs at 25° C (77° F) ambient temperature:

```
1 host subsystem + 1 vertical fan tray + 2 horizontal fan trays + SIBs = output power in watts

182 W + 80 W + 2(330 W) + 1170 W = 2092 W

Output power in watts / power supply efficiency = power consumption in watts

2092 W / 0.9 = 2324.4 W
```

- This example shows the calculation for a redundant base configuration with four FPC3-PTX-U3 FPCs and eight P3-15-U-QSFP28 PICs at 25° C (77° F) ambient temperature:

```
2 host subsystems + 1 vertical fan tray + 2 horizontal fan trays + SIBs + 4 FPC3-PTX-U3 FPCs
+ 8 P3-15-U-QSFP28 PICs = output power in watts

2(182 W) + 80 W + 2(330 W) + 1170 W + 4(754 W) + 8(119 W) = 6242 W

Output power in watts / power supply efficiency = power consumption in watts
```

```
6242 W / 0.9 = 6935.6 W
```

- This example shows the calculation for a redundant base configuration with eight FPC3-PTX-U3 FPCs and sixteen P3-15-U-QSFP28 PICs at 40° C (104° F) ambient temperature:

```
2 host subsystems + 1 vertical fan tray + 2 horizontal fan trays + SIBs + 8 FPC3-PTX-U3 FPCs
+ 16 P3-15-U-QSFP28 PICs = output power in watts

2(187 W) + 370 W + 2(900 W) + 1170 W + 8(777 W) + 16(123 W) = 11898 W

Output power in watts / power supply efficiency = power consumption in watts

11898 W / 0.9 = 13,220 W
```

Calculating System Thermal Output

After you have calculated the power consumption for your configuration, you can use that information to determine the system thermal output (BTUs per hour). To do so, multiply the power consumption in watts by 3.41.

For example, above we calculated the power consumption for a redundant base configuration with eight FPC3-PTX-U3 FPCs and sixteen P3-15-U-QSFP28 PICs at 40° C (104° F) ambient temperature to be 13,220 W. Using that information we can calculate the system thermal output for the configuration:

```
Power consumption in watts * 3.41 = system thermal output in BTU/hr

13220 W * 3.41 = 45080.2 BTU/hr
```

RELATED DOCUMENTATION

PTX5000 AC Power System Specifications | 66

PTX5000 DC Power System Electrical Specifications | 101

Understanding Normal-Capacity Power System Power Zones

IN THIS SECTION

PSM Slots

NOTE: There is no power zoning in the High Capacity power system.

The PTX5000 normal-capacity power system has up to eight power supply modules (PSMs), located in the lower front of the chassis below the FPC card cage. The PSMs insert into one of four slots—labeled **0** through **3**—located in the rear of each PDU labeled **PDU0** and **PDU1**. For full power redundancy, a minimum number of PSMs must be installed and fully operational:

- For full power redundancy, six PSMs are required to support up to four FPCs.
  - Zone 0—One **PSM0** in each PDU
  - Zone 1—One **PSM1** in each PDU
  - Zone 2—One **PSM2** or **PSM3** in each PDU
- For full power redundancy, all eight PSMs are required to support five or more FPCs:
  - Zone 0—One **PSM0** in each PDU
  - Zone 1—One **PSM1** in each PDU
  - Zone 2—Both **PSM2** and **PSM3** in each PDU

Normal-Capacity Power Zones and PSM Fault Tolerance

The normal-capacity power system contains three power zones. Table 67 on page 173 describes which components are powered by each zone and PSM. Table 68 on page 173, Table 69 on page 174, and Table 70 on page 175 describe the fault tolerance for each zone.

Table 67: Components Powered by Each Zone

Zone	PSM	Component
0	0	Fan trays
1	1	The craft interface and the following components installed in the rear card cage: Routing Engines, Control Boards, CCGs, and SIBs. • Channel 1: Routing Engines and Control Boards • Channel 2: SIBs, CCGs, and craft interface
2	2	Any four FPCs in slots **FPC0** through **FPC7**
	3	Any four FPCs in slots **FPC0** through **FPC7**

Table 68: Power Zone 0 Fault Tolerance

Nonredundant Configuration	Redundant Configuration	
	PDU0	PDU1
One **PSM0** in either PDU can provide power to all fan trays.	**PSM0** is required for full power redundancy. If **PSM0** in **PDU0** is powered off or fails, the configuration becomes nonredundant.	**PSM0** is required for full power redundancy. If **PSM0** in **PDU1** is powered off or fails, the configuration becomes nonredundant.
If the nonredundant PSM in this zone is not powered on, the fan trays are not powered on, and the PTX5000 will not be powered on.	If neither PSM in this zone is powered on, the fan trays are not powered on, and the PTX5000 will not be powered on.	
If the nonredundant PSM in this zone fails, the fan trays are not powered on, which will cause the PTX5000 to be powered off.	If both PSMs in this zone fail, the fan trays are not powered on, which will cause the PTX5000 to be powered off.	

Table 69: Power Zone 1 Fault Tolerance

Nonredundant Configuration	Redundant Configuration	
	PDU0	PDU1
One **PSM1** in either PDU can provide power to the craft interface, both host subsystems, both CCGs, and all nine SIBs.	**PSM1** in **PDU0** is required for full power redundancy. If **PSM1** in **PDU0** is powered off or fails, the configuration becomes nonredundant.	**PSM1** in **PDU1** is required for full power redundancy. If **PSM1** in **PDU1** is powered off or fails, the configuration becomes nonredundant.
If the nonredundant PSM in this zone is not powered on, the craft interface, host subsystems. CCGs, and SIBs are not powered on.	If **PSM1** in **PDU0** and **PSM1** in **PDU1** are not online, the craft interface, host subsystems, CCGs, and SIBs are not powered on.	
If the nonredundant PSM in this zone fails, the craft interface, host subsystems. CCGs, and SIBs are powered off.	If **PSM1** in **PDU0** and **PSM1** in **PDU1** both fail, the craft interface, host subsystems, CCGs, and SIBs are powered off.	

Table 70: Power Zone 2 Fault Tolerance

Number of FPCs	Nonredundant Configuration	Redundant Configuration	
		PDU0	PDU1
Up to four FPCs The PSMs must be in different PDUs for full power redundancy.	One **PSM2** or **PSM3** in either PDU can provide nonredundant power. **PSM2** and **PSM3** in the same PDU are nonredundant.	Two PSMs in this zone are required for full power redundancy. One **PSM2** or **PSM3** must be installed in **PDU0** and fully functional. If **PSM2** or **PSM3** in **PDU0** is powered off or fails, the configuration becomes nonredundant.	Two PSMs in this zone are required for full power redundancy. One **PSM2** or **PSM3** must be installed in **PDU1** and fully functional. If **PSM2** or **PSM3** in **PDU1** is powered off or fails, the configuration becomes nonredundant.
Five to eight FPCs	Two PSMs, one in each PDU can provide nonredundant power. **PSM2** and **PSM3** in the same PDU is nonredundant. **CAUTION**: Three PSMs are nonredundant.	All four PSMs in this zone are required for full power redundancy. **PSM2** and **PSM3** in **PDU0** must be present and fully functional. If **PSM2** or **PSM3** in **PDU0** is powered off or fails, the configuration becomes nonredundant.	All four PSMs in this zone are required for full power redundancy. **PSM2** and **PSM3** in **PDU1** must also be present and fully functional. If **PSM2** or **PSM3** in **PDU0** is powered off or fails, the configuration becomes nonredundant.
		If all four PSMs in this zone fail, all FPCs are powered off.	

SEE ALSO

PTX5000 Hardware Component Overview | 7

PTX5000 AC Power Distribution Unit LEDs | 54

PTX5000 DC Power Distribution Unit LEDs | 91

PTX5000 AC Power Supply Module LEDs | 62

PTX5000 DC Power Supply Module LEDs | 97

Network Cable and Transceiver Planning

IN THIS SECTION

Determining Transceiver Support and Specifications

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

Some transceivers support additional monitoring using the operational mode CLI command `show interfaces diagnostics optics`. Use the Hardware Compatibility Tool to determine if your transceiver supports monitoring. See the Junos OS documentation for your device for a description of the monitoring fields.

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

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

SEE ALSO

show interfaces diagnostics optics (Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet, and Virtual Chassis Port)

show interfaces diagnostics optics (SONET)

show interfaces diagnostics optics

show interfaces diagnostics optics

show interfaces diagnostics optics

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 71 on page 180 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 71: 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 71 on page 180. This example calculates link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 7\text{ dB}$

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 71 on page 180. 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.

PTX5000 Alarm and Management Cable Specifications and Pinouts

IN THIS SECTION

PTX5000 Alarm Relay Contact Wire Specifications

For management and service operations, you can connect the PTX5000 to external alarm-reporting devices through the alarm relay contacts on the craft interface. You must provide a wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2).

SEE ALSO

PTX5000 Craft Interface Description | 19
Connecting the PTX5000 to an External Alarm-Reporting Device | 268

PTX5000 Management Interface Cable Specifications

Table 72 on page 182 lists the specifications for the cables that connect to the management ports on the Control Board.

Table 72: Cable Specifications for Routing Engine Management

Port	Cable Specification	Cable Supplied	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	One 6-ft (1.83-m) length with RJ-45 connectors	6 ft (1.83 m)	RJ-45
Routing Engine Host/Ethernet interface	Category 5 cable or equivalent suitable for 10/100-Mbps/1-Gbps operation	One 15-ft (4.57-m) length with RJ-45/ RJ-45 connectors	328 ft (100 m)	RJ-45
(X) GE0 through (X) GE0 interfaces	Ports are reserved for future use.	None	328 ft (100 m)	SFP+
GE4 interface	Port is reserved for future use.	None	328 ft (100 m)	SFP

SEE ALSO

PTX5000 Control Board Description | 122
Connecting the PTX5000 to a Management Console or Auxiliary Device | 265
Connecting the PTX5000 to a Management Ethernet Device | 266

RJ-45 Connector Pinouts for the PTX5000 Auxiliary and Console Ports

The auxiliary and console ports on the Control Board (labeled **AUXILIARY** and **CONSOLE**) are RJ-45 receptacles that accept RS-232 (EIA-232) cable. The **AUXILIARY** port connects the Routing Engine to a laptop, modem, or other auxiliary unit, and the **CONSOLE** port connects it to a management console. The ports are configured as data terminal equipment (DTE). Table 73 on page 183 describes the RJ-45 connector pinouts.

Table 73: RJ-45 Connector Pinouts for the PTX5000 Auxiliary and Console Ports

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

SEE ALSO

PTX5000 Control Board Description | 122
Connecting the PTX5000 to a Management Console or Auxiliary Device | 265

RJ-45 Connector Pinouts for the PTX5000 Management HOST/ ETHERNET Port

The management Ethernet port on the Control Board labeled **HOST/ETHERNET** is an autosensing 10/100-Mbps/1-Gbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management). Table 74 on page 184 describes the RJ-45 connector pinouts.

Table 74: RJ-45 Connector Pinouts

Pin	Signal
1	TX+
2	TX –
3	RX+
4	Termination network
5	Termination network
6	RX–
7	Termination network
8	Termination network

SEE ALSO

PTX5000 Control Board Description | 122
Connecting the PTX5000 to a Management Ethernet Device | 266

3

CHAPTER

Initial Installation and Configuration

PTX5000 Installation Overview

IN THIS SECTION

Overview of Installing the PTX5000

You must proceed through the installation process in the following order:

1. Prepare the installation site for the PTX5000.

   See "Overview of Preparing the Site for the PTX5000" on page 150.
2. Review all safety guidelines and warnings for the PTX5000.

   > **WARNING**: To avoid harm to yourself or the PTX5000 as you install and maintain it, you must follow the safety procedures for working with routers, as well as the guidelines and warnings for working with and near electrical equipment. However, providing an exhaustive set of guidelines for working with electrical equipment is beyond the scope of this documentation.

   See "PTX5000 Installation Safety Guidelines" on page 187.
3. Unpack the PTX5000 and verify the parts received.

   See "Overview of Unpacking the PTX5000" on page 189.
4. Install the mounting hardware for your rack.
   - See "Installing the PTX5000 Mounting Hardware for an Open-Frame Rack" on page 199.
   - See "Installing the PTX5000 Mounting Hardware for a Four-Post Rack or Cabinet" on page 195.
5. Install the PTX5000 using a mechanical lift.

   See "Overview of Installing a PTX5000 Using a Mechanical Lift" on page 202.
6. Ground the PTX5000.

   See "Connecting the PTX5000 to Earth Ground" on page 211.
7. Connect the PTX5000 to external devices.

- See "Connecting the PTX5000 to a Management Console or Auxiliary Device" on page 265.
- See "Connecting the PTX5000 to a Management Ethernet Device" on page 266.
- See "Connecting the PTX5000 to an External Alarm-Reporting Device" on page 268.
- See "Connecting the PTX5000 to an External Clocking Device" on page 268.

8. Connect the power, and power on the PTX5000.

   - 60-A DC PDU and PSM—See "Connecting Power to the PTX5000 60-A DC Input Power Trays" on page 252 and "Powering On the DC Powered PTX5000 with 60-A DC PDUs and 60-A DC PSMs" on page 282.
   - 120-A DC PDU and PSM—See "Connecting Power to the PTX5000 120-A DC Input Power Trays" on page 256 and "Powering On the DC Powered PTX5000 with 120-A DC PDUs and 120-A DC PSMs" on page 284.
   - High Capacity DC PDU and PSM—See "Connecting Power to the PTX5000 High Capacity DC PDUs" on page 260 and "Powering On the DC-Powered PTX5000 with High Capacity DC PDUs and High Capacity DC PSMs" on page 285.
   - Three-phase delta AC PDU and AC PSM—See "Connecting Power to the PTX5000 Three-Phase Delta AC PDUs" on page 213 and "Powering On the Three-Phase AC-Powered PTX5000" on page 279.
   - Three-phase wye AC PDU and AC PSM—See "Connecting Power to the PTX5000 Three-Phase Wye AC PDUs" on page 220 and "Powering On the Three-Phase AC-Powered PTX5000" on page 279.

PTX5000 Installation Safety Guidelines

IN THIS SECTION

Observe the following guidelines before and during PTX5000 installation:

General Installation Safety Guidelines

Before installing or moving the PTX5000, verify that the intended site meets the specified power, environmental, and clearance requirements. See the following documentation:

- "Overview of Preparing the Site for the PTX5000" on page 150
- "PTX5000 Clearance Requirements for Airflow and Hardware Maintenance" on page 157
- "Rack Requirements for the PTX5000" on page 164
- "PTX5000 Environmental Specifications" on page 152
- "Calculating PTX5000 Power Consumption" on page 166

Chassis Lifting Guidelines

The weight of a fully configured PTX5000 chassis is 1,200 lb (544.3 kg). Observe the following guidelines for lifting and moving the PTX5000:

- A mechanical lift is required to maneuver the PTX5000 into a rack.

> **WARNING**: Do not attempt to manually lift a PTX5000.

- Before lifting or moving the PTX5000, disconnect all external cables.

SEE ALSO

PTX5000 Chassis Description | **14**

Installing the PTX5000 By Using a Pallet Jack | **206**

PTX5000 Physical Specifications | **159**

Unpacking the PTX5000

IN THIS SECTION

Overview of Unpacking the PTX5000

To unpack the PTX5000:

1. Gather the tools required to unpack the PTX5000.

   See "Tools and Parts Required to Unpack the PTX5000" on page 189.
2. Remove the PTX5000, accessory box, tool kit, and all parts from the shipping crate.

   See "Unpacking the PTX5000" on page 190.
3. Verify that all parts have been received.

   See "Verifying the PTX5000 Parts Received" on page 192.

SEE ALSO

Overview of Installing the PTX5000 | **186**

Tools and Parts Required to Unpack the PTX5000

Gather the tools required to unpack the PTX5000:

- Phillips (+) screwdriver, number 2
- 1/2-in. or 13-mm open-end or socket wrench to remove bracket bolts from the shipping pallet
- Blank panels to cover any slots not occupied by a component

Unpacking the PTX5000

The PTX5000 is shipped in a wooden crate. A wooden pallet forms the base of the crate. The chassis is bolted to this pallet. Quick Start installation instructions and a cardboard accessory box are also included in the shipping crate.

The shipping crate measures:

- 73.3 in (186.2 cm)high
- 33.0 in (83.8 cm) wide
- 51.5 in (130.9 cm) deep

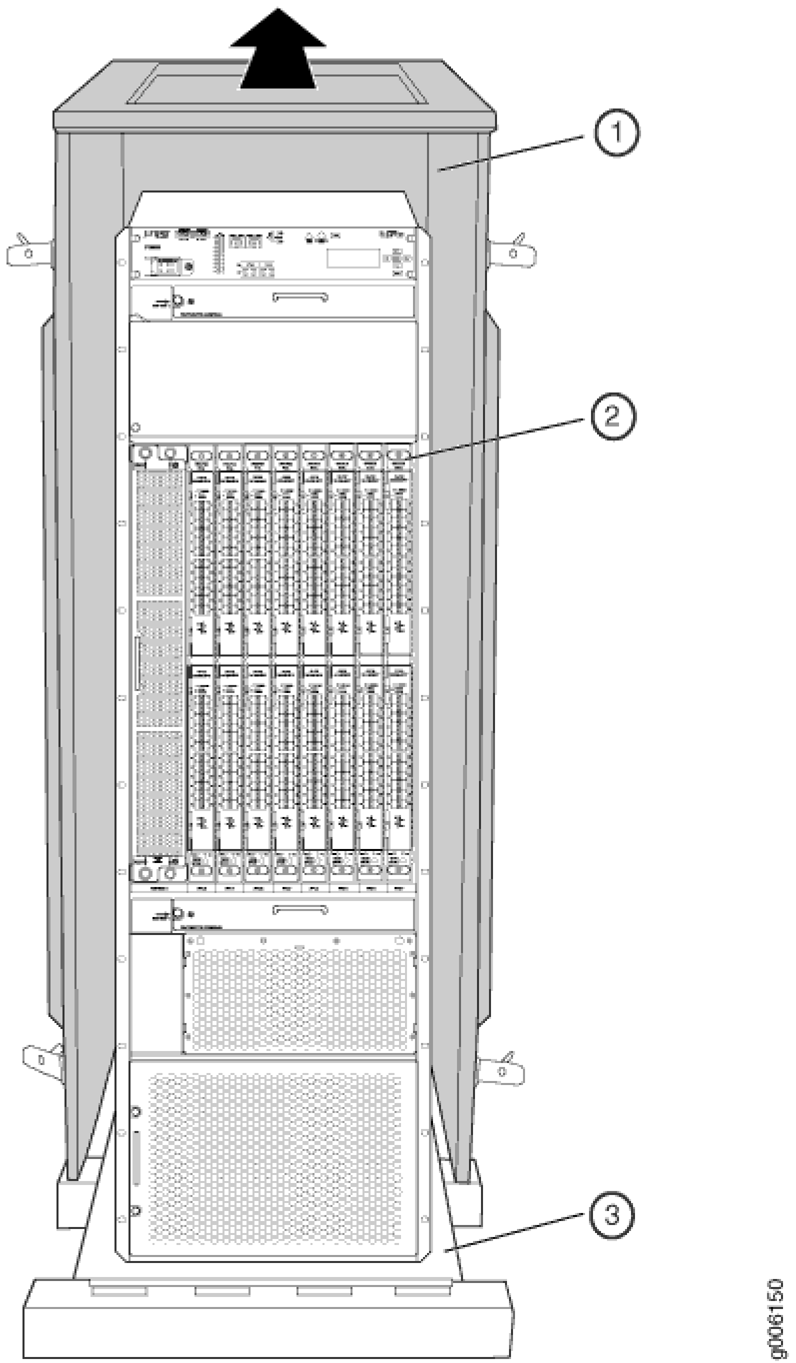
The total weight of the crate containing the PTX5000 and accessories can range up to 1,300 lb (589.7 kg).

NOTE: The PTX5000 is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the PTX5000 (see Figure 79 on page 191):

1. Move the shipping crate to a staging area as close to the installation site as possible, where you have enough room to remove the components from the chassis. While the chassis is bolted to the pallet, you can use a forklift or pallet jack to move it.
2. Position the shipping crate with the arrows pointing up.
3. Open all the latches on the shipping crate.
4. Remove the front door of the shipping crate cover and set it aside.
5. Slide the remainder of the shipping crate cover off the pallet.
6. Remove the foam covering the top of the PTX5000.
7. Remove the accessory box and the Quick Start documentation.
8. Verify the parts received against the lists in "Verifying the PTX5000 Parts Received" on page 192.
9. Remove the vapor corrosion inhibitor (VCI) packs attached to the pallet, being careful not to break the VCI packs open.
10. To remove the brackets holding the chassis on the pallet, use a 1/2-in. socket wrench and a number 2 Phillips (+) screwdriver to remove the bolts and screws from the brackets.
11. Store the brackets and bolts inside the accessory box.
12. Save the shipping crate cover, pallet, and packing materials in case you need to move or ship the PTX5000 at a later time.

Figure 79: Contents of the Shipping Crate



1– Shipping crate cover	3– Shipping crate base
2– Chassis	

Verifying the PTX5000 Parts Received

A packing list is included in each shipment. The packing list specifies the part numbers and descriptions of each part in your order.

To verify that you have received all parts:

1. Verify that the items on the packing list are included in the parts in the main shipment.

   See Table 75 on page 192.
2. Verify that all parts in the accessory kit have been received.

   See Table 76 on page 193.
3. If any part is missing, contact a customer service representative.

Table 75: PTX5000 Parts List

Component	Quantity
Chassis, including midplane and craft interface	1
FPCs	Up to 8
PICs	Up to 2 for each FPC
SIBs	9
Routing Engines	1 or 2
Control Boards	1 or 2 (one for each Routing Engine)
Centralized Clock Generators (CCGs)	1 or 2
Power distribution unit (PDU)	2
Power supply modules (PSMs)	Normal-capacity PDU: Up to 4 PSMs for each PDU High-capacity PDU: Up to 8 PSMs for each PDU

Table 75: PTX5000 Parts List *(Continued)*

Component	Quantity
Horizontal fan trays	2
Vertical fan tray	1
Quick start installation	1
Open-frame mounting shelf	1
Four-post mounting shelf	1
Rear support bracket—Required only for mounting a four-post rack or cabinet	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component

Table 76: Accessory Box Parts List

Part	Quantity
Screws to mount chassis, Phillips, 12-24 x 1/2 in. , self-tapping	42
Split washers for the grounding cable	3
Screws to fasten grounding cable to chassis, Phillips, 1/4-20 x 3/8	3

Table 76: Accessory Box Parts List *(Continued)*

Part	Quantity
DC cable lugs and power cable management system	Depending on your configuration, the following parts are included; • 60-A DC PDU— 36 4-AWG cable lugs • 120-A DC PDU— 20 0-AWG cable lugs • High Capacity DC PDU—72 4-AWG cable lugs and power cable management system **NOTE**: Spare cable lugs are included in the accessory kit. Use one of the included spare cable lugs to connect the PTX5000 to earth ground.
Connectors for alarm relay cables, Terminal Block Plug, 3 Pole, 5.08 mm spacing, 12 A	3
End User License Agreement (EULA)	1
ROHS and warranty card	1
15-ft Ethernet cable to connect the Routing Engine to a management device (RJ-45 connectors, 4-pair stranded UTP, Category 5E)	1
7-ft serial cable to connect the Routing Engine to a management console (DB9 to RJ-45 adapter, straight through)	1
ESD wrist strap with cable	1

Installing the PTX5000 in a Rack

IN THIS SECTION

Installing the PTX5000 Mounting Hardware for a Four-Post Rack or Cabinet

IN THIS SECTION

Installing Cage Nuts, If Needed

Insert cage nuts, if needed, into the holes listed in Table 1 and Table 2 (an X indicates a mounting hole location). The hole distances are relative to the standard U division on the rack that is aligned with the bottom of the mounting shelf and rear support bracket.

To install cage nuts in a four-post rack:

1. On the rear rack rails, insert cage nuts in the holes specified for the rear support bracket. Install the cage nuts in the rear of the rear rail (see Table 1).
2. On the front rack rails, insert cage nuts in the holes specified for the four-post mounting shelf. Install the cage nuts in the front of the front rail (see Table 1).

3. On the front rack rails, insert cage nuts in the holes specified for mounting the chassis. Install the cage nuts in the front of the front rail (see Table 2).

Table 77: Mounting Hole Locations for Installing the Four-Post Mounting Shelf and Rear Support Bracket

Hole	Distance Above U Division		Four-Post Rack Mounting Shelf	Rear Support Bracket
6	3.25 in. (8.3 cm)	1.86 U	X	X
5	2.63 in. (6.7 cm)	1.5 U	X	X
4	2.00 in. (5.1 cm)	1.14 U	X	X
3	1.50 in. (3.8 cm)	0.86 U	X	X
2	0.88 in. (2.2 cm)	0.50 U	X	X
1	0.25 in. (0.6 cm)	0.14 U	X	X

Table 78: Mounting Hole Locations for Installing a PTX5000 in a Four-Post Rack

Hole	Distance Above U Division	
110	63.88 in. (162.2 cm)	36.50 U
101	58.63 in. (148.9 cm)	33.50 U
92	53.38 in. (135.6 cm)	30.50 U
83	48.13 in. (122.2 cm)	27.50 U
74	42.88 in. (108.9 cm)	24.50 U
65	37.63 in. (95.6 cm)	21.50 U

Table 78: Mounting Hole Locations for Installing a PTX5000 in a Four-Post Rack *(Continued)*

Hole	Distance Above U Division	
56	32.38 in. (82.2 cm)	18.50 U
47	27.13 in. (68.9 cm)	15.50 U
38	21.88 in. (55.6 cm)	12.50 U
29	16.63 in. (42.2 cm)	9.50 U
20	11.38 in. (28.9 cm)	6.50 U
11	6.13 in. (15.6 cm)	3.50 U

The holes in the front-mounting flanges are spaced at 3 U (5.25 in. or 13.3 cm).

Installing the Four-Post Mounting Shelf and Rear Support Bracket

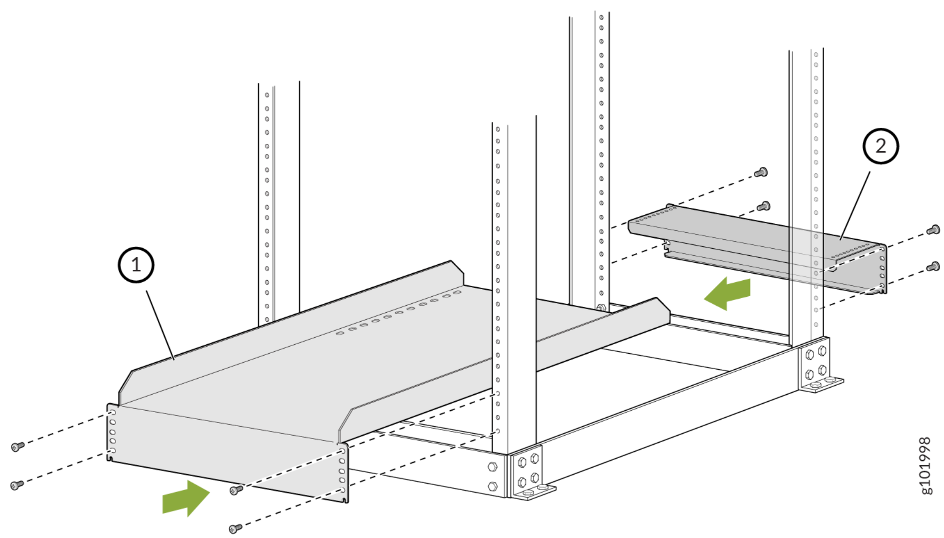
To install the four-post mounting shelf and rear support bracket (see Figure 80 on page 198):

1. On the rear of each rear rack rail, partially insert a mounting screw into the lowest hole specified in Table 1.
2. Install the rear support bracket on the rear of the rear rack rails. Rest the bottom slot of the rear support bracket on a mounting screw. The rear support bracket extends toward the center of the rack.
3. Partially insert screws into the open holes in the rear support bracket.
4. Tighten all the screws completely.
5. On the front of each front rack rail, partially insert a mounting screw into the lowest hole specified in Table 1.
6. Install the four-post rack mounting shelf on the front rack rails. Rest the bottom slot of the front flange on a mounting screw. Rest the back of the four-post rack mounting shelf on top of the rear support bracket.
7. Partially insert screws into the open holes in the mounting shelf.
8. Tighten all the screws completely.
9. Fasten the four-post mounting shelf to the rear support bracket by partially inserting the screws provided in the accessory kit into the open holes on top of the four-post mounting shelf.

NOTE: Several holes are provided on top of the shelf. Two holes on each side of the shelf will align with the holes in the rear support bracket.

10. Tighten all the screws completely.

Figure 80: Installing the Mounting Hardware for a Four-Post Rack



1– Four-post mounting shelf	2– Rear support bracket

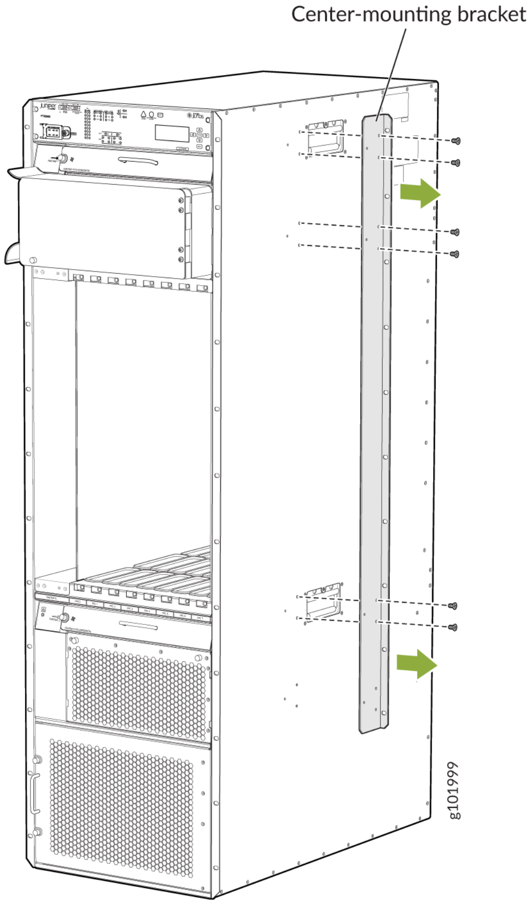
Removing the Center-Mounting Brackets

The center-mounting brackets are not used for a four-post rack, and must be removed from the chassis.

To remove the center-mounting brackets from the chassis:

1. Loosen the screws from each bracket (see Figure 81 on page 199).
2. Remove each bracket.

Figure 81: Removing the Center-Mounting Bracket



Installing the PTX5000 Mounting Hardware for an Open-Frame Rack

IN THIS SECTION

Installing Cage Nuts, If Needed

Insert cage nuts, if needed, into the holes listed in Table 3 and Table 4. The hole distances are relative to the standard U division on the rack that is aligned with the bottom of the mounting shelf and rear support bracket.

To install cage nuts in an open-frame rack:

1. On the rear side of both rack rails, insert cage nuts in the holes specified for the open-frame mounting shelf (see Table 3).
2. On the front side of both rack rails, insert cage nuts in the holes specified for mounting the chassis (see Table 4).

Table 79: Mounting Hole Locations for Installing a PTX5000 Open-Frame Rack Shelf

Hole	Distance Above U Division	
30	17.25 in. (43.8 cm)	9.86 U
27	15.5 in. (39.4 cm)	8.86 U
21	12.0 in. (30.5 cm)	6.86 U
15	8.5 in. (21.6 cm)	4.86 U
9	5.0 in. (12.7 cm)	2.86 U
3	1.5 in. (3.8 cm)	0.86 U

The holes in the center-mounting brackets are spaced at 3 U (5.25 in. or 13.3 cm).

Table 80: Mounting Hole Locations for Installing a Chassis in an Open-Frame Rack

Hole	Distance Above U Division	
104	60.38 in. (153.4 cm)	34.50 U
95	55.13 in. (140.0 cm)	31.50 U

Table 80: Mounting Hole Locations for Installing a Chassis in an Open-Frame Rack *(Continued)*

Hole	Distance Above U Division	
86	49.88 in. (126.7 cm)	28.50 U
77	44.63 in. (113.3 cm)	25.50 U
68	39.38 in. (100.0 cm)	22.50 U
59	34.13 in. (86.7 cm)	19.50 U
50	28.88 in. (73.3 cm)	16.50 U
41	23.63 in. (60.0 cm)	13.50 U
32	18.38 in. (46.7 cm)	10.50 U
23	13.13 in. (33.3 cm)	7.50 U

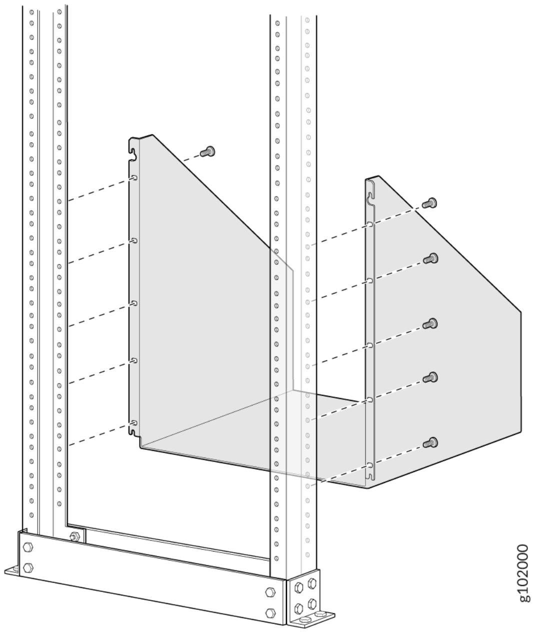
Installing the Open-Frame Rack Mounting Shelf

Before mounting the chassis in an open-frame rack, you must first install the open-frame rack mounting shelf.

To install the open-frame rack mounting shelf (see Figure 82 on page 202):

1. On the rear of each rack rail, partially insert a mounting screw into the highest hole specified in Table 3 for the open-frame rack mounting shelf.
2. Install the open-frame rack mounting shelf on the rack. Hang the shelf over the mounting screws by using the keyhole slots located near the top of the shelf flanges.
3. Partially insert screws into the open holes in the flanges of the open-frame rack mounting shelf.
4. Tighten all the screws completely.

Figure 82: Installing the Mounting Hardware for an Open-Frame Rack



Overview of Installing a PTX5000 Using a Pallet Jack

Before installing the PTX5000 using a pallet jack, verify that you have prepared your site, unpacked the chassis from the shipping crate, and installed the mounting hardware.

Because of the PTX5000 router's size and weight—up to 1,200 lb (544.3 kg) depending on the configuration (without any FRUs removed)— you must install the PTX5000 using a pallet jack.

NOTE: We recommend that you remove the heavy FRU items prior to installing the chassis into the rack.

- FPCs—24.5 lb (11.1 kg) to 38.5 lb (17.5 kg). See Figure 83 on page 203 (for detailed instructions, see "Replacing a PTX5000 FPC" on page 493).
- Vertical fan tray—26.8 lb (12.2 kg), See Figure 84 on page 204 (for detailed instructions, see "Replacing a PTX5000 Vertical Fan Tray" on page 313).

- AC PSMs or DC PSMs—10.6 lb (4.8 kg), See Figure 84 on page 204 (for detailed instructions, see "Maintaining the PTX5000 AC Power System" on page 332 or "Maintaining the PTX5000 DC Power System" on page 398).

- AC PDUs or DC PDUs—51.2 lb (23.2 kg) to 64.5 lb (29.3 kg), For detailed instructions, See Figure 85 on page 205 (for detailed instructions, see "Maintaining the PTX5000 AC Power System" on page 332 or "Maintaining the PTX5000 DC Power System" on page 398).

Figure 83: Removing the FPCs

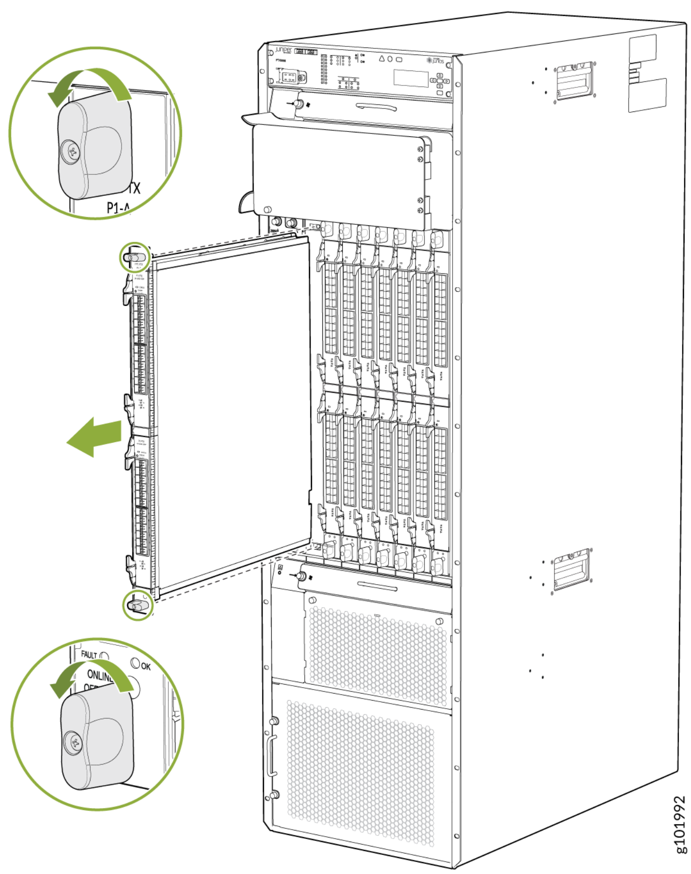


Figure 84: Removing the Vertical fan tray and Power Supply Modules

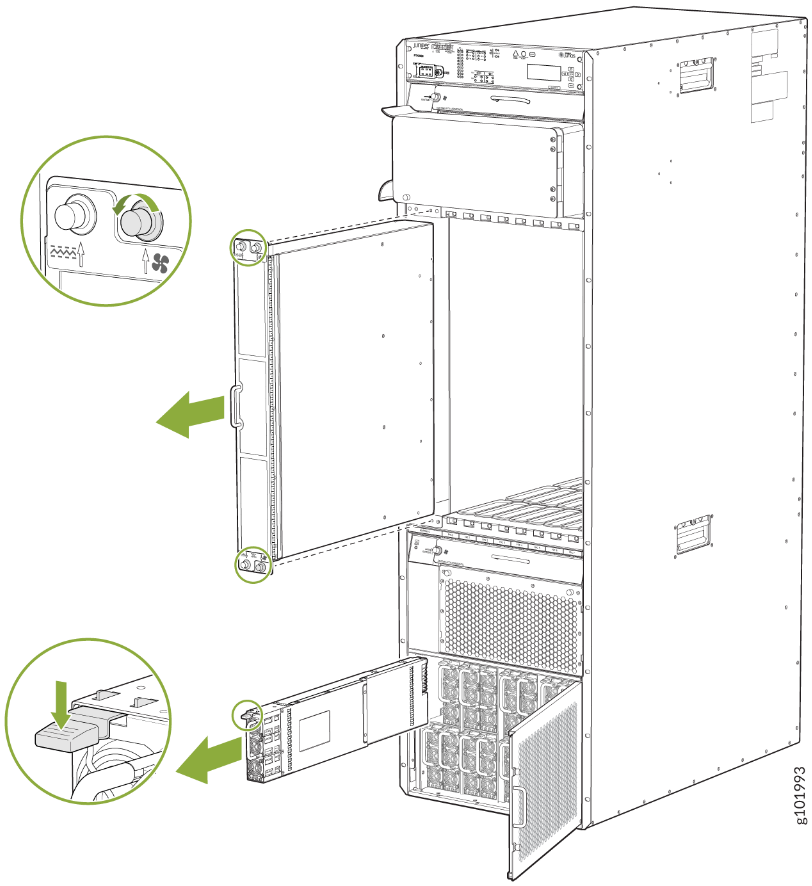
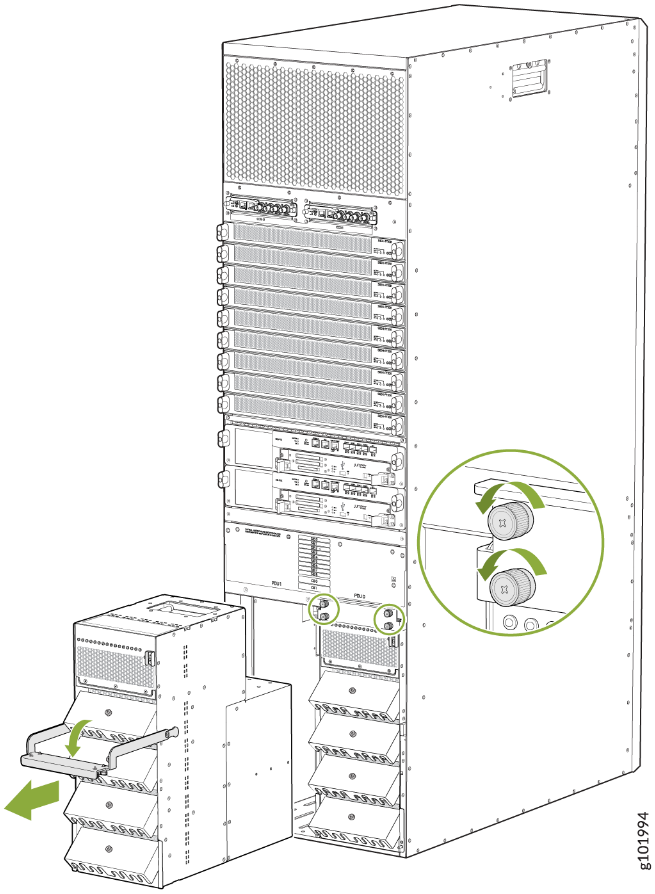


Figure 85: Removing the PDUs



To install the PTX5000:

1. Gather the tools required to install the PTX5000.

   See "Tools Required to Install the PTX5000 Using a Mechanical Lift" on page 206.

2. Read the safety information in *General Safety Guidelines and Warnings* and "PTX5000 Installation Safety Guidelines" on page 187.

3. Install the PTX5000 into the rack using a pallet jack.

   See "Installing the PTX5000 By Using a Mechanical Lift" on page 206.

SEE ALSO

Overview of Preparing the Site for the PTX5000 | 150

Overview of Unpacking the PTX5000 | 189

Tools Required to Install the PTX5000 Using a Pallet Jack

Gather the tools required to install the PTX5000:

- The use of a pallet jack is recommended when positioning the chassis in front of the rack.
- Phillips (+) screwdriver, number 2

Installing the PTX5000 By Using a Pallet Jack

CAUTION: Before installing the PTX5000:

- Ensure that a pallet jack is available for the installation. Because of the PTX5000 router's size and weight—up to 1,200 lb (544.3 kg) depending on configuration—you must use a pallet jack to install the chassis.
- Have a qualified technician verify that the rack is strong enough to support the chassis weight and is adequately supported at the installation site.
- We recommend that you have multiple people available to help with the installation of the PTX5000 into the rack.
- Ensure that the rack is in its permanent location and is secured to the building.
- Ensure that the installation site allows adequate clearance for both airflow and maintenance.

To install the PTX5000 by using a pallet jack (see Figure 86 on page 208, Figure 87 on page 209, and Figure 88 on page 210):

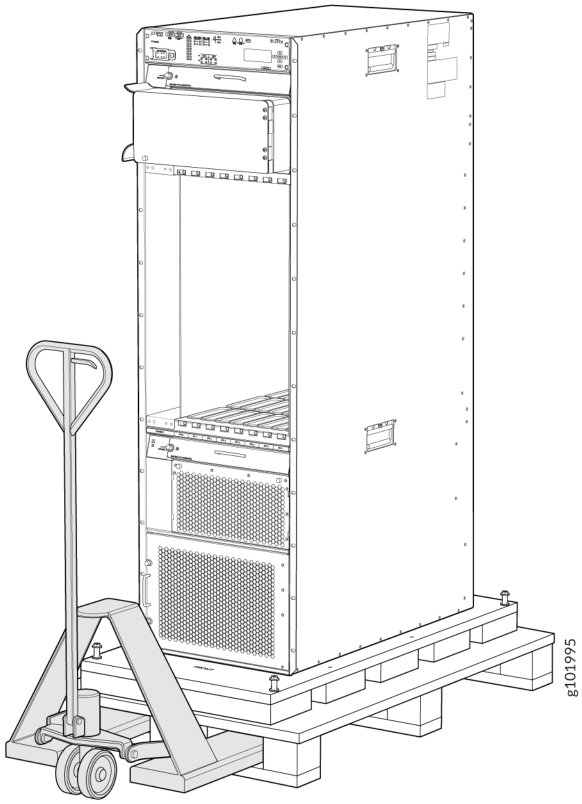
1. Load the PTX5000 onto the shipping pallet.

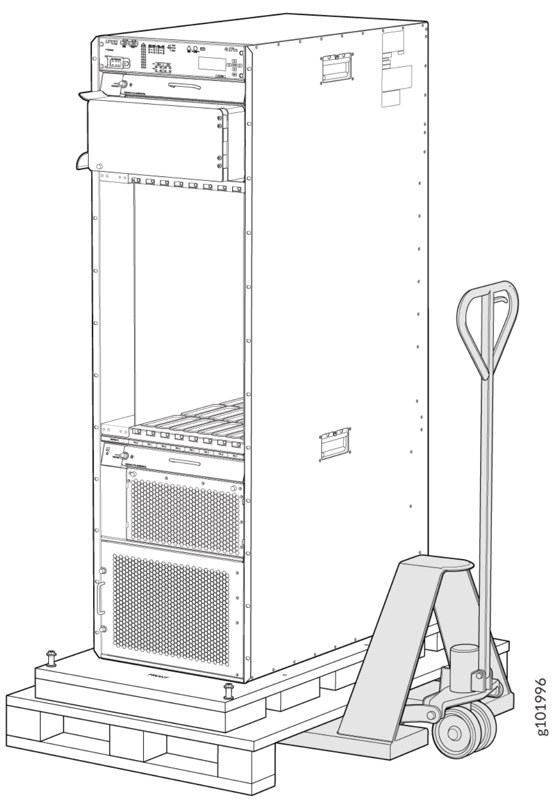
   CAUTION: Do not lift the PTX5000 by using the handles on the sides of the chassis. Use these handles only to help position the PTX5000.

2. Position the chassis in front of the mounting rack using a pallet jack. To reduce the gap when pushing the chassis onto the mounting shelf, position the pallet as close as possible to the rack.
3. Center the chassis in front of the mounting shelf between the rack pillars.
4. Lift the chassis slightly above the surface of the mounting shelf and position the chassis as close as possible to the shelf.

5. Carefully slide the PTX5000 onto the mounting shelf, so that the bottom of the chassis and the mounting shelf overlap by approximately 2 inches.
6. Pushing on the front-mounting flanges, slide the PTX5000 onto the mounting shelf until the center-mounting brackets (open-frame racks) or front-mounting flanges (four-post racks) contact the rack rails The shelves ensure that the holes in the center-mounting brackets and the front-mounting flanges of the chassis align with the holes in the rack rails. We recommended that at least two people help push the PTX5000 onto the mounting shelf while a third person aligns the PTX5000 to the mounting rack.
7. Visually inspect the alignment of the PTX5000. If the chassis is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side, and the chassis should be level.
8. Install a mounting screw into each of the mounting holes aligned with the rack, starting from the bottom.
9. Move the pallet jack away from the rack.

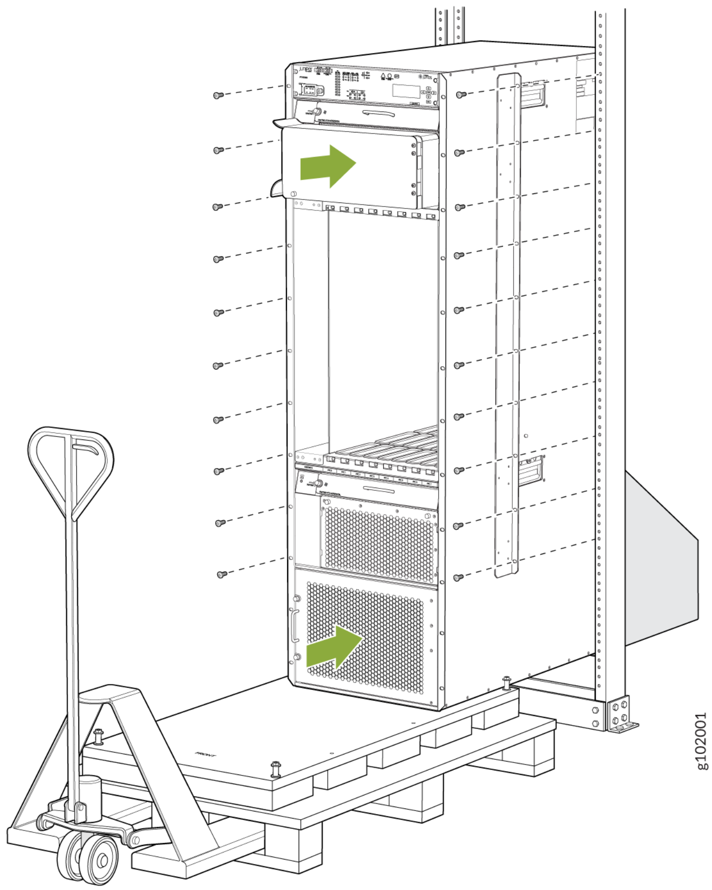
Figure 86: Loading the PTX5000 onto the Pallet Jack





The holes in the center-mounting brackets are spaced at 3 U (5.25 in. or 13.3 cm).

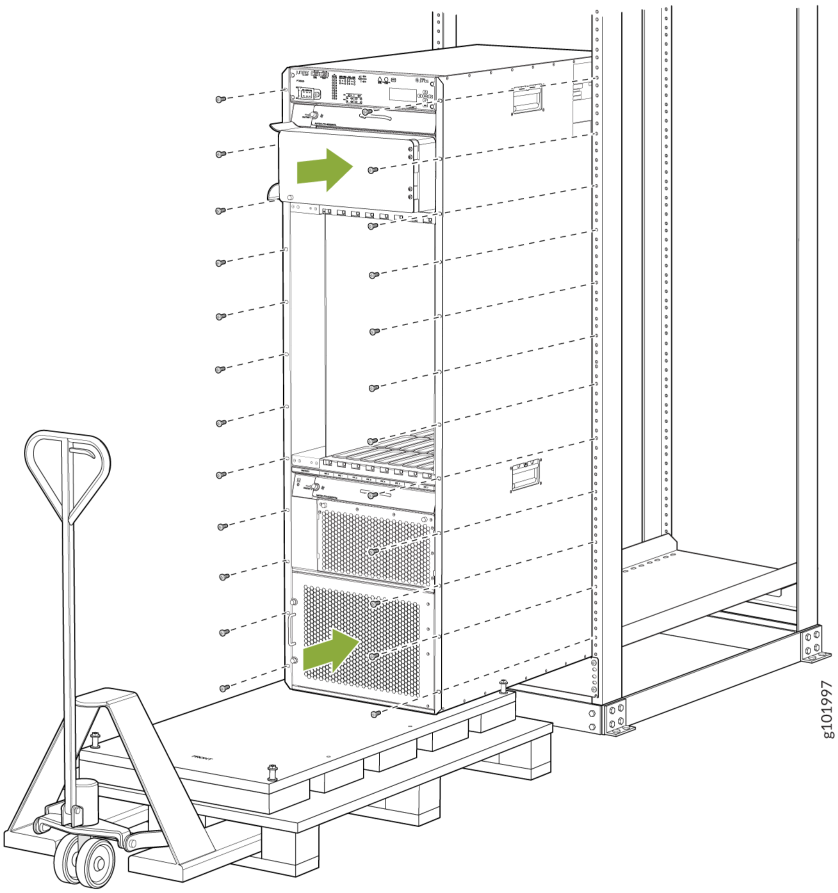
Figure 87: Installing the PTX5000 in an Open-Frame Rack



1– Open-frame rack	2– Center-mounting bracket

The holes in the front-mounting flanges are spaced at 3 U (5.25 in. or 13.3 cm).

Figure 88: Installing the PTX5000 in a Four-Post Rack



1– Four-post rack	2– Front-mounting flange

RELATED DOCUMENTATION

Rack Requirements for the PTX5000 | 164
Overview of Installing the PTX5000 | 186

Connecting the PTX5000 Grounding Cable

IN THIS SECTION

Tools and Parts Required to Ground the PTX5000

Gather the tools required to ground the PTX5000:

- Grounding cable (which you must provide)
- Grounding lug (depending on your configuration, 0-AWG or 4-AWG (21.2 mm^2) cable lugs are supplied with DC PDUs, and can be used for grounding.)
- M6 screws or UNC 1/4-20 screws
- Electrostatic discharge (ESD) grounding wrist strap

SEE ALSO

Verifying the PTX5000 Parts Received | 192

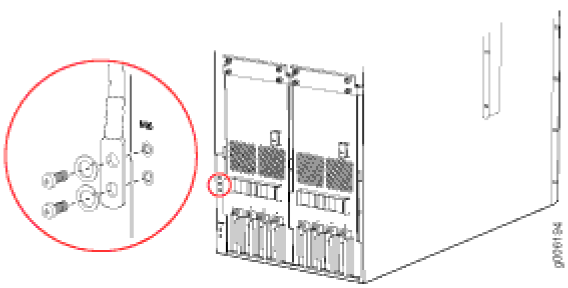
Connecting the PTX5000 to Earth Ground

You ground the PTX5000 by attaching a grounding cable to the chassis. You must provide the grounding cable. Depending on your configuration, 0-AWG or 4-AWG (21.2 mm^2) cable lugs are supplied with DC PDUs, and can be used for grounding. See "PTX5000 Chassis Grounding Cable and Lug Specifications" on page 154 for more information. You must install the PTX5000 in a restricted-access location and ensure that the chassis is always properly grounded. The PTX5000 has a two-hole protective grounding terminal provided on the chassis. See Figure 89 on page 212. Under all circumstances, use this grounding connection to ground the chassis. For AC-powered systems, you must also use the grounding wire in the AC power cord along with the two-hole grounding lug connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the two-hole protective grounding terminal.

To ground the PTX5000 (see Figure 89 on page 212):

1. Connect the grounding cable to a proper earth ground.
2. Verify that a licensed electrician has attached the cable lug provided with the PTX5000 to the grounding cable.
3. Make sure that grounding surfaces are clean and brought to a bright finish before grounding connections are made.
4. Place the grounding cable lug over the grounding points on the bottom rear of the chassis. The top pair is sized for M6 screws, and the bottom pair is sized for UNC 1/4-20 screws. You can use either pair of grounding points. UNC 1/4-20 screws are provided in the accessory kit.
5. Secure the grounding cable lug to the grounding points, first with the washers, then with the screws.
6. Verify that the grounding cabling is correct, that the grounding cable does not touch or block access to the PTX5000 components, and that it does not drape where people could trip on it.

Figure 89: Connecting the Grounding Cable



Connecting the PTX5000 to AC Power

IN THIS SECTION

Tools and Parts Required to Provide AC Power to the PTX5000

If you have an AC-powered router, gather the tools required to connect the PTX5000 to AC power:

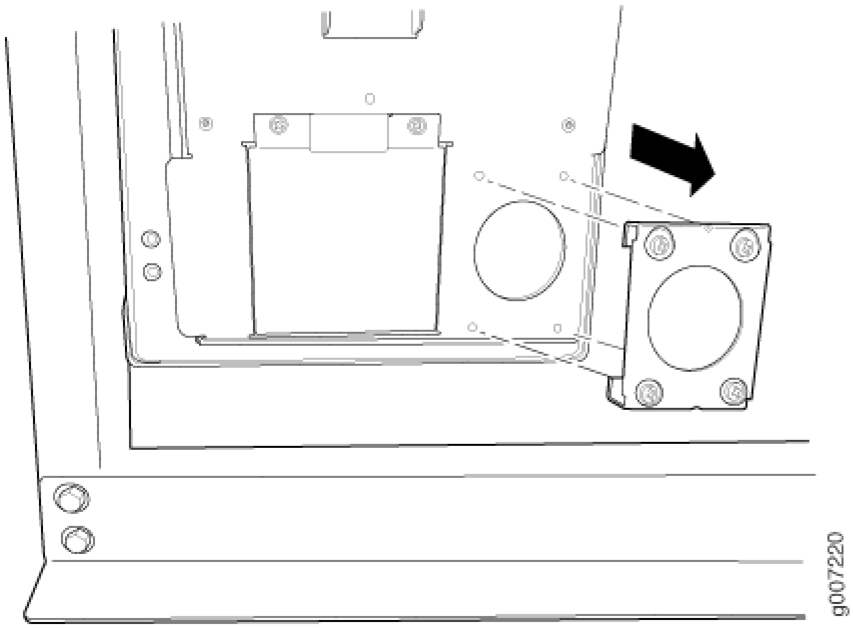
- AC power cords
- Phillips (+) screwdriver, number 2 to access the metal AC wiring compartment and remove or attach the AC power cord.
- 1/5-in. (5.5-mm) slotted screwdriver to attach the ground wire and input terminal wires of the AC power cord.

Connecting Power to the PTX5000 Three-Phase Delta AC PDUs

To connect the delta AC power cords to the three-phase delta AC PDUs (see Figure 96 on page 219):

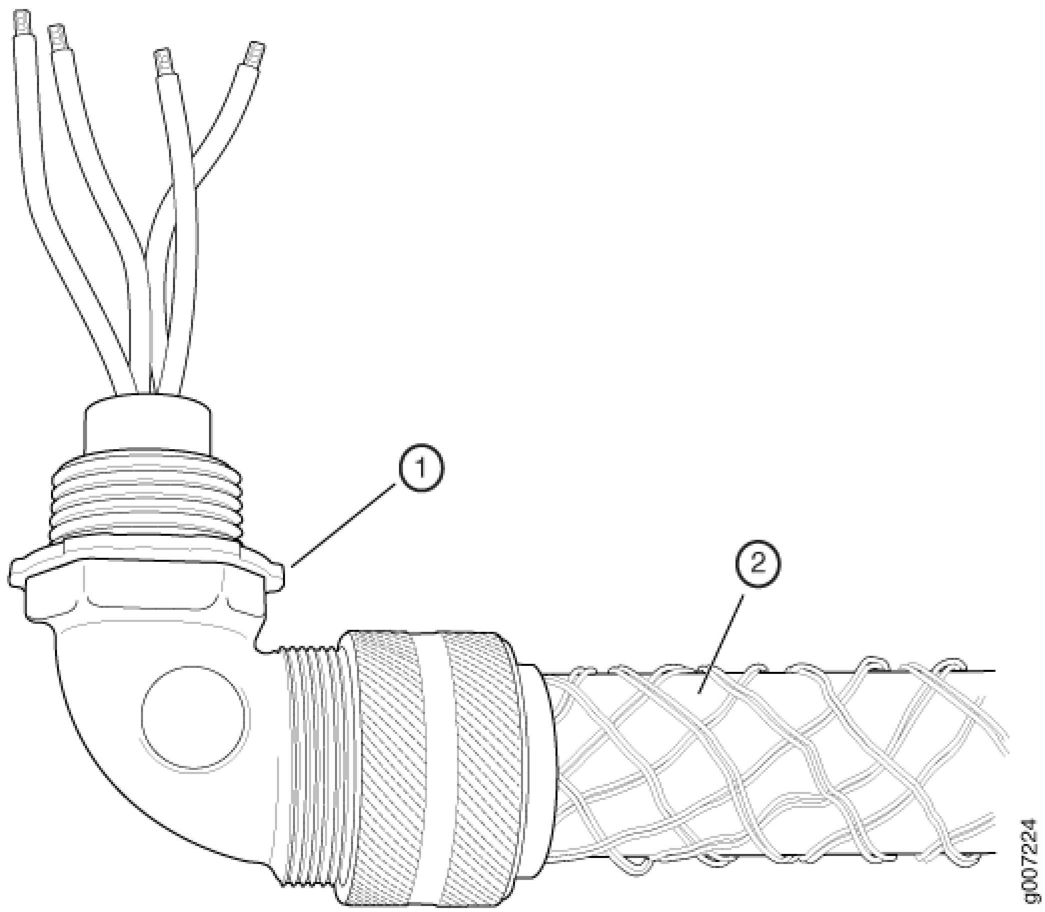
1. Switch off the customer-site circuit breakers. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker and power **OUTPUT** switch on the PDU faceplate to the off (**O**) position.
3. Using a number 2 Phillips (+) screwdriver, remove the four screws from the metal retaining bracket located on the lower right of the PDU. Remove the metal retaining bracket from the PDU (see Figure 90 on page 214).

Figure 90: Removing the Metal Retaining Bracket from a Three-Phase Delta AC PDU



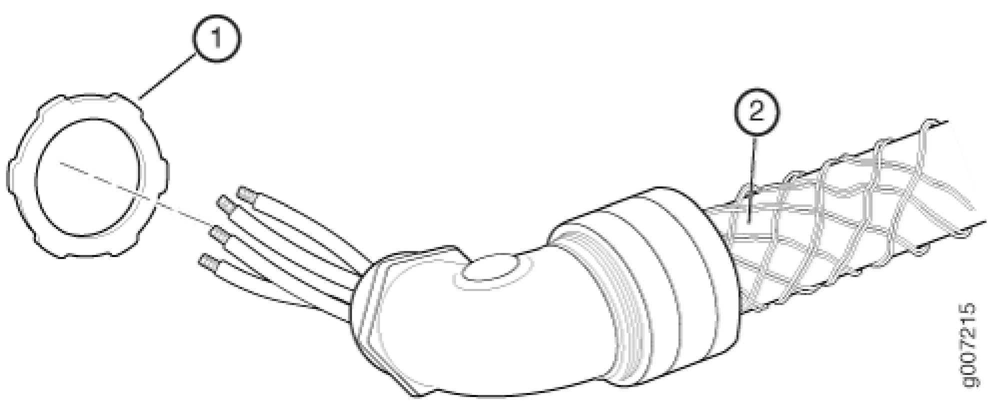
4. Unscrew the retaining nut from the AC power cord (see Figure 91 on page 215 and Figure 92 on page 215).

Figure 91: Retaining Nut on a Three-Phase Delta AC Power Cord



1– Retaining nut	2– Three-phase delta AC power cord

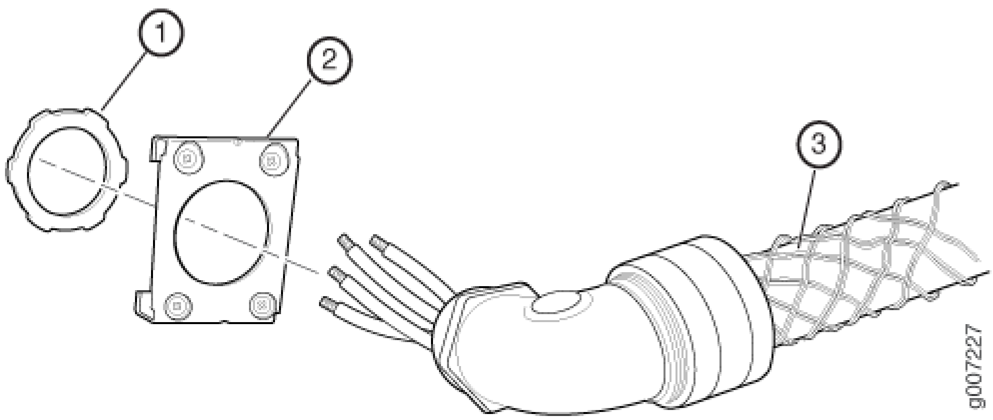
Figure 92: Removing the Retaining Nut from a Three-Phase Delta AC Power Cord



1– Retaining nut	2– Three-phase delta AC power cord

5. Put the wires of the AC power cord through the hole of the metal retaining bracket, and screw the retaining nut onto the AC power cord to secure it to the metal retaining bracket (see Figure 93 on page 216).

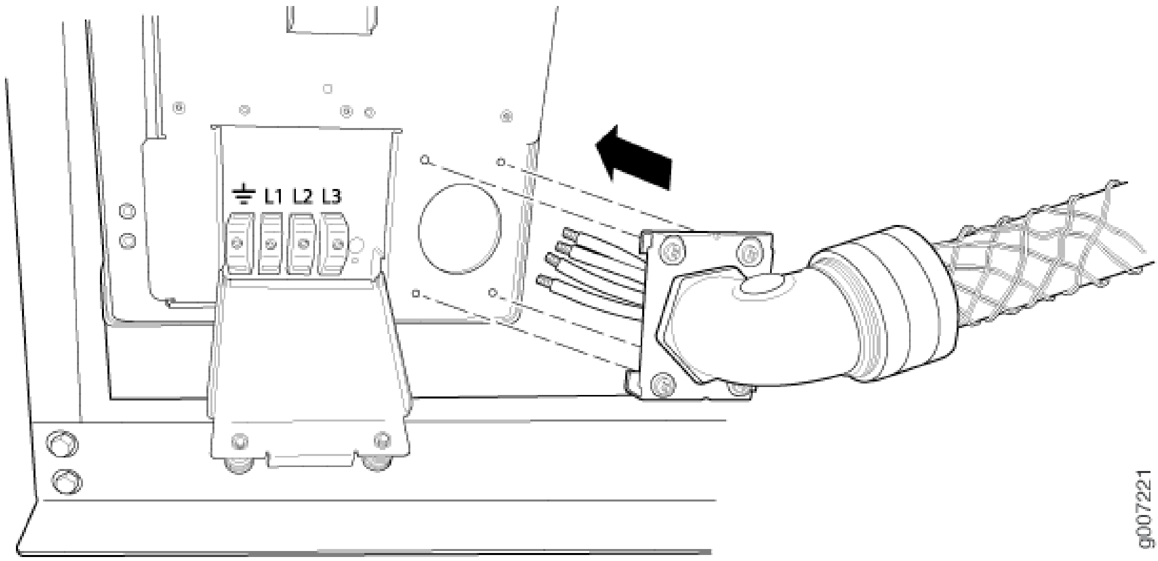
Figure 93: Connecting the Metal Retaining Bracket to Three-Phase Delta AC Power Cord



1– Retaining nut	3– Three-phase delta AC power cord
2– Metal retaining bracket	

6. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment. Open the metal door of the metal AC wiring compartment. Push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment. Using a number 2 Phillips (+) screwdriver, use the four screws on the metal retaining bracket to secure the AC power cord to the PDU (see Figure 94 on page 217).

Figure 94: Connecting Power to a Three-Phase Delta AC PDU



7. Connect the wires to the AC terminal block on the three-phase delta AC PDU (Figure 95 on page 218). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen each of the input terminals or grounding point screws, insert each wire into the grounding point or input terminal, and tighten the screw.

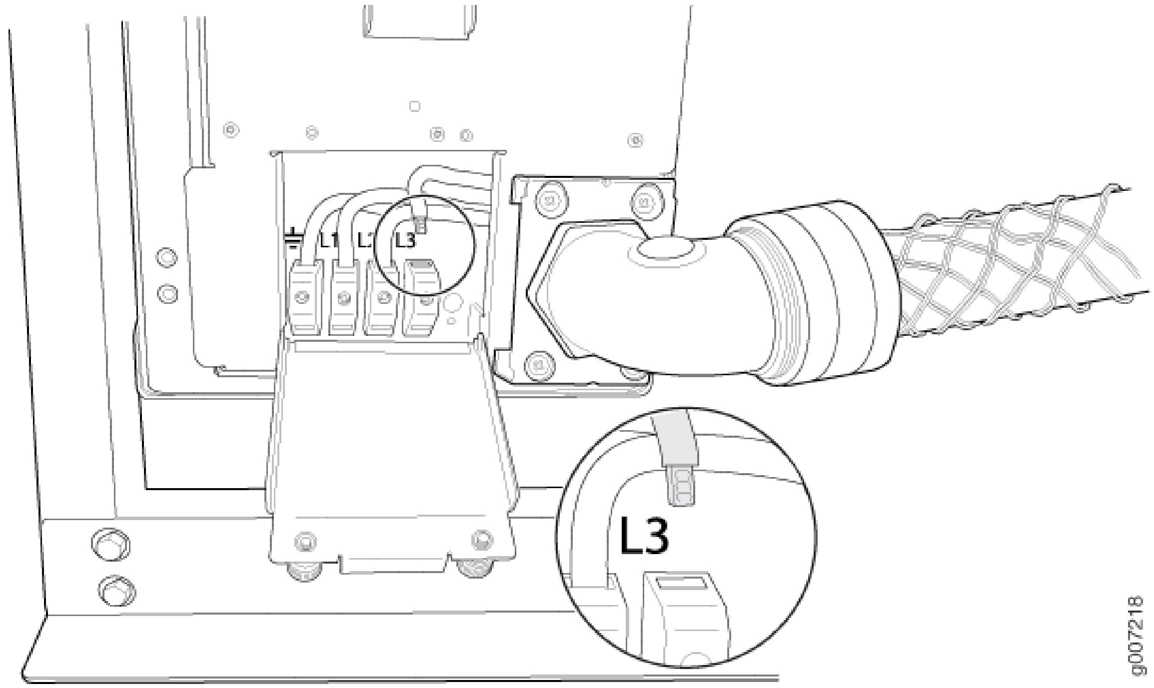
   a. Insert the wire labeled **GND** into the grounding point.

   b. Insert the wire labeled **L1** into the **L1** input terminal.

   c. Insert the wire labeled **L2** into the **L2** input terminal.

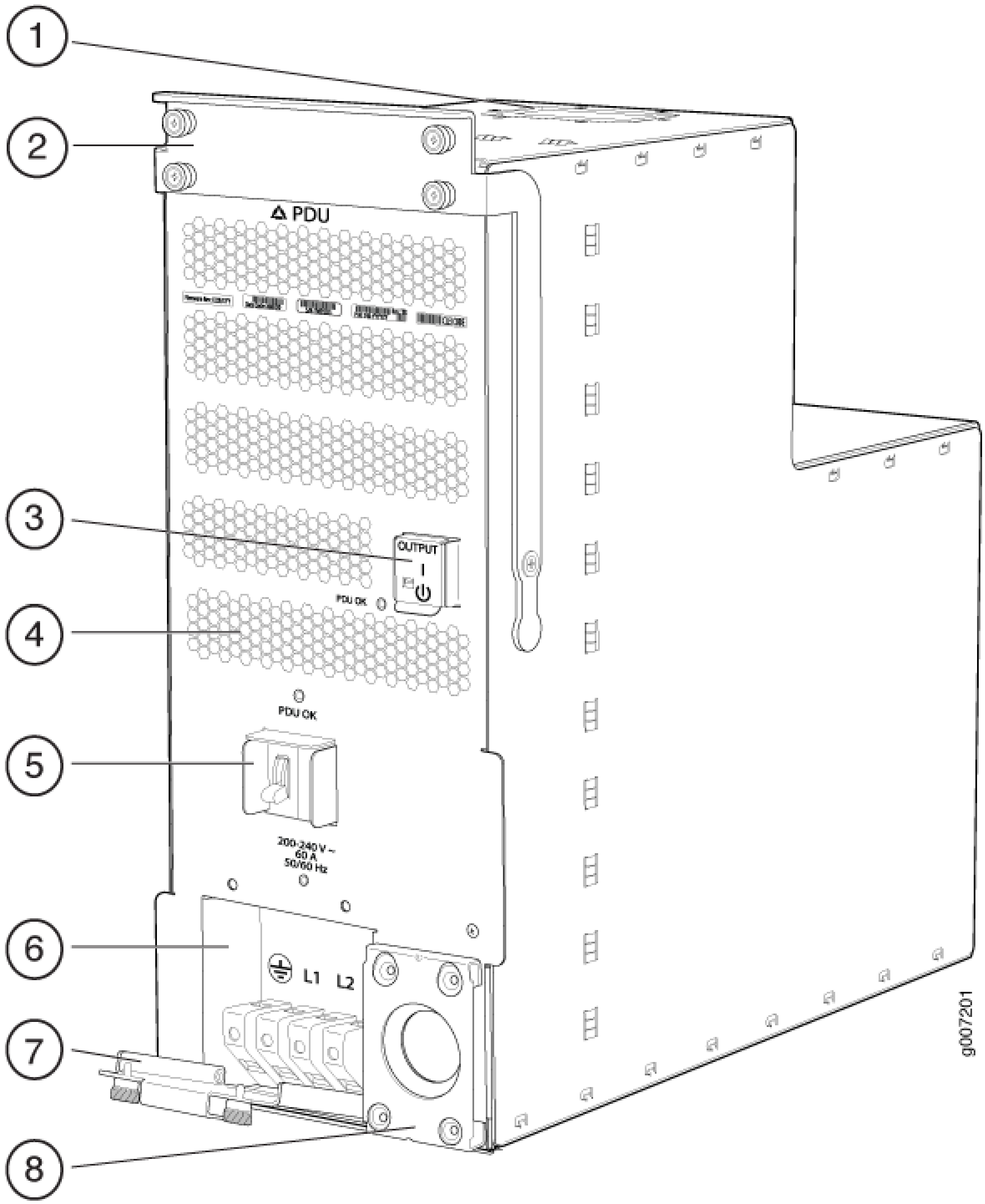
   d. Insert the wire labeled **L3** into the **L3** input terminal.

Figure 95: Connecting Ground and Power to a Three-Phase Delta AC PDU



8. Verify that the AC power wiring connections are correct.
9. Close the door to the metal AC wiring compartment, and use a number 2 Phillips (+) screwdriver to tighten the two captive screws to secure the door to the metal AC wiring compartment.
10. Verify that the AC power cord does not touch or block access to PTX5000 components, and that it does not drape where people could trip on it.
11. Repeat the procedure for the other three-phase delta AC PDU.

Figure 96: Three-Phase Delta AC PDU



1– Top installation handle	5– Circuit breaker
2– Front installation handle	6– Wiring compartment
3– Power **OUTPUT** switch	7– Wiring compartment door

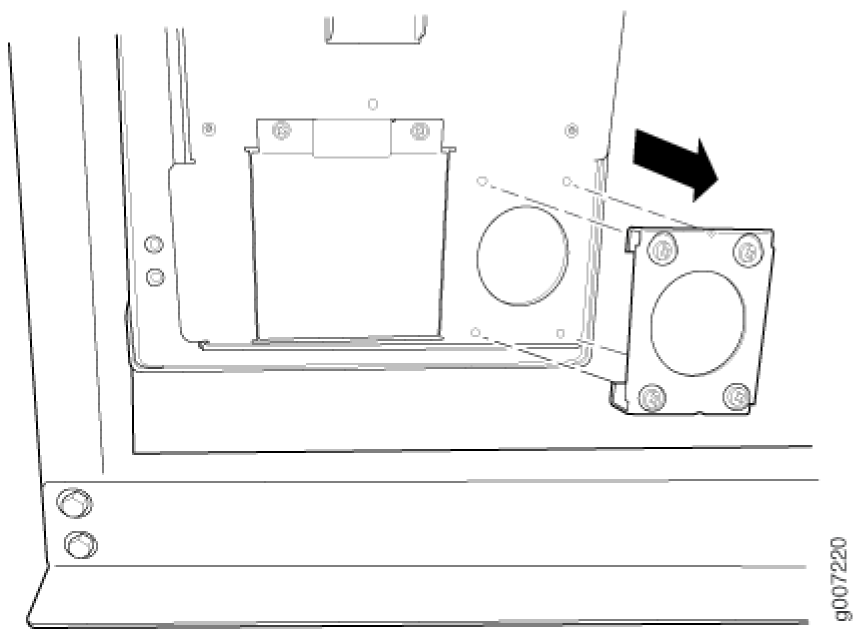
4– Air exhaust ventilation	8– Metal retaining bracket

Connecting Power to the PTX5000 Three-Phase Wye AC PDUs

To connect an AC power cord to a three-phase wye AC PDU (see Figure 103 on page 225):

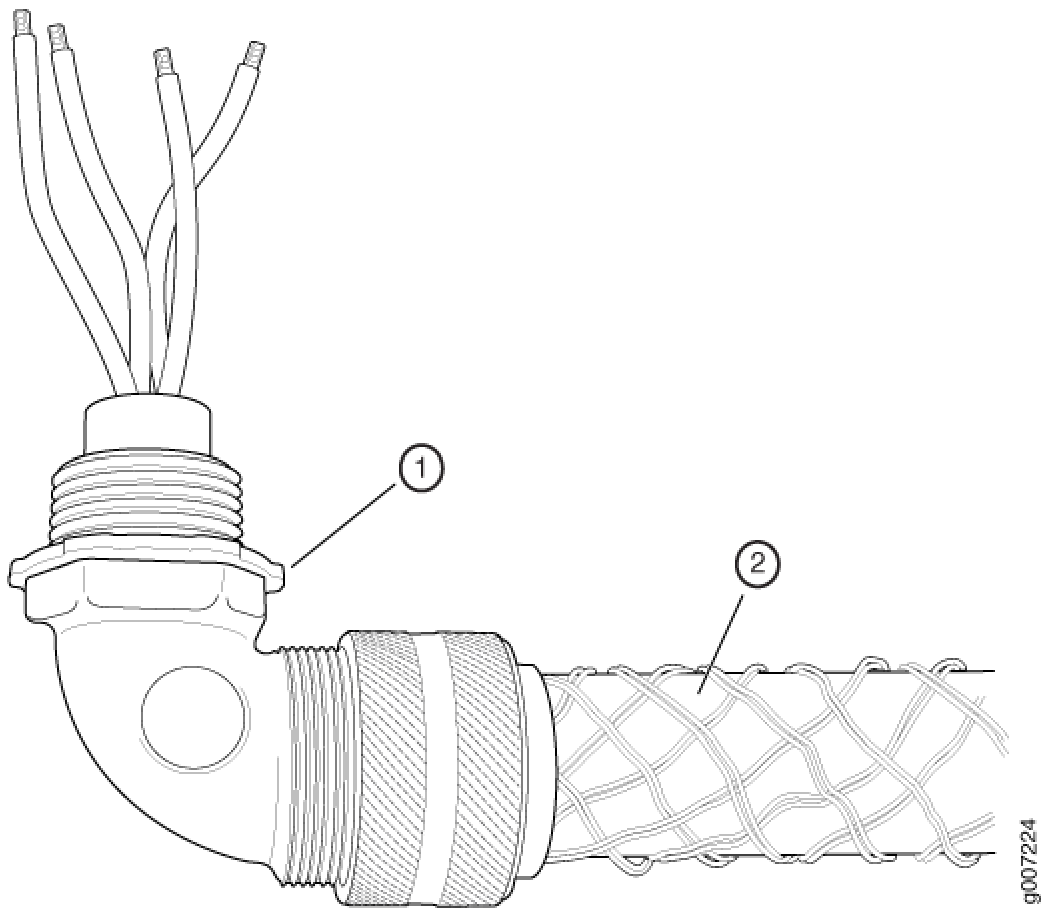
1. Switch off the customer-site circuit breakers. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker and power **OUTPUT** switch on the PDU faceplate to the off (**O**) position.
3. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws that fasten the metal retaining bracket to the PDU, and remove the metal retaining bracket from the PDU (see Figure 97 on page 220).

Figure 97: Removing the Metal Retaining Bracket from a Three-Phase Wye AC PDU



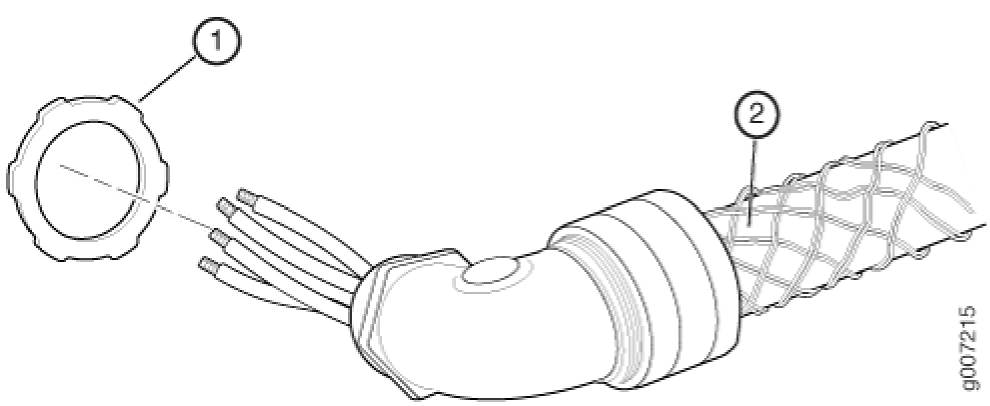
4. Unscrew the retaining nut from the AC power cord (see Figure 98 on page 221 and Figure 99 on page 221).

Figure 98: Retaining Nut on a Three-Phase Wye AC Power Cord



1– Retaining nut	2– Three-phase wye AC power cord

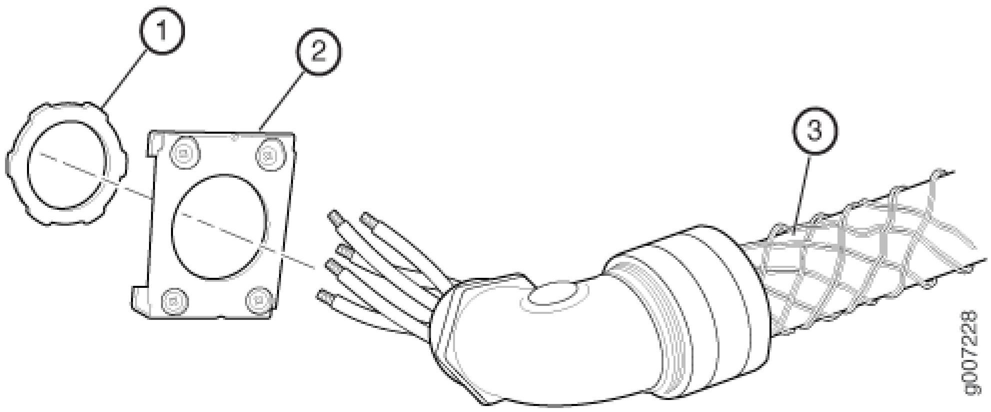
Figure 99: Removing the Retaining Nut from a Three-Phase Wye AC Power Cord



1– Retaining nut	2– Three-phase wye AC power cord

5. Put the wires of the AC power cord through the hole of the metal retaining bracket, and screw the retaining nut onto the AC power cord to secure it to the metal retaining bracket (see Figure 100 on page 222).

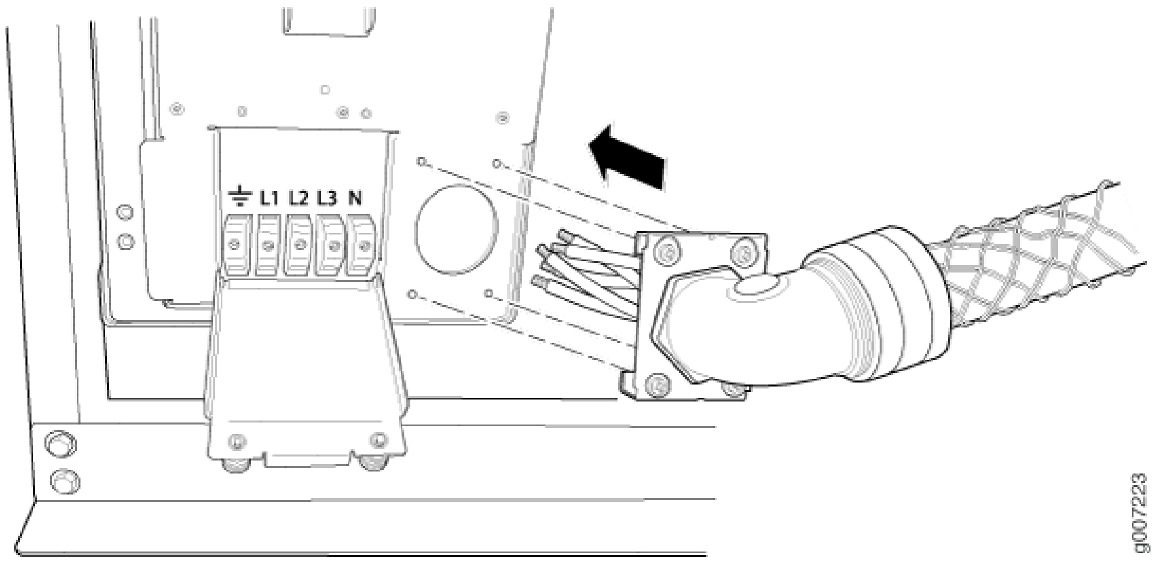
Figure 100: Connecting the Metal Retaining Bracket to the Three-Phase Wye AC Power Cord



1– Retaining nut	3– Three-phase wye AC power cord
2– Metal retaining bracket	

6. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment. Open the metal door of the metal AC wiring compartment. Push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment. Using a number 2 Phillips (+) screwdriver, use the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU (see Figure 101 on page 223).

Figure 101: Connecting Power to a Three-Phase Wye AC PDU



7. Connect the wires to the AC terminal block on the three-phase wye AC power supply (Figure 102 on page 224). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen each of the input terminals or grounding point screws, insert each wire into the grounding point or input terminal, and tighten the screw.

   a. Insert the wire labeled **GND** into the grounding point.

   b. Insert the wire labeled **L1** into the **L1** input terminal.

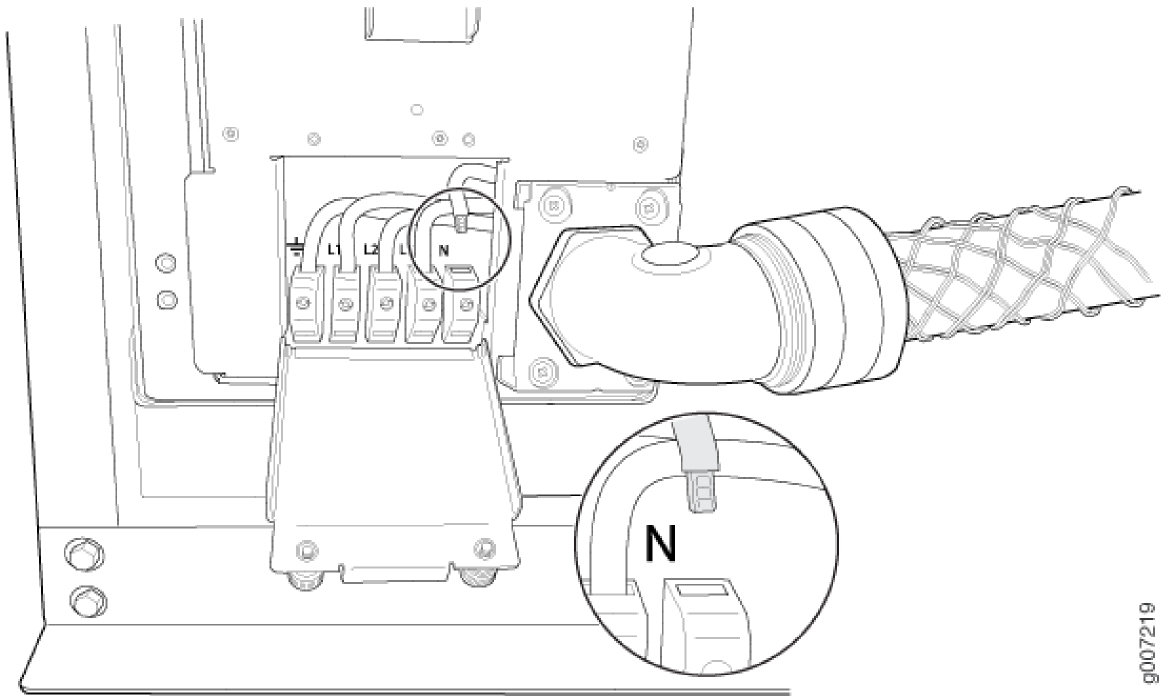
   c. Insert the wire labeled **L2** into the **L2** input terminal.

   d. Insert the wire labeled **L3** into the **L3** input terminal.

   e. Insert the wire labeled **N** into the **N** input terminal

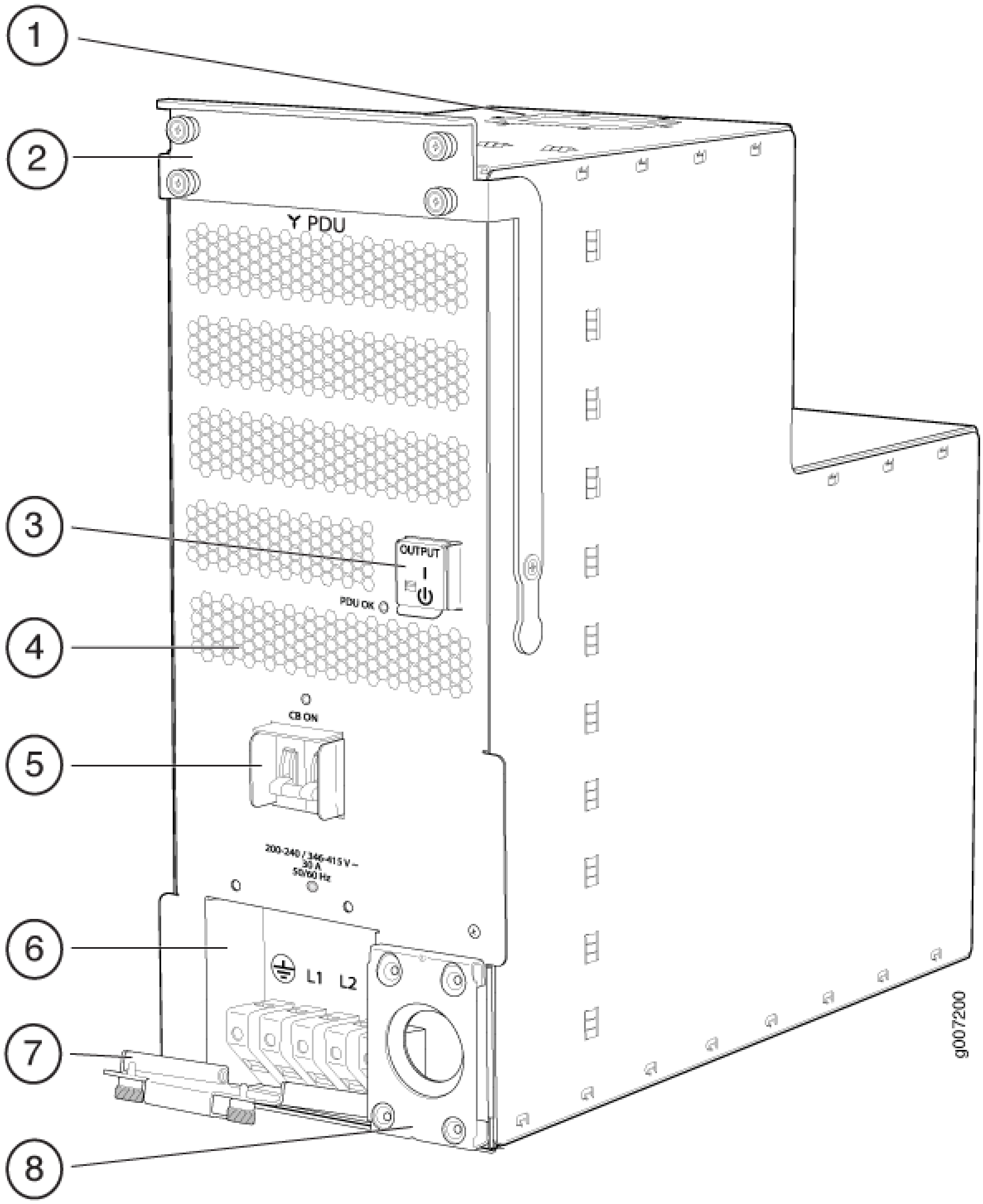
> **CAUTION**: To avoid damage to the PDU, do not connect the neutral wire to the **L1**, **L2**, or **L3** input terminals.

Figure 102: Connecting Power to the Three-Phase Wye AC Power Supply



8. Verify that the AC power wiring connections are correct.
9. Close the door to the metal AC wiring compartment, and use a number 2 Phillips (+) screwdriver to tighten the two captive screws to secure the door to the metal AC wiring compartment.
10. Verify that the AC power cord does not touch or block access to router components, and that it does not drape where people could trip on it.
11. Repeat the procedure for the other three-phase wye AC PDU.

Figure 103: Three-Phase Wye AC PDU



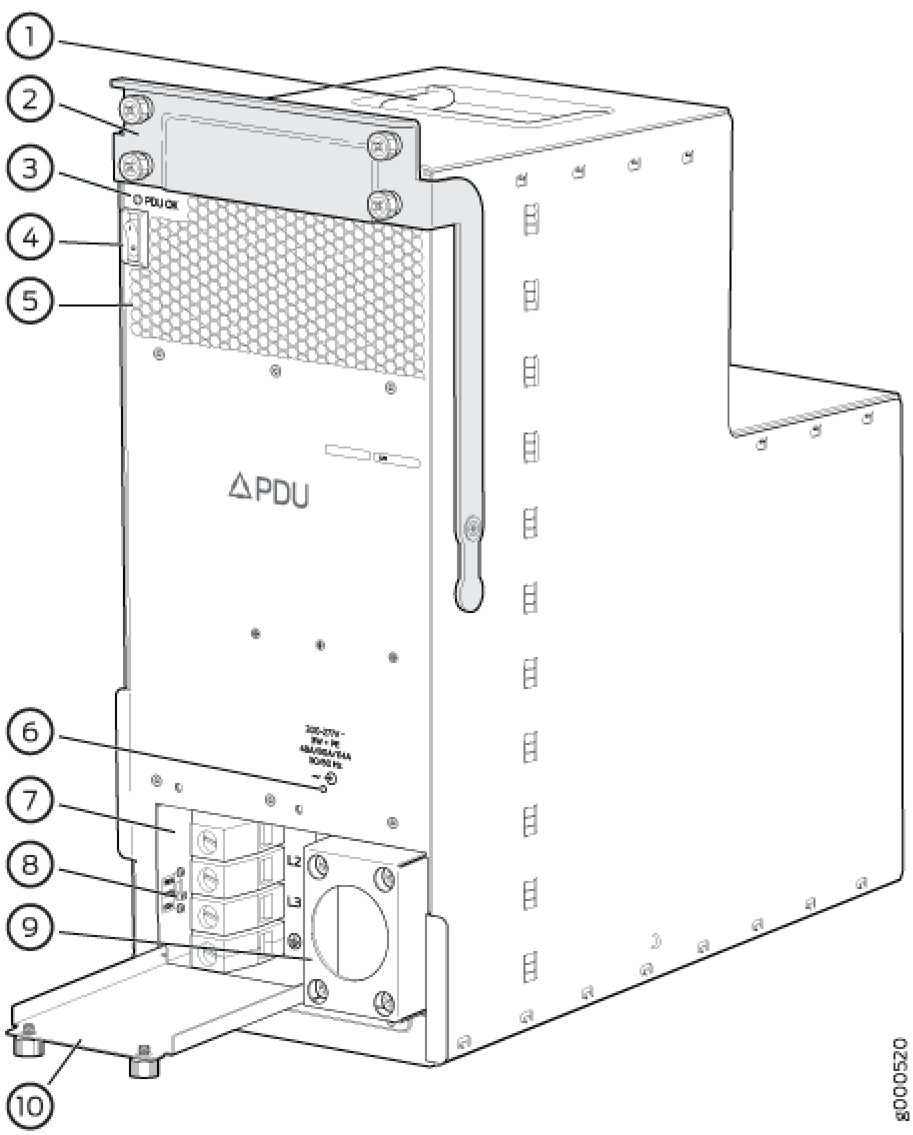
1– Top installation handle	5– Circuit breaker
2– Front installation handle	6– Wiring compartment
3– Power **OUTPUT** switch	7– Wiring compartment door

4– Air exhaust ventilation	8– Metal retaining bracket

Connecting Power to the PTX5000 High Capacity Delta AC PDUs

To connect an AC power cord to a High Capacity Delta AC PDU (see Figure 104 on page 226):

Figure 104: High Capacity Delta AC PDU

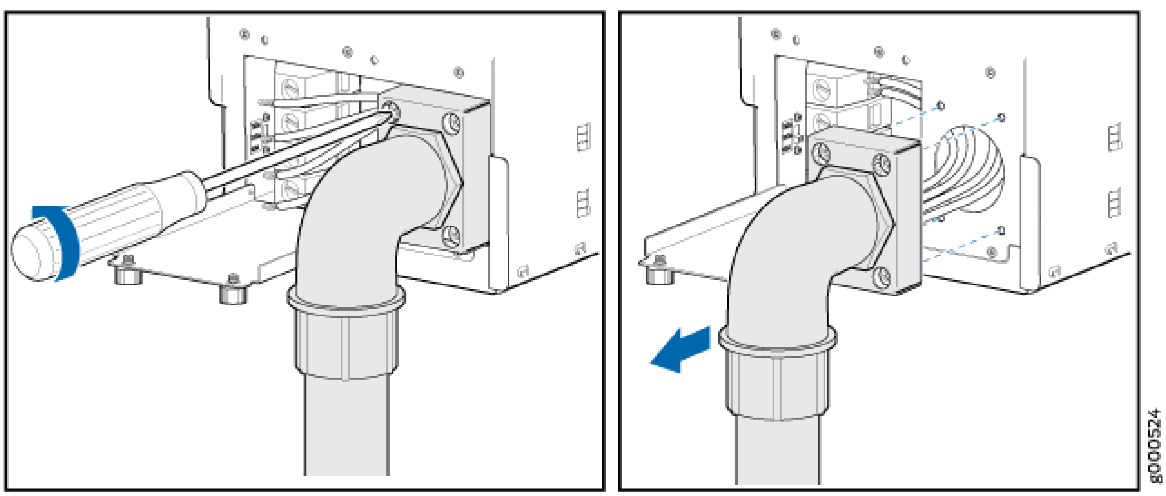


1– Top installation handle	6– Input voltage LED
2– Front installation handle	7– Wiring compartment

3– **PDU OK** LED	8– Power input cord selection switch
4– Power switch labeled (|) for the on position and (⏻) for the standby position.	9– Metal retaining bracket
5– Air exhaust ventilation	10– Wiring compartment door

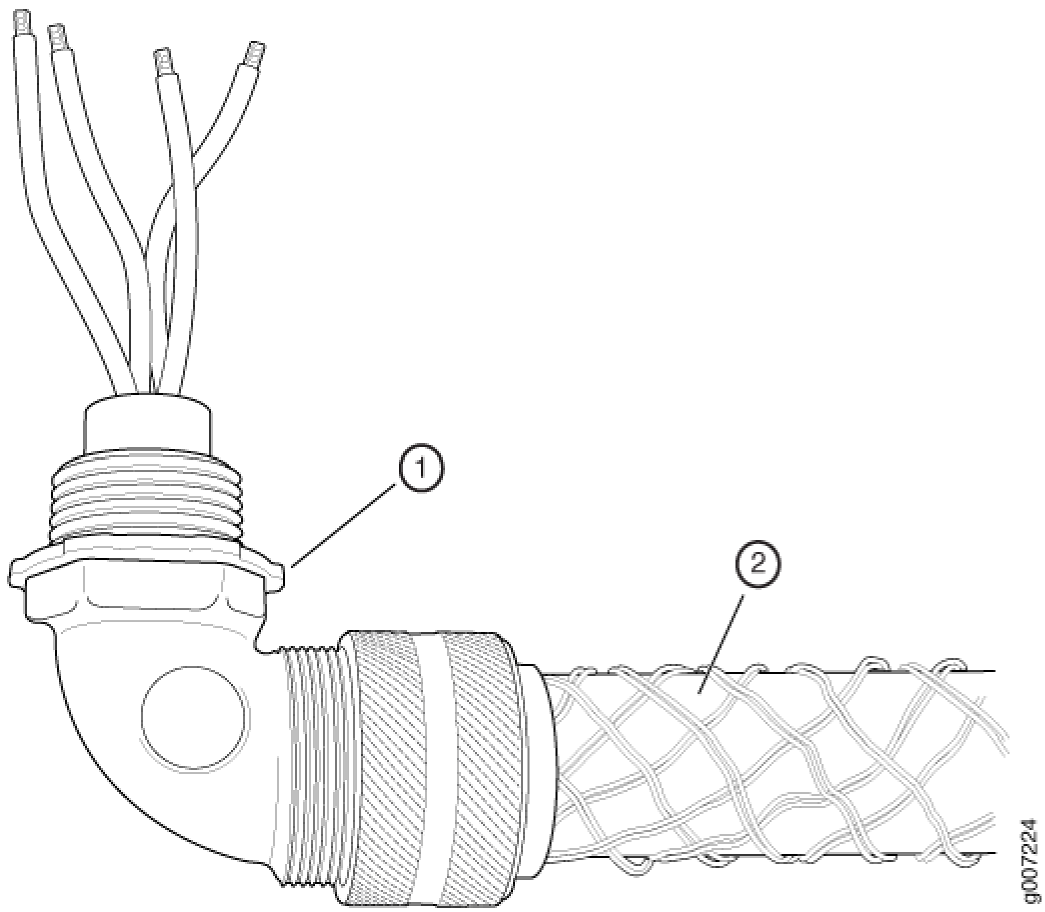
1. Switch off the customer-site circuit breakers. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the power switch on the PDU faceplate to the standby (⏻) position.
3. Using a number 2 Phillips (+) screwdriver, remove the four screws from the metal retaining bracket located on the lower right of the PDU. Remove the metal retaining bracket from the PDU (see Figure 105 on page 227).

Figure 105: Removing the Metal Retaining Bracket from a High Capacity Delta AC PDU



4. Unscrew the retaining nut from the AC power cord (see Figure 106 on page 228 and Figure 107 on page 229).

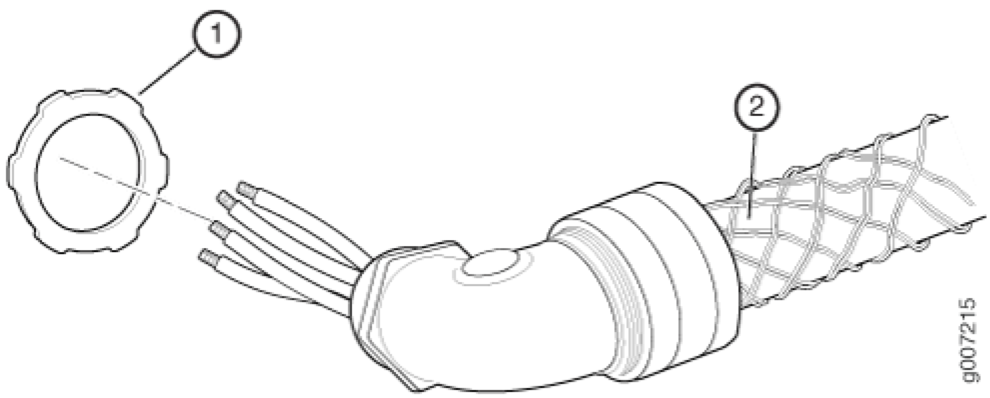
Figure 106: Retaining Nut on an AC Power Cord



1– Retaining nut	2– AC power cord

NOTE: This is a representational image. The High Capacity Delta AC PDU supports three power cords for 60 A, 100 A, and 150 A, respectively.

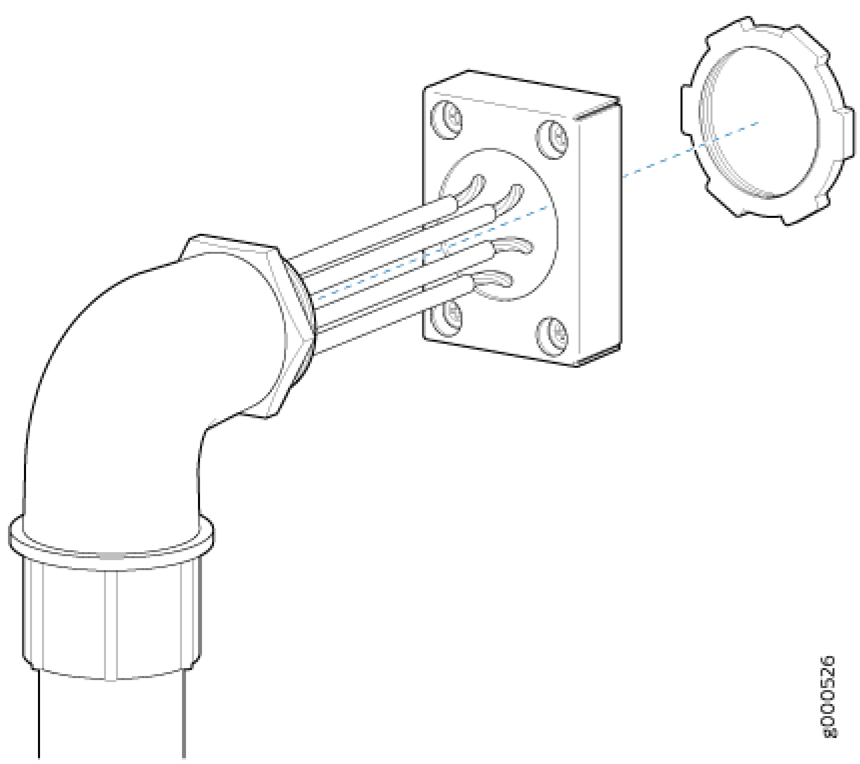
Figure 107: Removing the Retaining Nut from an AC Power Cord



1– Retaining nut	2– AC power cord

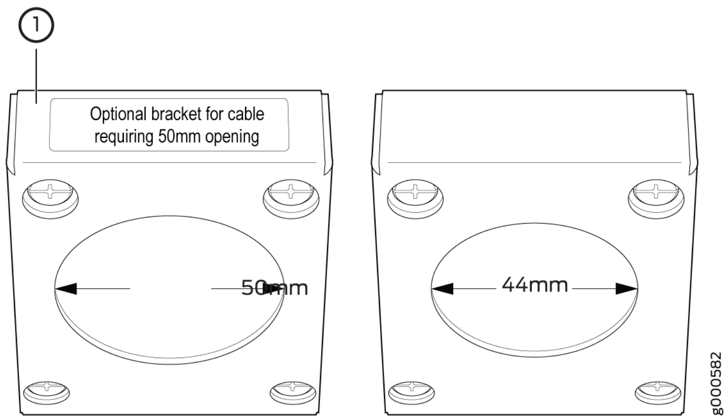
5. Put the wires of the AC power cord through the hole of the metal retaining bracket, and screw the retaining nut onto the AC power cord to secure it to the metal retaining bracket (see Figure 108 on page 229).

Figure 108: Connecting the Metal Retaining Bracket to an AC Power Cord



NOTE: If you are using 150 A power, you must use a metal bracket that is larger than the default metal bracket. This bracket is shipped along with the High Capacity Delta AC PDUs. Labels on top of the metal brackets specify the power cords that can be used for each bracket (see Figure 109 on page 230). The installation procedure to connect the metal bracket to the PDU is the same for both metal brackets.

Figure 109: Metal Brackets for Power Cords



1– Metal Bracket with label **Use for 740-053918, 740-059634 Power Cords**—740-053918 indicates the 100-A power cord and 740-059634 the 150-A power cord for the High Capacity Delta AC PDU.	2– Metal Bracket with label **Use for 740-053919, 740-059635, 740-035459 Power Cords**—740-053919 indicates the power cord for the High Capacity Delta AC PDU. 740-059635 indicates the 100-A power cord and 740-035459 the 60-A power cord.

6. Attach the power cord to the PDU:

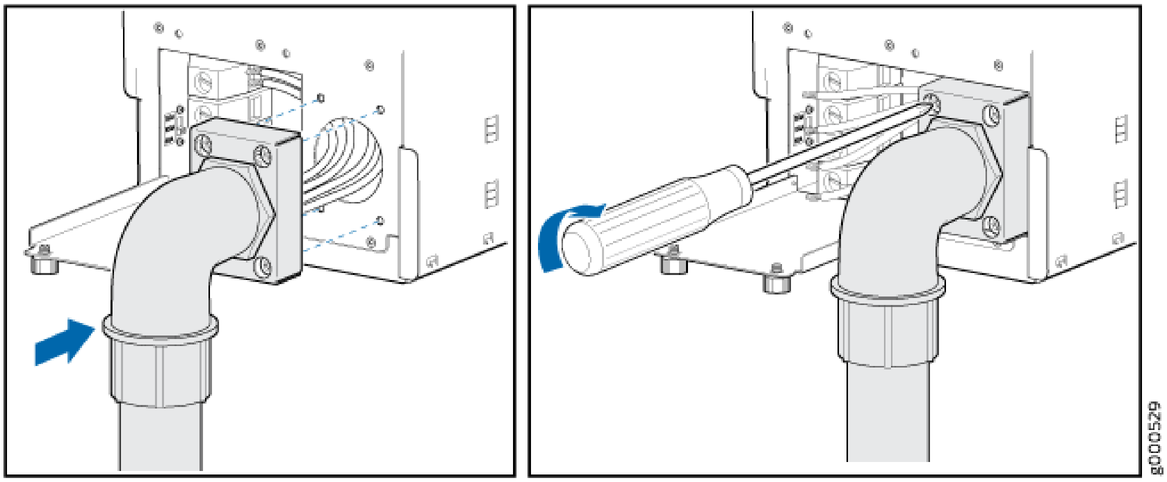
   a. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment.

   b. Open the metal door of the metal AC wiring compartment.

   c. Push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.

   d. Using a number 2 Phillips (+) screwdriver, use the four screws on the metal retaining bracket to secure the AC power cord to the PDU (see Figure 110 on page 231).

Figure 110: Attaching the Power Cord to the High Capacity Delta AC PDU



7. Connect the wires to the AC terminal block on the High Capacity Delta AC PDU (Figure 111 on page 232). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen each of the input terminal screws and the grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw.

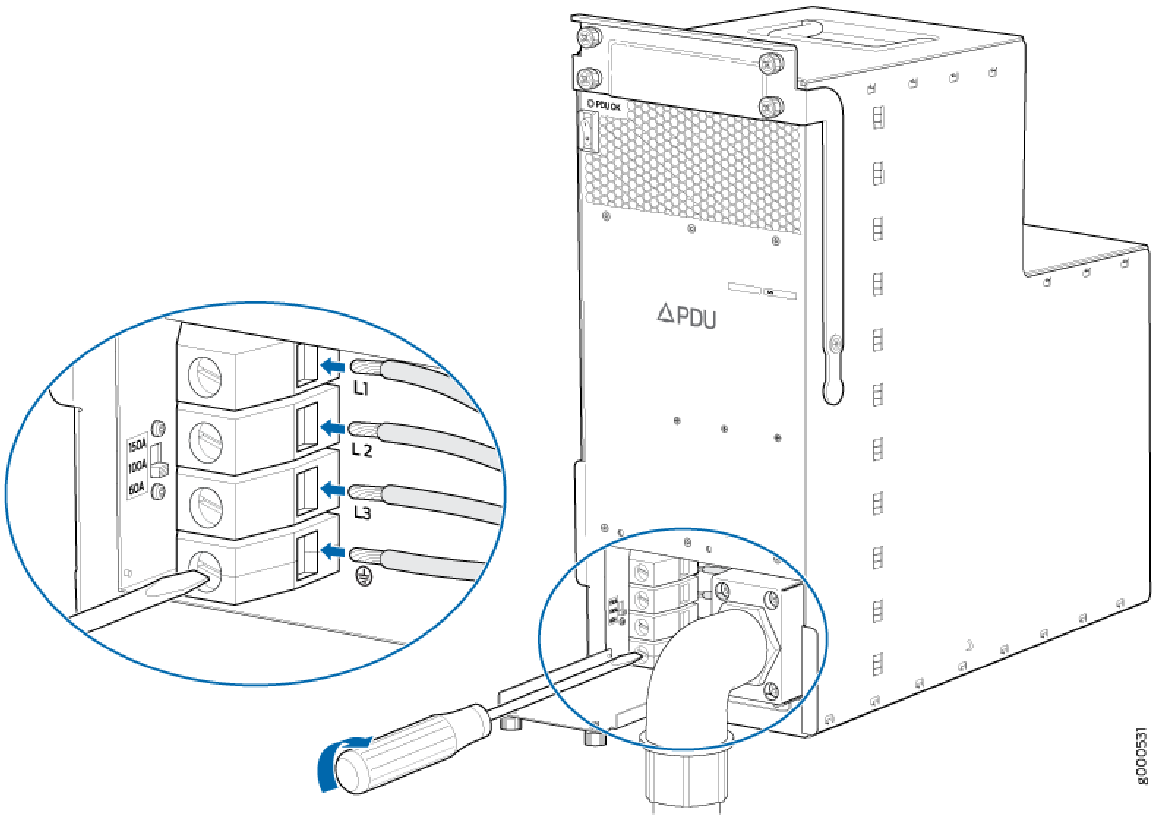
   a. Insert the wire labeled **GND** into the grounding point.

   b. Insert the wire labeled **L1** into the **L1** input terminal.

   c. Insert the wire labeled **L2** into the **L2** input terminal.

   d. Insert the wire labeled **L3** into the **L3** input terminal.

Figure 111: Connecting Ground and Power to a High Capacity Delta AC PDU



8. Verify that the AC power wiring connections are correct.
9. Close the door to the metal AC wiring compartment, and use a number 2 Phillips (+) screwdriver to tighten the two captive screws to secure the door to the metal AC wiring compartment.
10. Verify that the AC power cord does not touch or block access to PTX5000 components, and that it does not drape where people could trip on it.
11. Before you power on the PDU, select the switch setting corresponding to the AC input power cord that is connected to the PDU. Figure 112 on page 233 shows an ampere switch, located inside the wiring compartment.

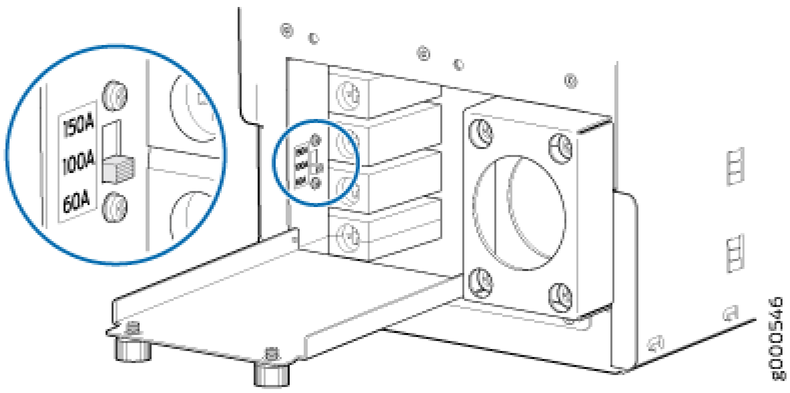
    - If CBL-PTX-AC-D cable is used, set the switch to 60A.
    - If CBL2-PTX-100AC-D cable is used, set the switch to 100A.
    - If CBL2-PTX-150AC-D cable is used, set the switch to 150A.

    You can verify the switch setting by using the `show chassis environment pdu` command. The command displays the input power rating as shown in the following example:

    show chassis environment pdu 0

```
PDU 0 status: State Online BoostConv OK Feed Switch 150Amps <<<=== Hours Used 142 Firmware Version (MCU1)
03.04
```

Figure 112: Ampere Switch



WARNING: If you set the ampere switch in the wiring compartment incorrectly, the AC power cord might overheat. Setting the ampere switch incorrectly might also cause the site circuit breaker to trip.

NOTE: The system software gets the system power configuration from the PDU and displays it in the output of the `show chassis environment pdu` command. Depending on the setting, the system software limits the system configuration (FPCs and PICs) to keep the power demand within the maximum output power available from the PDU.

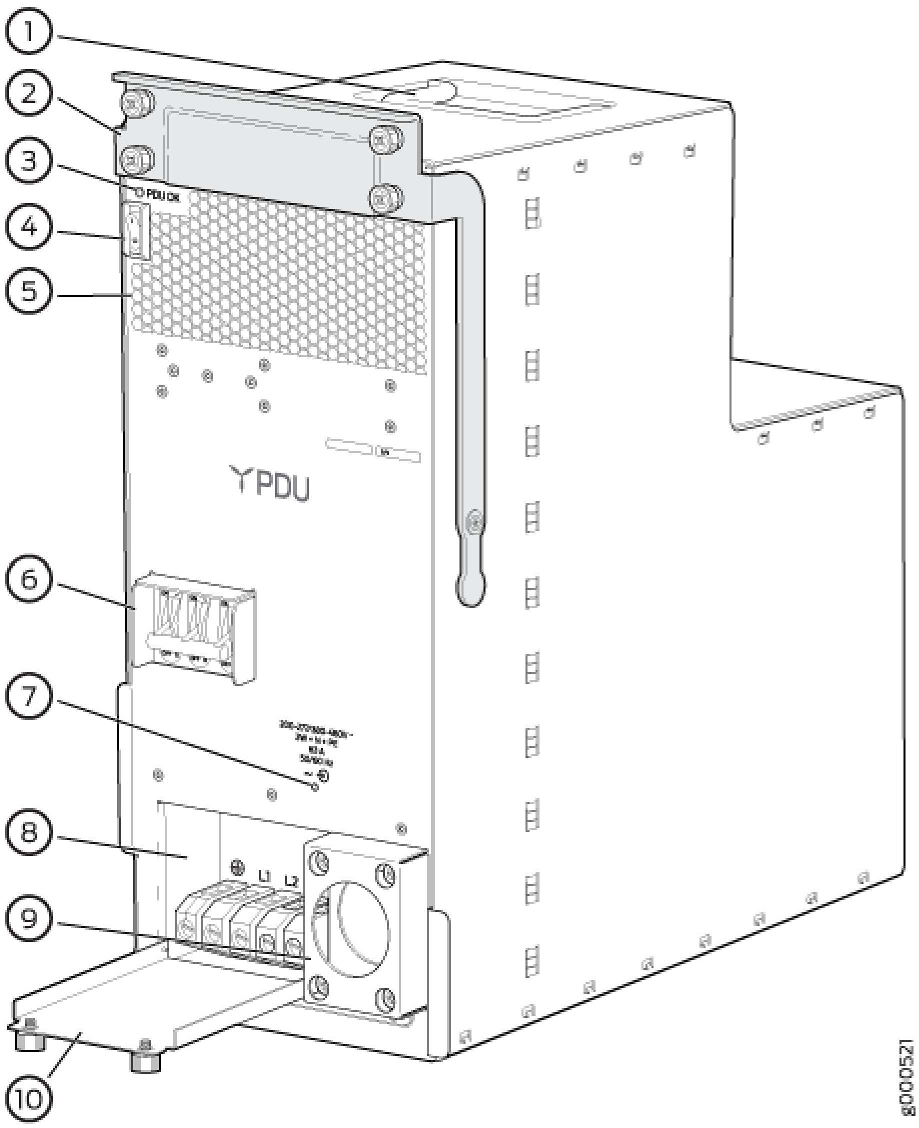
NOTE: In a redundant system with two PDUs, the PDUs share the load. If the ampere switch setting of one PDU is lower than the other, Junos OS reduces the rating of the other PDU to the lower value.

12. Repeat the procedure for the other High Capacity Delta AC PDU.

Connecting Power to the PTX5000 High Capacity Wye AC PDUs

To connect an AC power cord to a High Capacity Wye AC PDU (see Figure 113 on page 234):

Figure 113: High Capacity Wye AC PDU

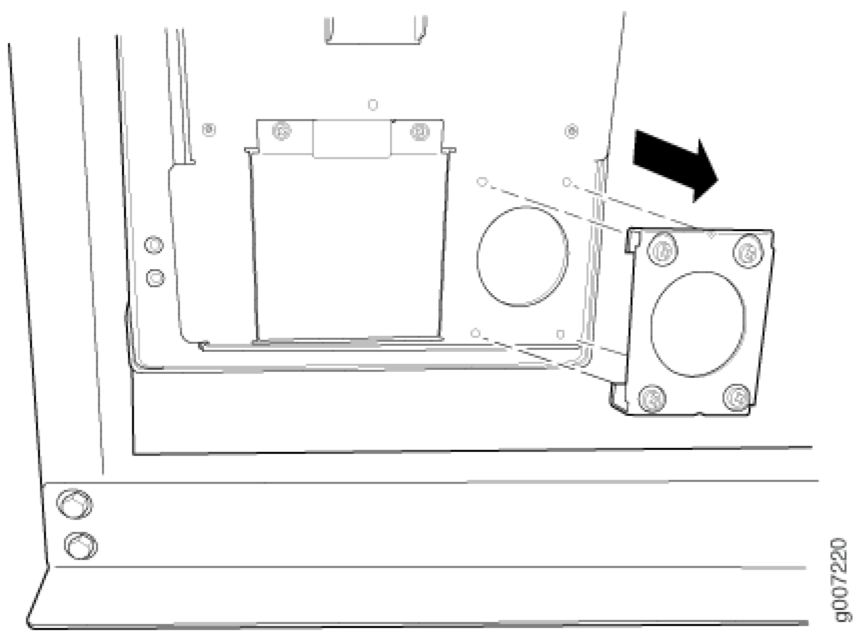


1– Top Installation handle	6– Circuit breaker
2– Front installation handle	7– Input voltage LED
3– **PDU OK** LED	8– Wiring compartment
4– Power switch labeled (|) for the on position and (⏻) for the standby position.	9– Metal retaining bracket
5– Air exhaust ventilation	10– Wiring compartment door

To connect an AC power cord to a High Capacity Wye AC PDU (see Figure 113 on page 234):

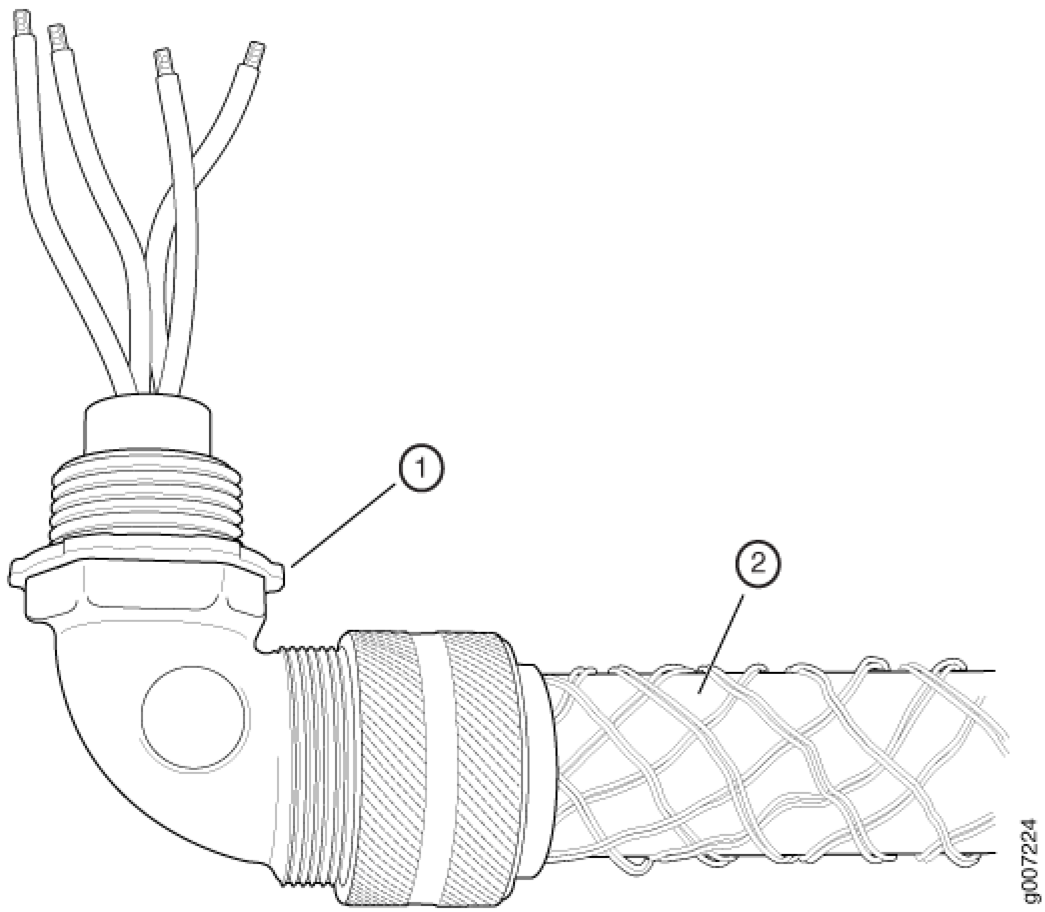
1. Switch off the customer-site circuit breakers. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Move the circuit breaker on the faceplate of the PDU to the off position.
3. Move the power switch located on the faceplate of the PDU to the standby
   (
   ⏻
) position.
4. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws that fasten the metal retaining bracket to the PDU, and remove the metal retaining bracket from the PDU (see Figure 114 on page 235).

Figure 114: Removing the Metal Retaining Bracket from a High Capacity Wye AC PDU



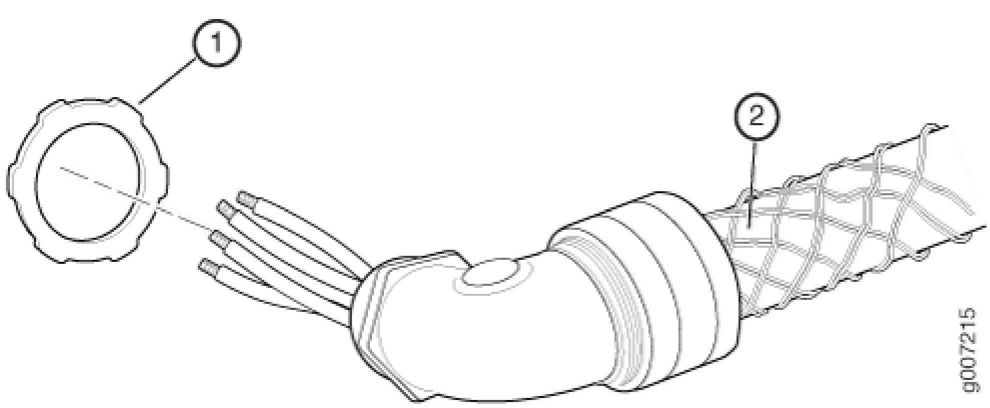
5. Unscrew the retaining nut from the AC power cord (see Figure 115 on page 236 and Figure 116 on page 236).

Figure 115: Retaining Nut on an AC Power Cord



1– Retaining nut	2– AC power cord

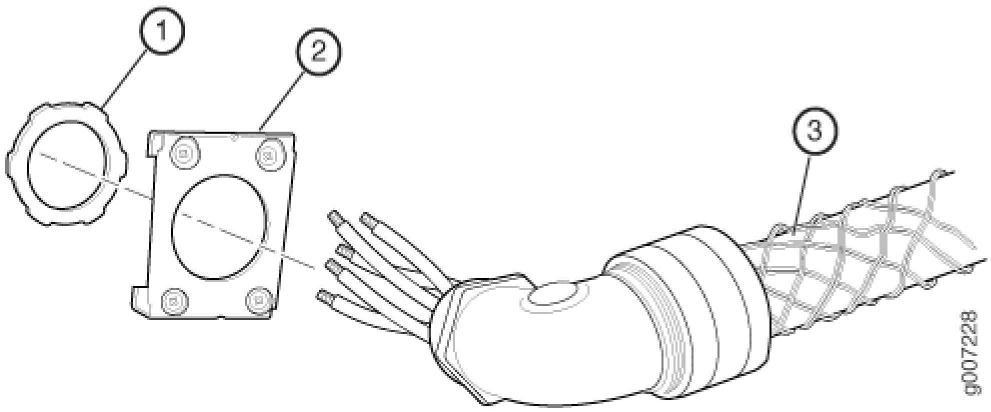
Figure 116: Removing the Retaining Nut from an AC Power Cord



1– Retaining nut	2– AC power cord

6. Put the wires of the AC power cord through the hole of the metal retaining bracket, and screw the retaining nut onto the AC power cord to secure it to the metal retaining bracket (see Figure 117 on page 237).

Figure 117: Connecting the Metal Retaining Bracket to the AC Power Cord



1– Retaining nut	3– AC power cord
2– Metal retaining bracket	

7. Attach the power cord to the PDU:

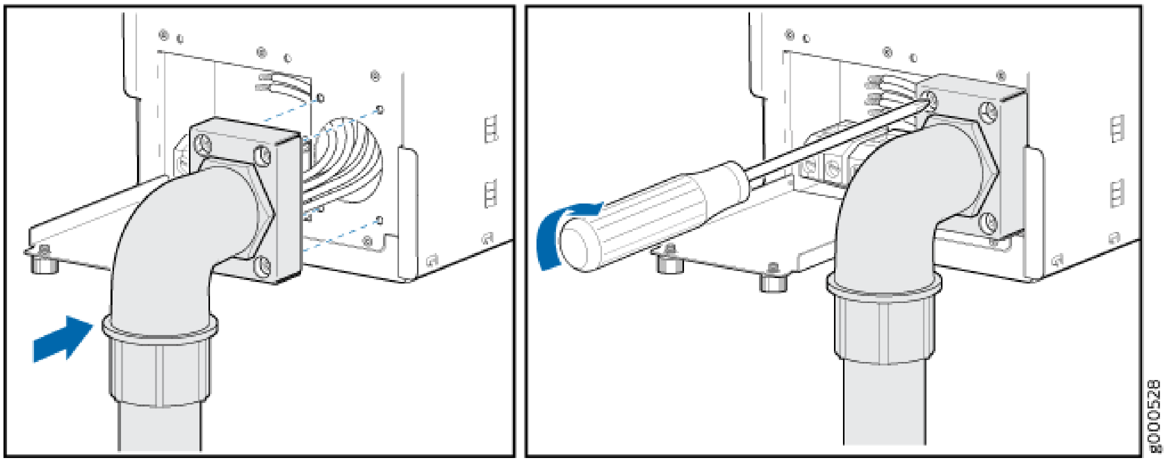
   a. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment.

   b. Open the metal door of the metal AC wiring compartment.

   c. Push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.

   d. Using a number 2 Phillips (+) screwdriver, use the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU (see Figure 118 on page 238).

Figure 118: Connecting Power to a High Capacity Wye AC PDU



8. Connect the wires to the AC terminal block on the High Capacity Wye AC PDU (see Figure 119 on page 239). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen each of the input terminal screws and the grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw.

   a. Insert the neutral wire labeled **GND** into the grounding point.

   b. Insert the wire labeled **L1** into the **L1** input terminal.

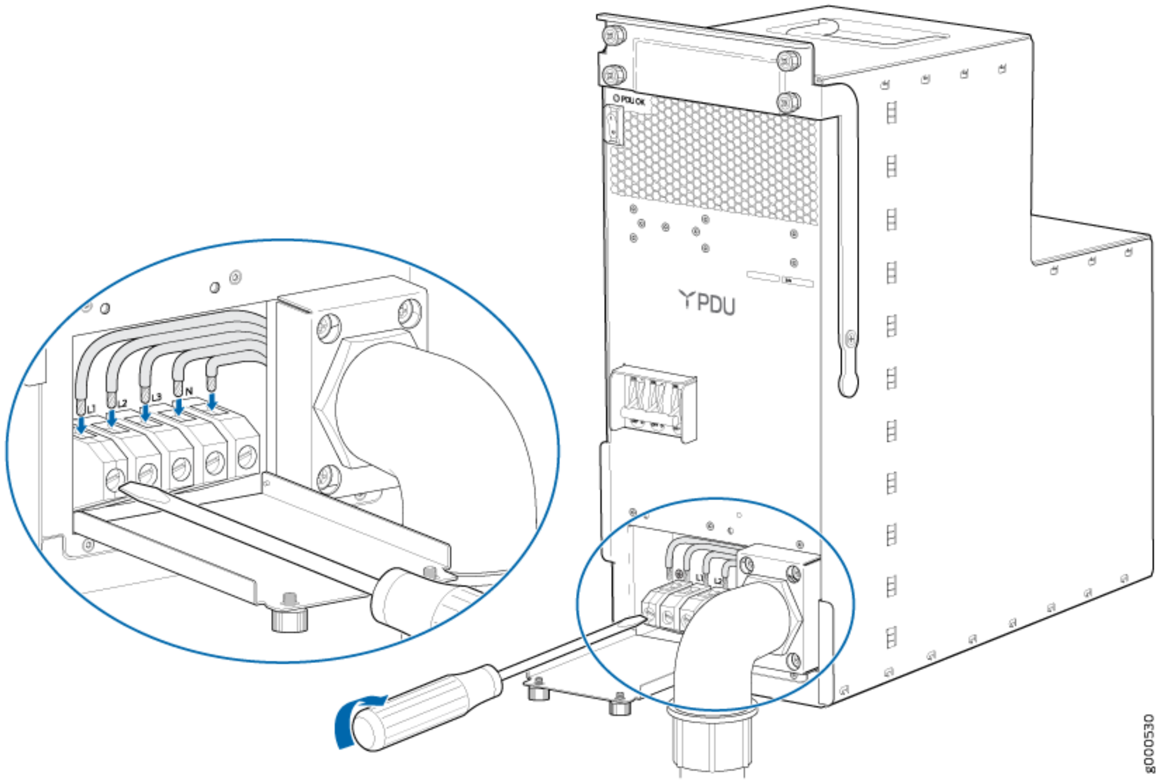
   c. Insert the wire labeled **L2** into the **L2** input terminal.

   d. Insert the wire labeled **L3** into the **L3** input terminal.

   e. Insert the wire labeled **N** into the **N** input terminal.

> **CAUTION**: To avoid damage to the PDU, do not connect the neutral wire to the **L1**, **L2**, or **L3** input terminal.

Figure 119: Connecting Power to the High Capacity Wye AC PDU



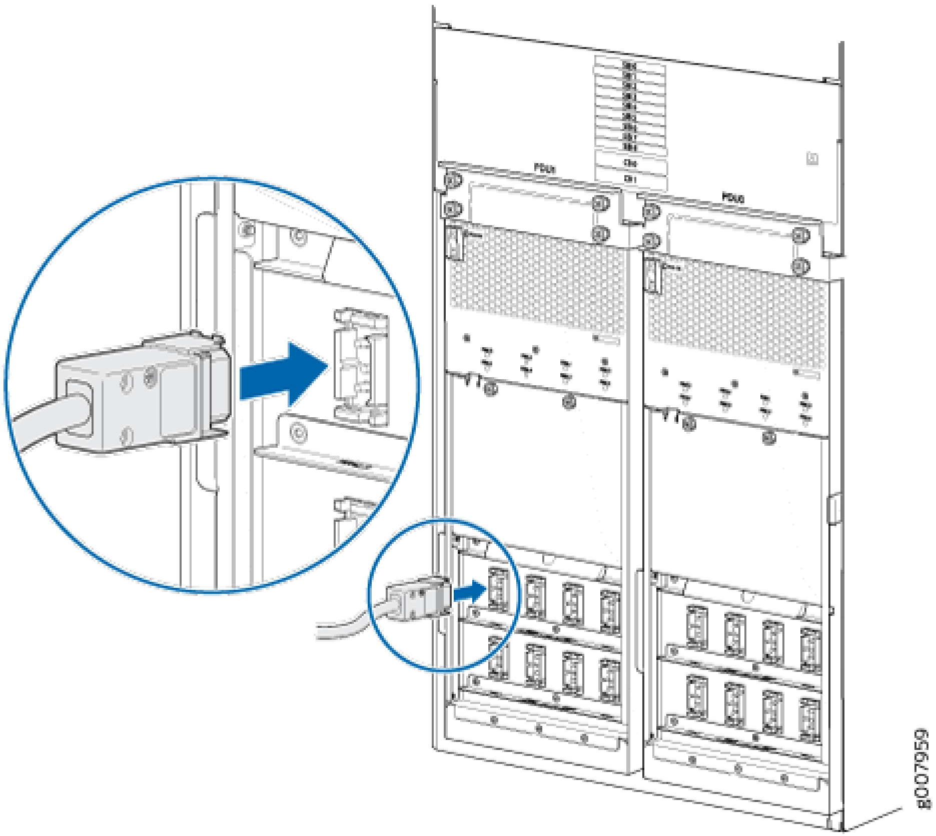
9. Verify that the AC power wiring connections are correct.
10. Close the door to the metal AC wiring compartment, and use a number 2 Phillips (+) screwdriver to tighten the two captive screws to secure the door to the metal AC wiring compartment.
11. Verify that the AC power cord does not touch or block access to PTX5000 components, and that it does not drape where people could trip on it.
12. Repeat the procedure for the other High Capacity Wye AC PDU.

Connecting Power to the PTX5000 High Capacity Single-Phase AC PDUs

The high-capacity single-phase AC PDU accepts eight single-phase 30-A or eight single-phase 20-A, 200–250 VAC L-L input power. One 30-A or 20-A input power provides dedicated input power to each PSM.

To connect the AC power cords to the single-phase AC PDUs (see Figure 120 on page 240):

Figure 120: Connecting the Source Power to a High Capacity Single-Phase AC PDU



1. Switch off the customer-site circuit breakers. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Move the power output switch on the PDU faceplate to the standby
   (
   ⏻
) position.
3. Using a number 2 Phillips (+) screwdriver, loosen the two screws from the metal door of the metal AC wiring compartment—located in the middle of the PDU faceplate for 20-A inputs and lower part of the PDU for the 30-A inputs.
4. Using a number 2 Phillips (+) screwdriver, loosen the screw on the 20-A input terminal and plug in the connector (see Figure 121 on page 241 and Figure 122 on page 242). Tighten the screw after plugging in the connector.

> **NOTE**: The 30-A connector does not have a clamp, but it has its own integral clip for locking the connector.

Figure 121: Plug Type for the 20-A Connector

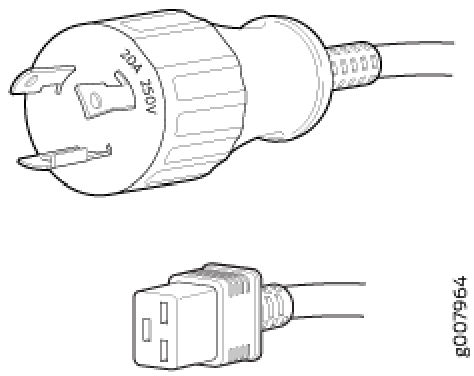
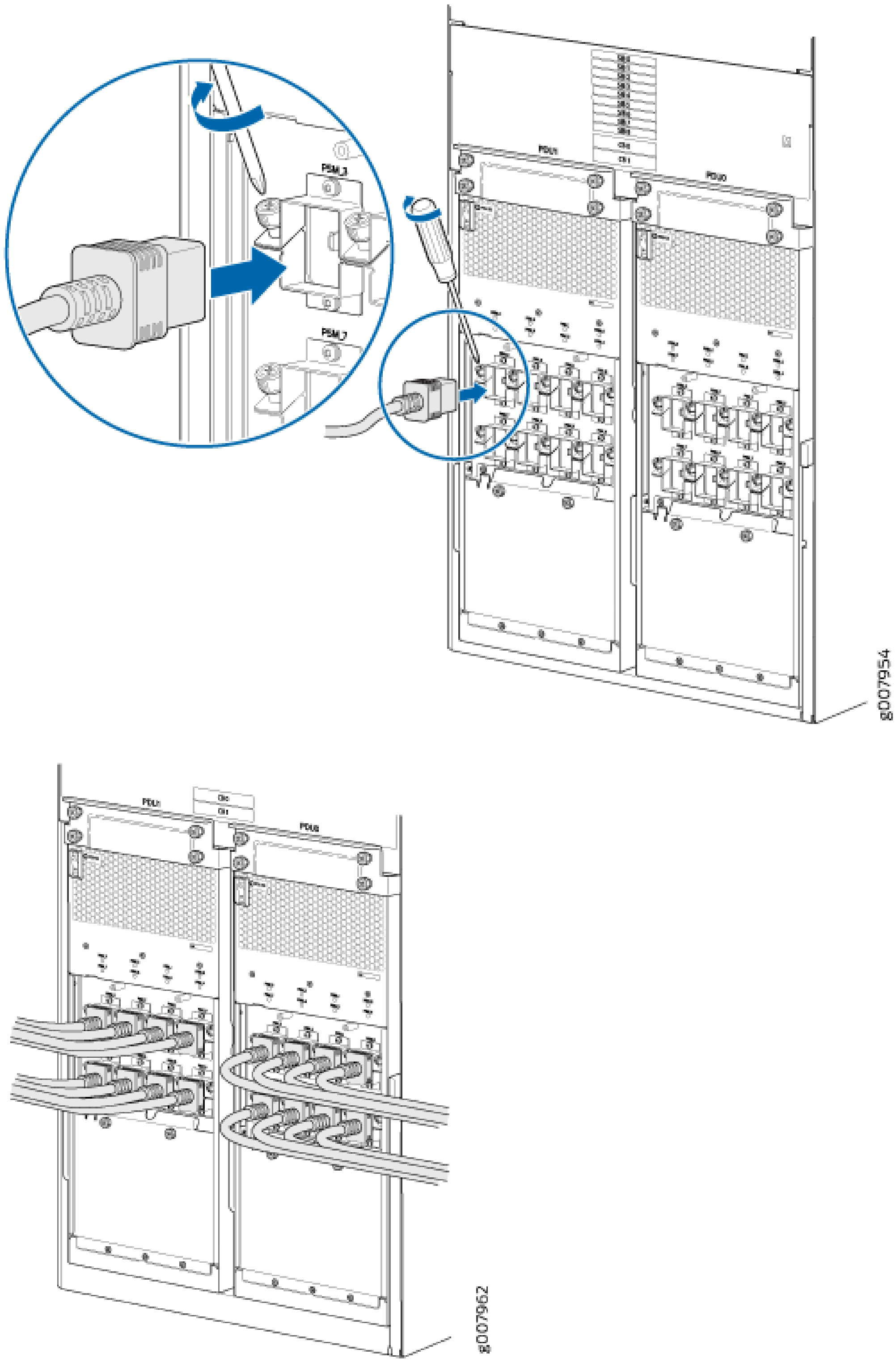


Figure 122: Connecting 20-A Inputs to a High Capacity Single-Phase AC PDU



5. Connect up to eight inputs (20-A or 30-A) to the PDU. See Figure 123 on page 243 and Figure 124 on page 244.

Figure 123: Plug Types for the 30-A Connector

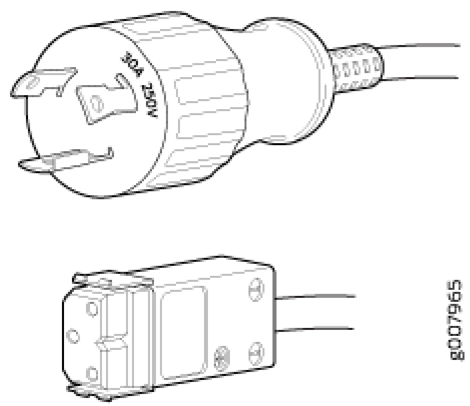
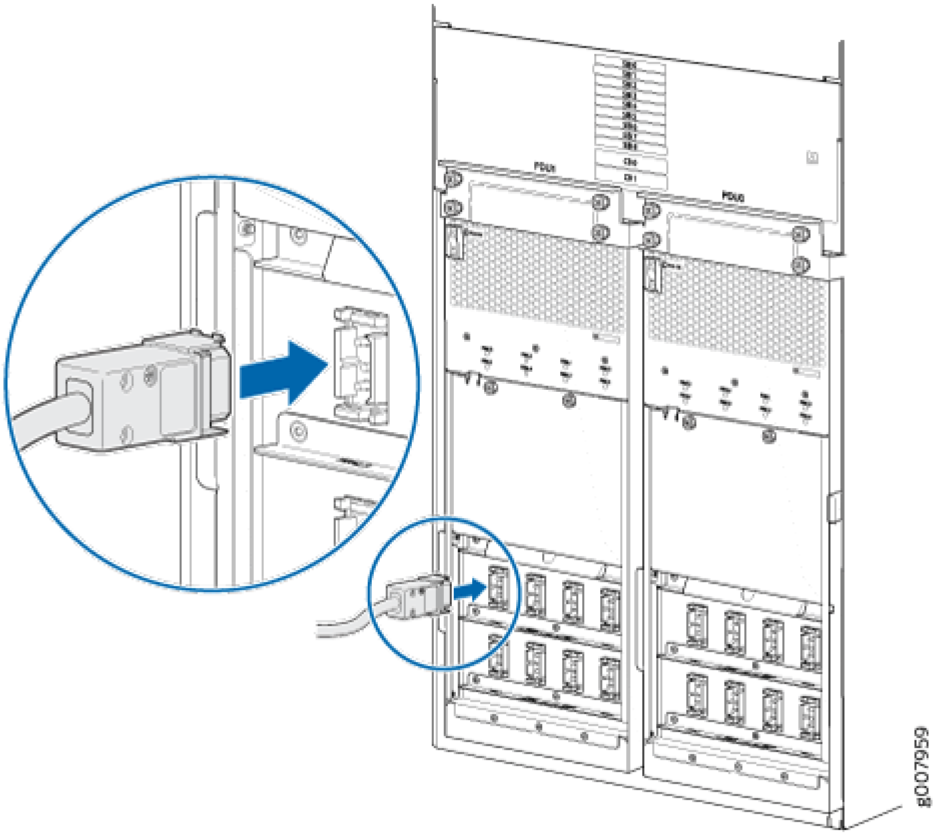
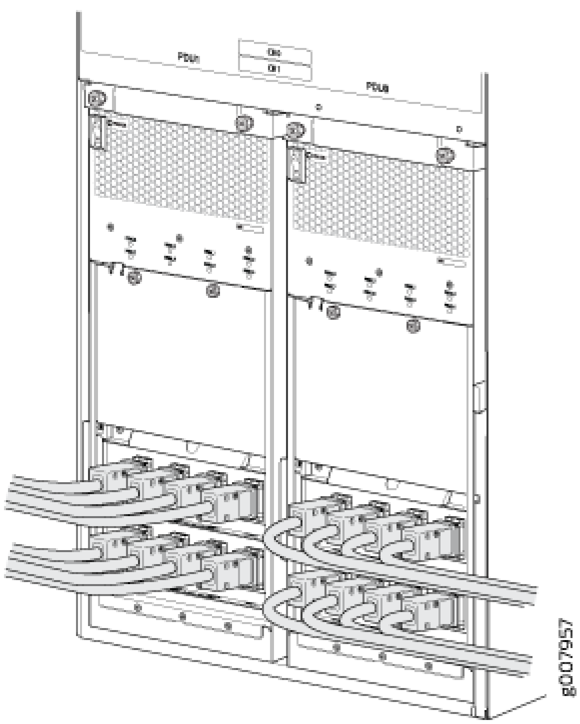


Figure 124: Connecting 30-A Inputs to a High Capacity Single-Phase AC PDU





6. Verify that the AC power wiring connections are correct.

7. Verify that the AC power cord does not touch or block access to PTX5000 components, and that it does not drape where people could trip on it.
8. Repeat the procedure for the other single-phase AC PDU.

RELATED DOCUMENTATION

Connecting the PTX5000 to DC Power

IN THIS SECTION

Tools and Parts Required to Provide DC Power to the PTX5000

If you have a DC-powered router, gather the tools required to connect the PTX5000 to DC power:

- 7/16-in. (11-mm) nut driver, between 23 lb-in. to 25 lb-in. (2.6 Nm to 2.8 Nm) tightening torque, for tightening nuts to the terminal studs.

CAUTION: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs. The maximum torque that may be applied to this nut is 62 lb-in. (7 Nm).

- Phillips (+) screwdriver, number 2
- DC power cables, which you must provide
- DC power lugs

Installing the PTX5000 Cable Management System for a High Capacity DC PDU

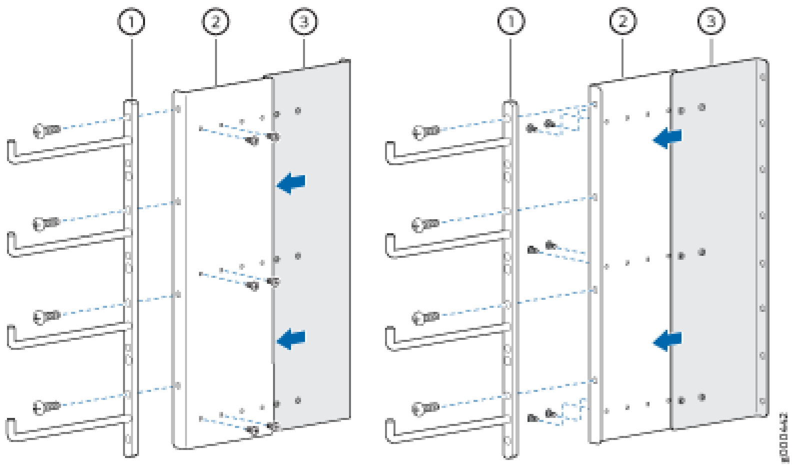
IN THIS SECTION

Identifying the Parts of the Cable Management System

NOTE: You cannot install this cable management system on a two-post rack.

1. Remove the cable management system parts from the accessories kit in the shipping crate.
2. Identify all the parts of the cable management system.
   - Two comb panel assemblies—the comb assembly, fixed to the extension panel with four screws, is detachable. See Figure 1 for left and right side views of the cable manager.
   - Four number 12 or M6 screws to install the comb panel assembly to the rack (not provided).

Figure 125: Cable Manager for a PTX5000 with High Capacity Power System



1– Comb assembly	3– Extension panel—Outside piece
2– Extension panel—Inside piece	

Installing the Cable Management Comb Assembly with Extension

> **NOTE**: Ensure that while mounting the PTX5000 chassis on the four-post rack, you leave at least 1.75 in. (4.45 cm) between the bottom of the PTX5000 chassis and the floor, so that there is enough space to install the High Capacity DC power system and to connect the cables.

To install the comb assembly to the rack:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Align a cable manager assembly for one PDU against the rack vertically. Move the comb assembly up or down so that the mounting holes are aligned to the mounting holes on the rack.

   > **NOTE**: The cable manager assembly is installed with the side wall of the comb assembly closer to the PDU but you can also install it with the side wall away from the PDU. The cable manager is symmetric in both positions. It might be easier for you to handle the mounting screws if the extension piece side wall is closer to the PDU as shown in Figure 126 on page 249. You might have to remove the comb assembly from the extension pieces and reinstall the comb assembly with the extension pieces upside down, so that the side wall is closer to the PDU.

3. Secure the cable manager assembly to the rack by placing four screws and tightening them using a number 3 Phillips (+) screwdriver. To widen the cable management comb assembly extension, see "Widening the Cable Management Comb Assembly Extension" on page 250

> **NOTE**: If the provided screws are not compatible with your rack, you might have to use different types of screws (such as metric screws).

> **CAUTION**: The maximum torque that may be applied to the provided number 12 screws is 30.0 lb-in. (3.4 Nm).

4. Similarly, secure the cable manager for the other PDU.
5. Connect power cables to the PDU (see "Connecting Power to the PTX5000 High Capacity DC PDUs" on page 260).
6. Route the power cables through the comb assembly. Ensure that each row of cables from the PDU is passed through the same row of the comb. For example, route the bottom row cables from the PDU through the bottom comb (see Figure 127 on page 250). You can secure the cables by tie-wrapping the cables to the comb.

Figure 126: Installing the Cable Manager on the Four-post Rack

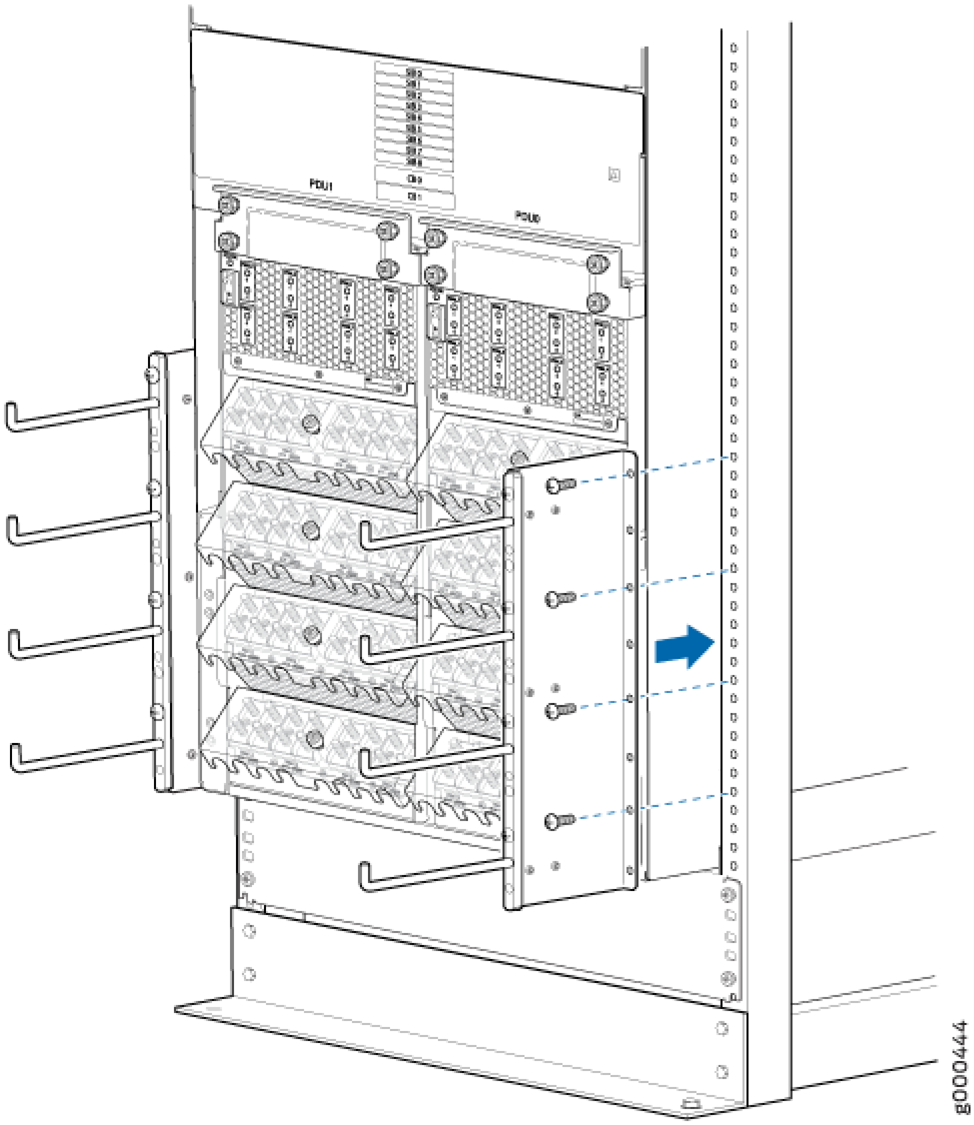
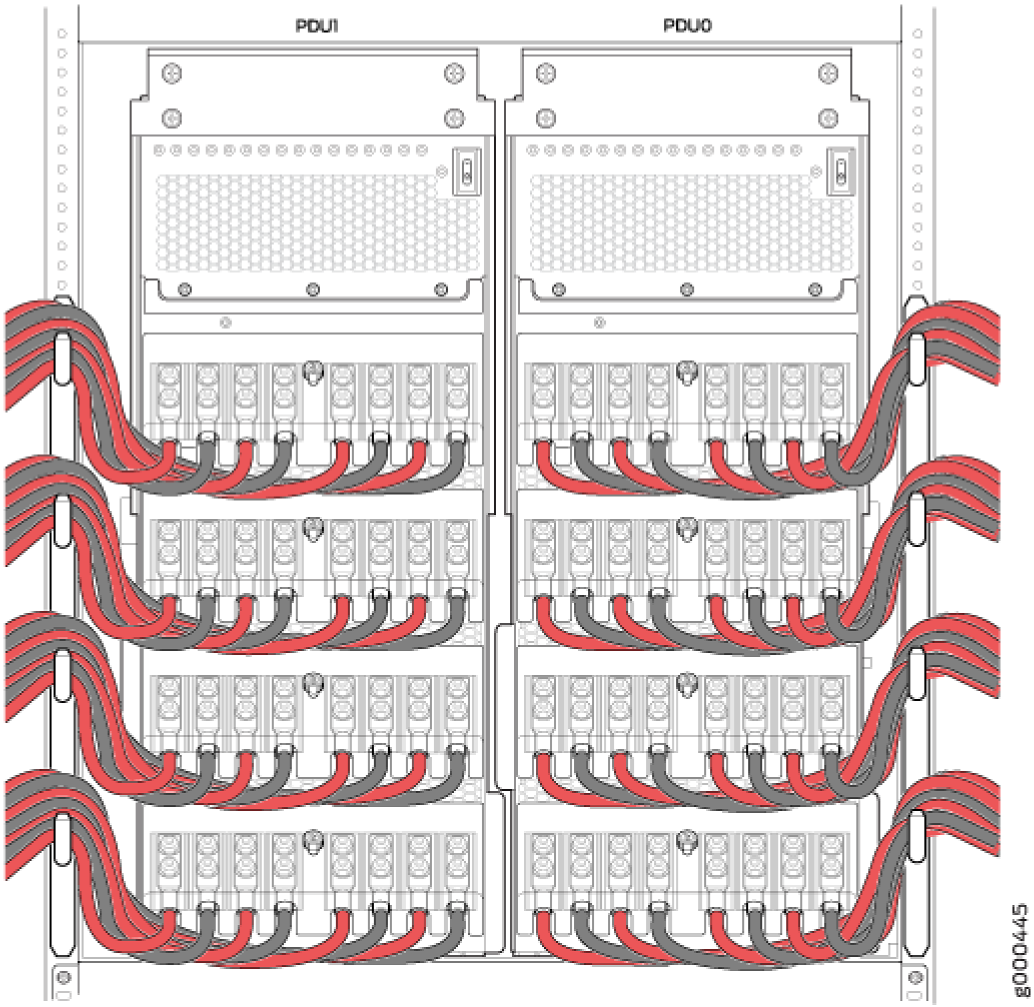


Figure 127: Routing Power Cables Through the Comb Assembly



Widening the Cable Management Comb Assembly Extension

> **NOTE**: The cable manager comb assembly extension is fixed at the minimum (default) position when shipped. You can widen the comb assembly, if the rear edge of the PTX5000 chassis extends out from the rack post and you do not have enough space to route the cables with the default comb assembly extension width.

To widen the comb assembly extension:

1. Unfasten the screws that join the two plates of the cable manager extension panel assembly. Realign the plates along the next set of holes so that the extension is at the maximum length. See Figure 1.
2. Reassemble the extension plates by fastening the six screws by using a number 2 Phillips (+) screwdriver.

NOTE: Ensure that you fasten at least two rows of screws (four screws on each extension bracket assembly) for required strength to hold the extension plates.

3. See "Installing the Cable Management Comb Assembly with Extension" on page 247 to install the cable management comb assembly.

   CAUTION: The maximum torque that may be applied to these screws is 9.0 lb-in. (1.0 Nm).

Installing the Cable Management Comb Assembly Without Extension

NOTE: You can use only the comb assembly without the extension, if the rear edge of the PTX5000 chassis is aligned with the four-post rack. In such a scenario, only the comb assembly is sufficient to route the cables.

To install the comb assembly on the four-post rack:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Unfasten the four screws attaching the comb assembly to the extension manager by using a Phillips (+) screwdriver and separate the comb assembly from the extension.
3. Align the comb assembly for one PDU against the rack vertically. Move the comb assembly up or down so that the mounting holes are aligned to the mounting holes on the rack.
4. Secure the comb assembly to the rack by using the four screws that were removed. See Figure 128 on page 252.

   NOTE: If the provided screws are not compatible with your rack, you might have to use different types of screws (such as metric screws).

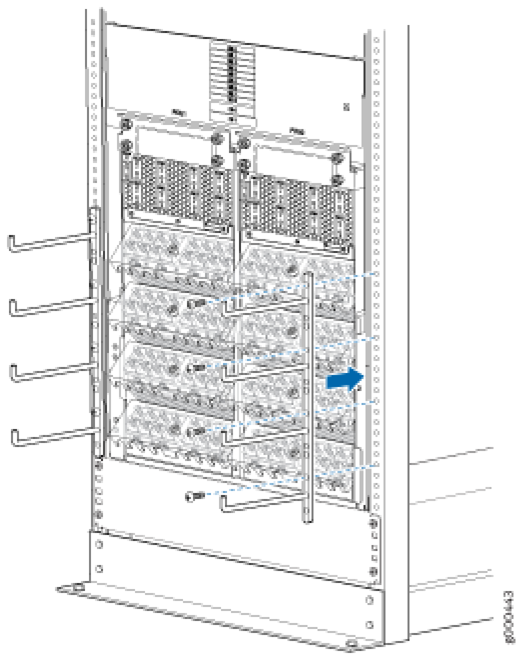
   CAUTION: The maximum torque that may be applied to the provided number 12 screws is 30.0 lb-in. (3.4 Nm).

5. Similarly, secure the comb assembly to the rack for the other PDU.

   See "Connecting Power to the PTX5000 High Capacity DC PDUs" on page 260 to connect the power cables.

6. Route the power cables through the comb assembly. Ensure that you route each row of cables from the PDU through the corresponding row of the comb (see Figure 127 on page 250).

Figure 128: Installing Comb Assembly Without Extension



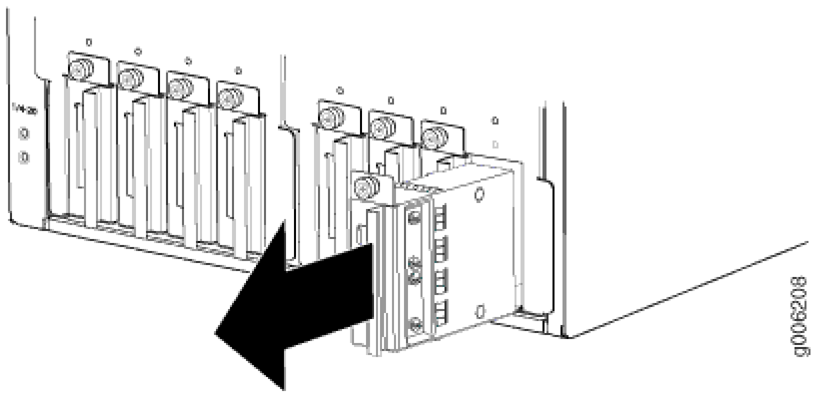
Connecting Power to the PTX5000 60-A DC Input Power Trays

To connect the DC source power cables to the 60-A DC inputs:

1. Verify that a properly rated customer-site circuit breaker for each DC power cable has been installed. See "PTX5000 DC Power Electrical Safety Guidelines" on page 670 in the *PTX5000 Packet Transport Router Hardware Guide* for more information.
2. Switch off the customer-site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Verify that a licensed electrician has attached appropriate cable lugs to the DC power cables. See "PTX5000 DC Power Cable and Lugs Specifications" on page 103 in the *PTX5000 Packet Transport Router Hardware Guide* for more information.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
5. Switch the input power switches on the PDU faceplate to the off (**O**) position.

6. Loosen the captive screw that fastens the input power tray to the PDU .
7. Grasp the metal handle of the input power tray, and pull it out to remove the input power tray from the PDU (see Figure 129 on page 253. The 60-A DC input power tray weighs 1.6 lb (0.7 kg).

Figure 129: Removing the 60-A DC Input Power Tray



8. Use a Phillips (+) screwdriver to loosen the screw on the metal input power tray cover.
9. Open the metal input power tray cover.
10. Loosen the cable restraints.
11. Remove the nuts from the DC power terminal studs.
12. Route the positive (+) DC source power cable through the cable restraint, and connect it to the **RTN –1** input terminal (see Figure 130 on page 254). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal (see Figure 131 on page 255).

> **CAUTION**: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and power supply. The maximum torque that may be applied to this nut is 99 lb-in. (11 Nm).

Figure 130: 60-A DC Input Terminals

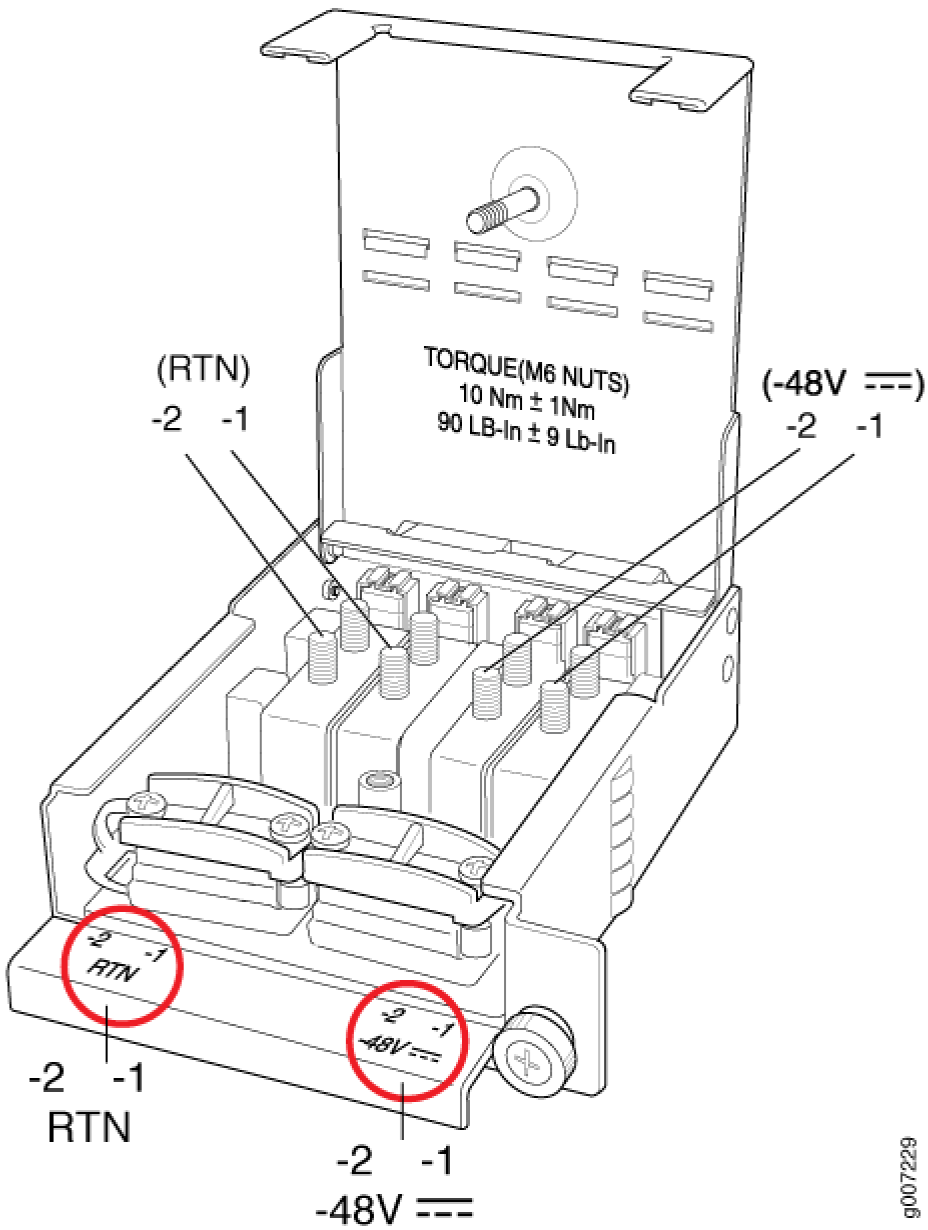
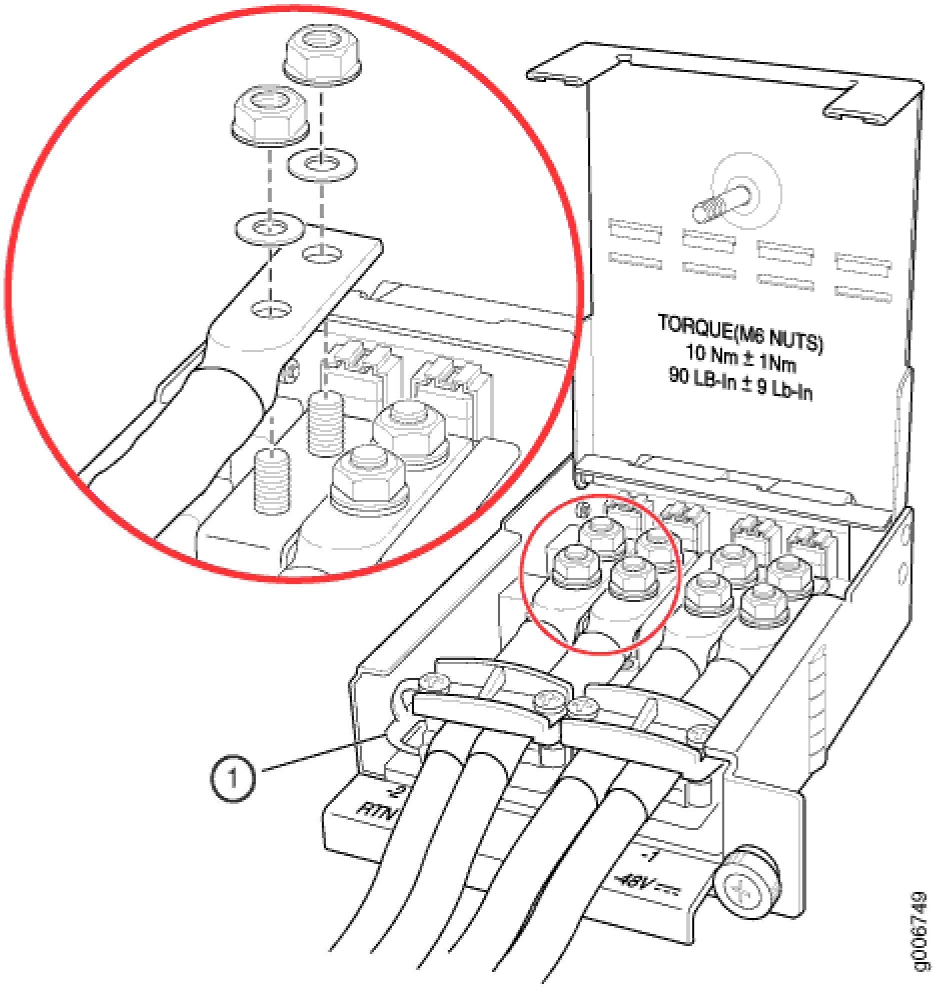


Figure 131: Connecting the DC Source Power Cable Lugs to an Input Power Tray

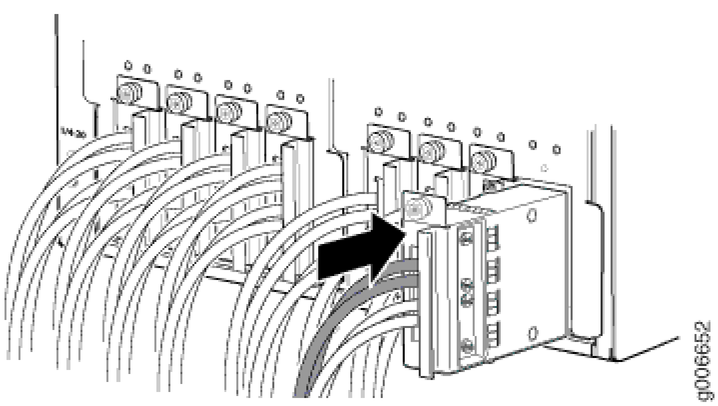


> **CAUTION**: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled **(+)** and **(–)** to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines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

> **CAUTION**: All inputs on the DC PDU in slot **PDU0** must be powered by dedicated power feeds derived from feed A, and all inputs on the DC PDU in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

13. Route the positive (+) DC source power cable through the cable restraint, and connect it to the **RTN –2** input terminal (see Figure 130 on page 254). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal.
14. Route the negative (–) DC source power cable through the cable restraint, and connect it to the **-48 V –1** input terminal (see Figure 130 on page 254). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal.
15. Route the negative (–) DC source power cable through the cable restraint, and connect it to the **-48 V –2** input terminal (see Figure 130 on page 254). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal (see Figure 131 on page 255).
16. Tighten the cable restraints over the DC power cables.
17. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminals (labeled **RTN**) and the negative (–) source cable to the input terminals (labeled **–48V**).
18. Close the input power tray cover, and secure it with the screw.
19. Insert the input power tray into the PDU (see Figure 132 on page 256).
20. Repeat the procedure for all input power trays in the PDU.
21. Repeat the procedure for the other PDU.
22. Verify that the DC power cables do not touch or block access to the components, and that they do not drape where people could trip on them.

Figure 132: Installing a 60-A DC Input Power Tray

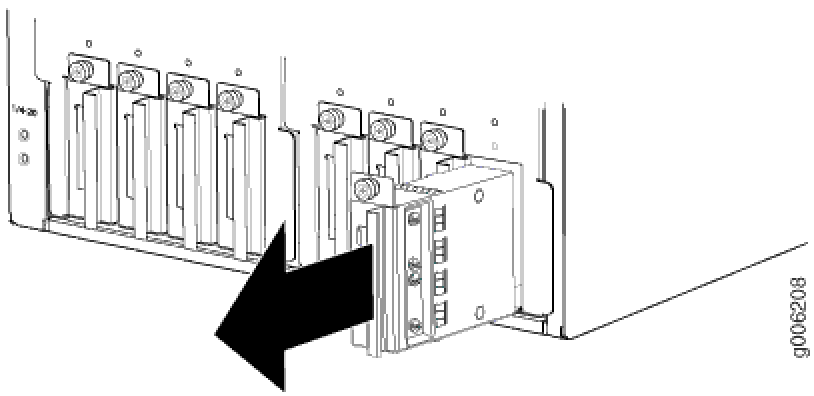


Connecting Power to the PTX5000 120-A DC Input Power Trays

To connect the DC source power cables to the 120-A DC inputs:

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Switch the circuit breakers on the power distribution unit (PDU) faceplate to the off (**O**) position.
4. Loosen the captive screw that fastens the input power tray to the PDU .
5. Grasp the metal handle of the input power tray, and pull it out to remove the input power tray from the PDU (see Figure 133 on page 257). The 120-A DC input power tray weighs 1.6 lb (0.7 kg).

Figure 133: Removing the 120-A DC Input Power Tray



6. Use a Phillips (+) screwdriver to loosen the screw on the metal input power tray cover.
7. Open the metal input power tray cover.
8. Loosen the cable restraints.
9. Remove the nuts from the DC power terminal studs.
10. Route the positive (+) DC source power cable lug through the left cable restraint.
11. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal, located on the left, with a nut.

    Use a 10-mm nut driver to tighten the nut.
12. Route the negative (–) DC source power cable lug through the right cable restraint.
13. Attach the negative (–) DC source power cable lug to the **–48V** (input) terminal, located on the right (see Figure 134 on page 259).

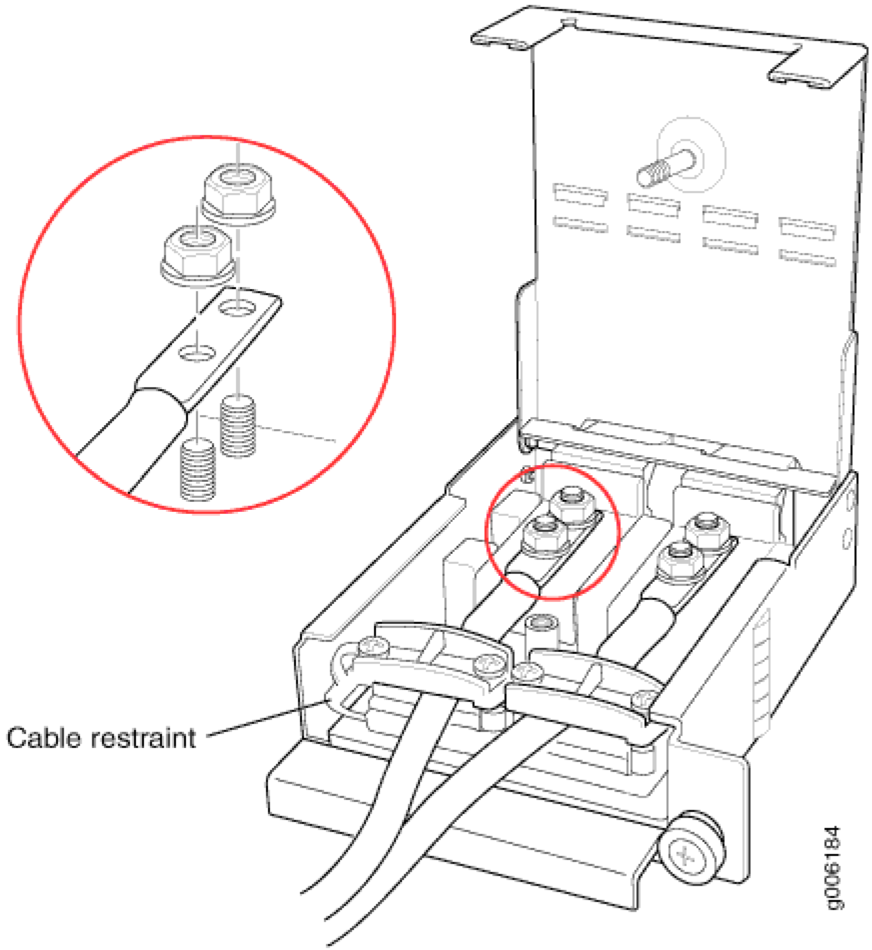
    Use a 10-mm nut driver to tighten the nut.

CAUTION: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and power supply. The maximum torque that may be applied to this nut is 99 lb-in. (11 Nm).

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

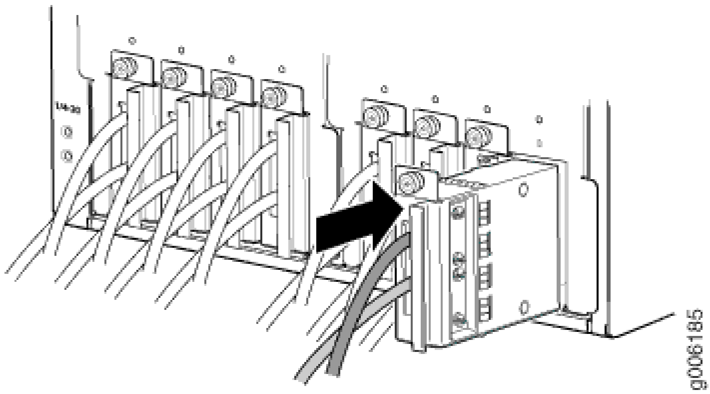
CAUTION: All inputs on the DC PDU in slot **PDU0** must be powered by dedicated power feeds derived from feed A, and all inputs on the DC PDU in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

Figure 134: Connecting the DC Source Power Cable Lugs to an Input Power Tray



14. Tighten the cable restraint over the DC power cables.
15. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V**).
16. Close the input power tray cover, and secure it with the screw.
17. Insert the input power tray into the PDU (see Figure 135 on page 260).
18. Repeat the procedure for all input power trays in the PDU.
19. Repeat the procedure for the other PDU.
20. Verify that the DC power cables do not touch or block access to the components, and that they do not drape where people could trip on them.

Figure 135: Installing a 120-A DC Input Power Tray



Connecting Power to the PTX5000 High Capacity DC PDUs

To connect the DC source power cables to the High Capacity DC inputs:

1. Verify that a properly rated customer-site circuit breaker for each DC power cable has been installed. See "PTX5000 DC Power Electrical Safety Guidelines" on page 670 in the *PTX5000 Packet Transport Router Hardware Guide* for more information.
2. Switch off the customer-site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Verify that a licensed electrician has attached appropriate cable lugs to the DC power cables. See "PTX5000 DC Power Cable and Lugs Specifications" on page 103 in the *PTX5000 Packet Transport Router Hardware Guide* for more information.
4. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
5. Move the power switch to the standby
   (
   ⏻
) position.
6. Unfasten the screw using a number 2 Phillips (+) screwdriver and remove the terminal block safety cover.
7. Remove the nuts from the DC power terminal studs.
8. Install heat-shrink tubing insulation around the power cables.

   To install heat-shrink tubing:

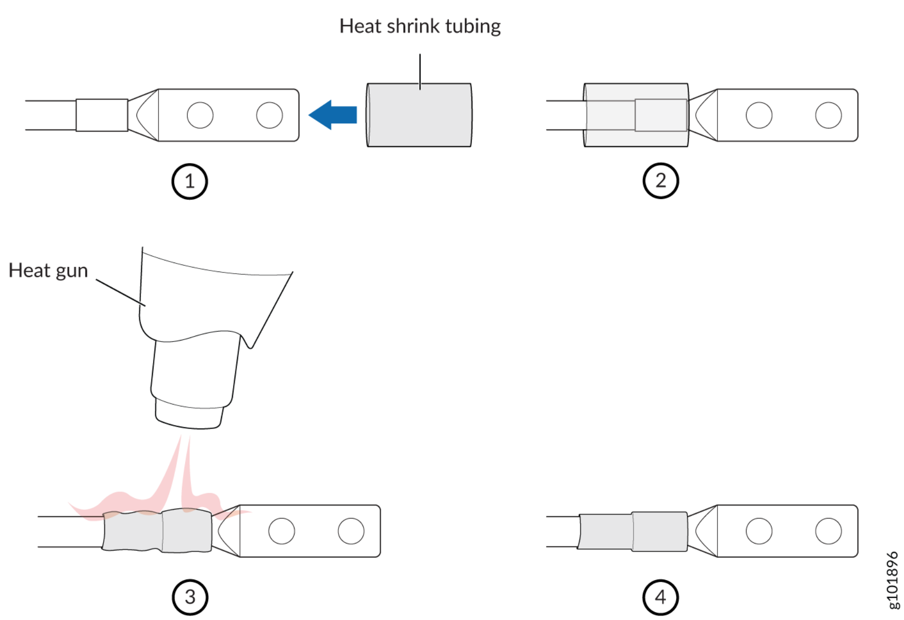
a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

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

Figure 136 on page 261 shows the steps to install heat-shrink tubing.

NOTE: Do not overheat the tubing.

Figure 136: How to Install Heat-Shrink Tubing



9. Connect the positive (+) DC source power cable to the **RTN** input terminal (see Figure 137 on page 262). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal (see Figure 138 on page 263).

   The terminal studs for each PSM are numbered on the faceplate. For example, the DC input terminals for PSM0 are **PSM0_1** and **PSM0_2**, in the first and second rows of the terminal blocks. There are sixteen 60-A input terminals for the eight PSMs supported for each PDU.

CAUTION: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and power supply. The maximum torque that may be applied to this nut is 65 lb-in. (7.3 Nm).

Figure 137: High Capacity DC Input Terminals

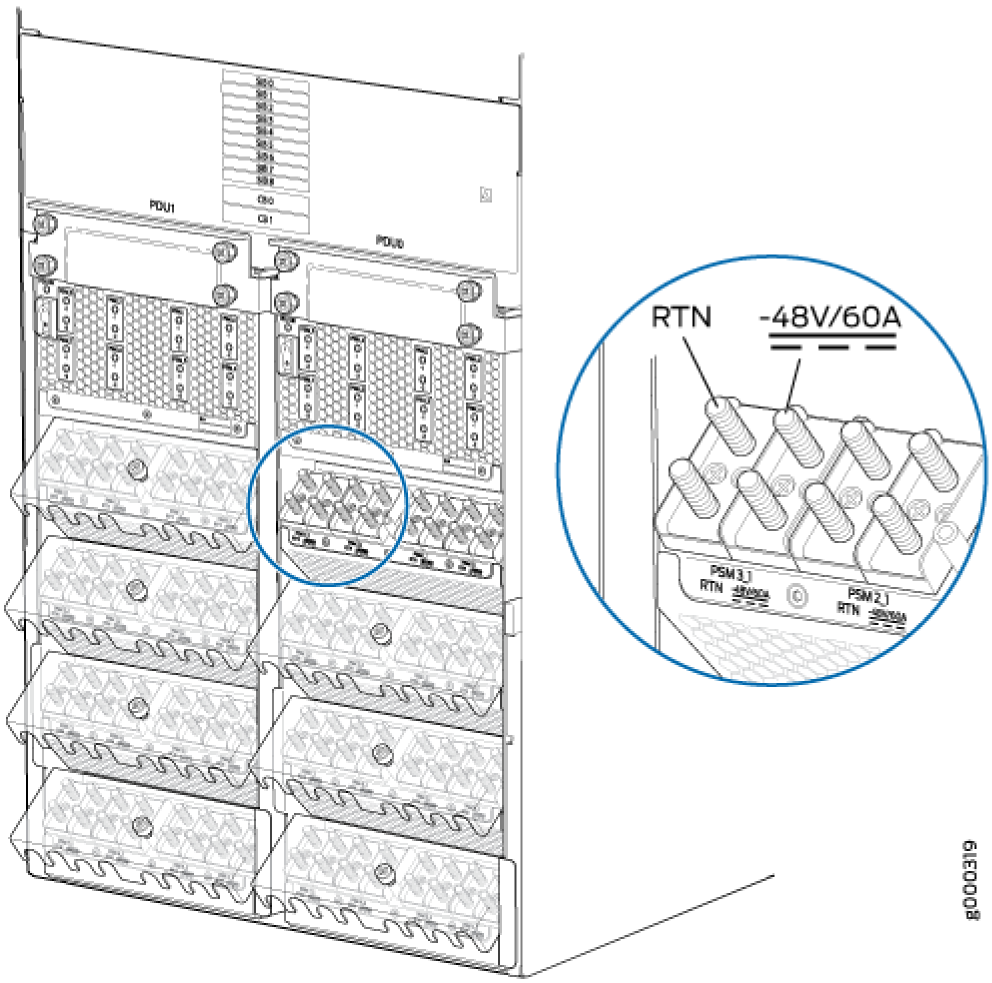
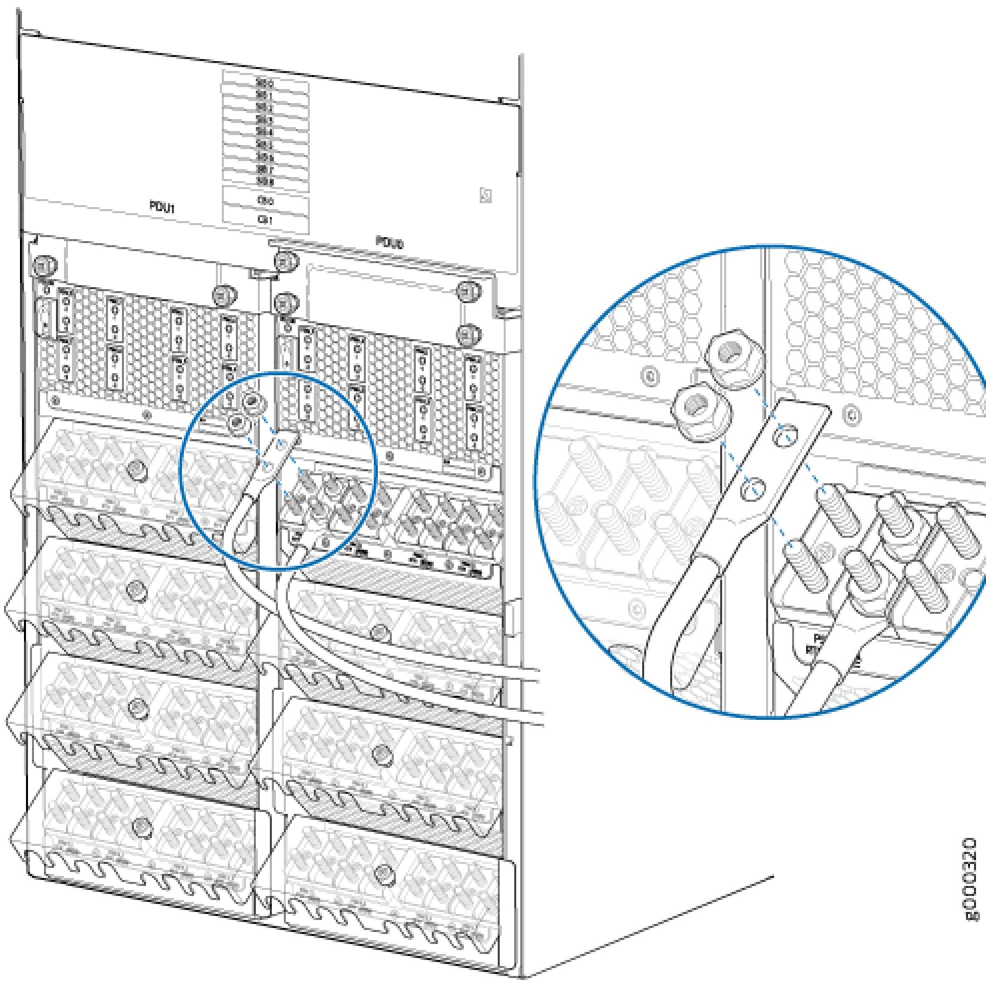


Figure 138: Connecting the DC Source Power Cable Lugs to an Input Power Terminal



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

> **CAUTION**: All inputs on the DC PDU in slot **PDU0** must be powered by dedicated power feeds derived from feed A, and all inputs on the DC PDU in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

10. Connect the negative (–) DC source power cable to the **-48 V/60A** input terminal (see Figure 138 on page 263). Using a 7/16-in. (11-mm) nut driver, tighten the nut to secure the cable lug to the input terminal.
11. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminals (labeled **RTN**) and the negative (–) source cable to the input terminals (labeled **–48V/60A**).
12. Replace the terminal block safety cover and ensure that the cables fit into the slots of the safety cover.
13. Repeat the procedure for the input power terminals for all the PSMs in the PDU.
14. Repeat the procedure for the other PDU.
15. Verify that the DC power cables do not touch or block access to the components, and that they do not drape where people could trip on them.

RELATED DOCUMENTATION

Connecting the PTX5000 to External Devices

IN THIS SECTION

Tools and Parts Required to Connect the PTX5000 to External Devices

To connect the PTX5000 to external devices, you need the following tools and parts:

- 2.5-mm flat-blade (–) screwdriver for the alarm relay contacts
- Electrostatic discharge (ESD) grounding wrist strap (provided in the accessory kit)

SEE ALSO

Verifying the PTX5000 Parts Received | 192

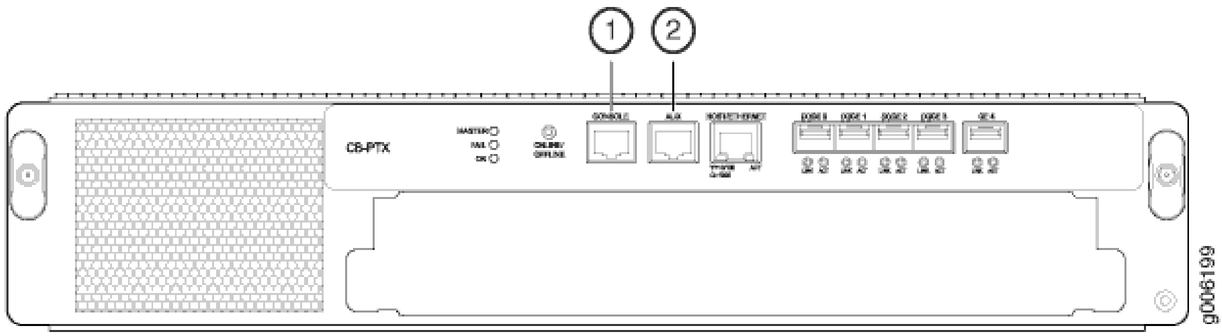
Connecting the PTX5000 to a Management Console or Auxiliary Device

Attach one or more management console or auxiliary devices to the Routing Engine ports on each Control Board for management and service operations (see Figure 139 on page 266).

To connect the cables to a management console or auxiliary device:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. If necessary, turn off the power to the console or auxiliary device.
3. Plug one end of a copper cable with RJ-45 connectors into the **CONSOLE** or **AUXILIARY** port on the Control Board in slot **CB0**. This port connects to the Routing Engine installed into the Control Board in slot **CB0**.
4. Attach the other end of the cable to the console or auxiliary device.
5. Plug one end of another copper cable with RJ-45 connectors into the **CONSOLE** or **AUXILIARY** port on **CB1**. This port connects to the Routing Engine installed into the control in slot **CB1**.
6. Attach the other end of the cable to the console or auxiliary device.

Figure 139: Connecting to the Console or Auxiliary Port on the Control Board



1– Console port	2– Auxiliary port

SEE ALSO

PTX5000 Control Board Description | 122
PTX5000 Management Interface Cable Specifications | 182
RJ-45 Connector Pinouts for the PTX5000 Auxiliary and Console Ports | 183

Connecting the PTX5000 to a Management Ethernet Device

To connect the Routing Engines in a PTX5000 to a network for management of the PTX5000, connect a UTP Category 5 Ethernet cable with an RJ-45 connector to the **HOST/ETHERNET** port on a Control Board.

> **NOTE**: For PTX5000 routers with two host subsystems, we recommend that you connect both Control Boards to a network. One cable is provided in the accessory box. To connect another cable to the **HOST/ETHERNET** port on the other Control Board, you must provide an additional cable.

To connect a cable to a network device:

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

> **CAUTION**: During the initial installation before the chassis is grounded, you must connect to an approved site ESD point. See the instructions for your site.

2. Plug one end of a UTP Category 5 Ethernet cable (Figure 140 on page 267 shows the connector) into the **HOST/ETHERNET** port on the Control Board in slot **CB0** (see Figure 141 on page 267). This port connects to the Routing Engine installed into the Control Board in slot **CB0**.
3. Plug the other end of the cable into the network device.
4. Plug one end of another UTP Category 5 Ethernet cable into the **HOST/ETHERNET** port on the Control Board in slot **CB1**. This port connects to the Routing Engine installed into the Control Board in slot **CB1**.
5. Plug the other end of the cable into the network device.

Figure 140: Routing Engine Ethernet Cable Connector

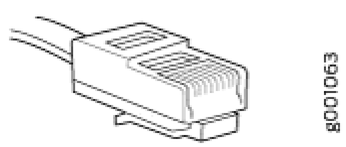
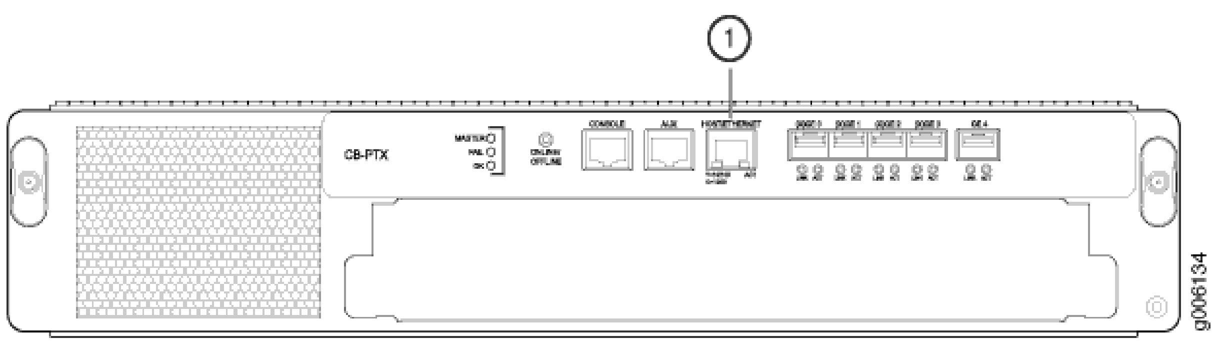


Figure 141: Connecting to the HOST/ETHERNET Port on the Control Board



1– HOST/ETHERNET port	

SEE ALSO

PTX5000 Control Board Description | 122

PTX5000 Management Interface Cable Specifications | 182

RJ-45 Connector Pinouts for the PTX5000 Management HOST/ETHERNET Port | 184

Connecting the PTX5000 to an External Alarm-Reporting Device

To connect an external device to an alarm relay contact on the craft interface:

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

   CAUTION: During the initial installation before the chassis is grounded, you must connect to an approved site ESD point. See the instructions for your site.

2. Prepare the required length of wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2).
3. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Connect the major and minor alarm circuits to the **NO** (normally open) pins on the alarm connectors. Tighten the screws to secure the wire.

   NOTE: The top, middle, and bottom slots correspond to **NC** (normally closed), **C** (common), and **NO** (normally open).

4. Plug the terminal block into the relay contact, and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
5. Attach the other end of the wires to the external device.

SEE ALSO

PTX5000 Control Board Description | 122
PTX5000 Alarm Relay Contact Wire Specifications | 181

Connecting the PTX5000 to an External Clocking Device

To connect the PTX5000 to one or two external clocking devices, connect a cable with RJ-48 connectors to the **BITS A** or **BITS B** port on the CCG.

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Plug one end of the cable into the **BITS A** port on the CCG.

3. Plug the other end of the cable into the T1 external clocking device.
4. Repeat the procedure for the **BITS B** port on the CCG.
5. Verify that the **LINK** LED for the port is lit steadily green and that the **FAULT** LED is not lit.
6. Configure the port. See the `synchronization` statement for PTX Series routers in the Junos OS Administration Library.
7. Issue the `show chassis synchronization extensive` command to check the status of the port.

```
user@host> show chassis synchronization extensive
Clock Synchronization Status :
  Clock module on CCG 0
    Current state            : Online - Master
    Validation interval      : 103 seconds
    Signal type              : t1
    Switching mode           : non-revertive
    Line termination         : no-y-cable
    Transmitter              : disabled
    Current clock state      : locked to gps-0-10mhz
      Selected for           : 10 seconds
      Selected since         : 2011-09-26 17:04:24 PDT
      Deviation (in ppm)     : -0.01
      Last deviation (in ppm): -0.01
    Configured sources
      Source      Priority   Deviation    Last deviation   Status
                             (in ppm)     (in ppm)
      bits-a      secondary  -0.01        -0.01            qualified
      gps-0-10mhz primary    -0.01        -0.01            in-use
Clock Synchronization Status :
  Clock module on CCG 1
    Current state            : Online - Standby
    Validation interval      : 103 seconds
    Signal type              : t1
    Switching mode           : non-revertive
    Line termination         : no-y-cable
    Transmitter              : disabled
    Current clock state      : locked to master CCG
      Selected for           : 10 seconds
      Selected since         : 2011-09-26 17:04:24 PDT
    Configured sources
      Source      Priority   Deviation    Last deviation   Status
                             (in ppm)     (in ppm)
```

```
bits-a       secondary  +0.05        +0.05           qualified
gps-0-10mhz  primary    unknown      unknown         unknown
```

SEE ALSO

PTX5000 Centralized Clock Generator Description | 28

Connecting PIC Cables to the PTX5000

The PTX5000 supports PICs that use various kinds of network cable, including multimode and single-mode fiber-optic cable. For information about the type of cable used by each PIC, see the PTX Series Interface Module Reference.

You connect PICs to the network by plugging in network cable. To connect cable to the PICs (see Figure 142 on page 272):

1. Have ready a length of the type of cable used by the PIC. See the PTX Series Interface Module Reference.
2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.

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

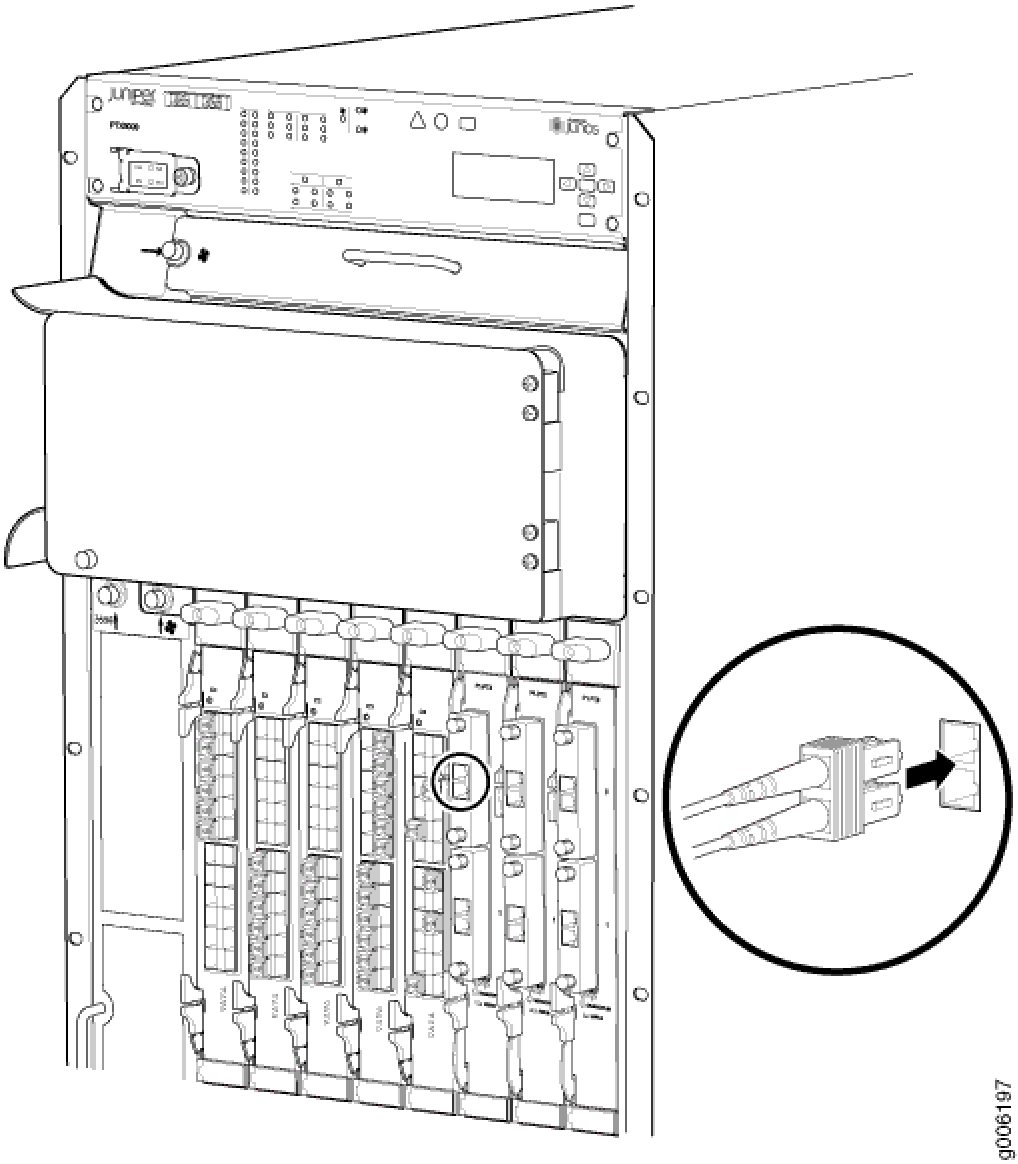
> **CAUTION**: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

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

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

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

Figure 142: Connecting PIC Cables



SEE ALSO

PTX5000 PIC Description | 139
Radiation from Open Port Apertures Warning | 650
Laser and LED Safety Guidelines and Warnings | 651

Installing the Front Doors on the PTX5000

IN THIS SECTION

Installing the Front Door on a PTX5000 in a Four-Post Rack

Optionally, you can install a door over the front card cage of the PTX5000. Captive thumbscrews secure the door in a closed position.

> **CAUTION**: You can install the front door any time after you have installed the chassis into the rack and grounded the router. Perform the procedures described in"Installing the PTX5000 Mounting Hardware for a Four-Post Rack or Cabinet" on page 195, "Installing the PTX5000 By Using a Mechanical Lift" on page 206, and "Connecting the PTX5000 to Earth Ground" on page 211 before proceeding.

Before you begin, ensure that you have the following parts and tools available to install the front door on a PTX5000 in a four-post rack.

- Electrostatic discharge (ESD) grounding strap
- Phillips (+) screwdriver, number 2

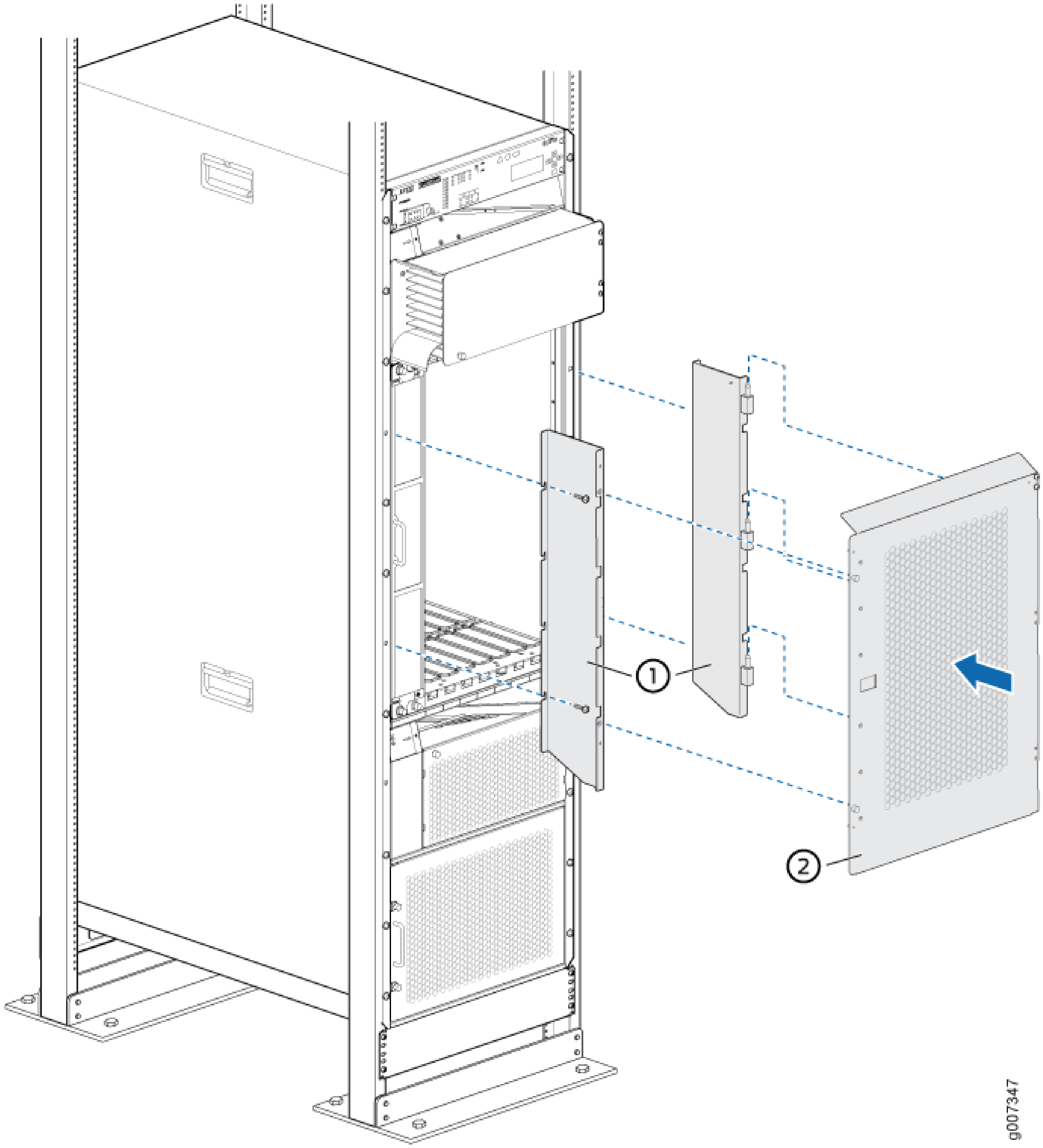
To install the front door on a PTX5000 in a four-post rack (see Figure 143 on page 275):

1. 1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to the approved ESD site grounding point.
2. Partially loosen the mounting screws that secure the chassis to the front of the four-post rack, beginning with the fourth hole from the top of the chassis, ending with the seventh hole from the top of the chassis. Do this for both front-mounting flanges. When you are done, there should be four screws loosened on each side of the chassis.
3. Attach the side panels to the front mounting flanges, by using the cutouts in the side panel mounting holes to slide the panel behind the loosened screws. Tighten the screws completely using the Phillips (+) screwdriver.

4. Attach the door to the side panels by placing the door on the hinges. Ensure that the door opens and closes properly, and the captive screws on the door align correctly with the holes in the side panels.

   NOTE: If the door is not aligned properly, loosen the screws securing the side panels to the front-mounting flanges, and adjust the panels until the door closes correctly, then tighten the screws completely using the screwdriver.

Figure 143: Installing the Front Door on a PTX5000 in a Four-Post Rack



1– Side panels	2– Door

Installing the Front Door on a PTX5000 in an Open-Frame Rack

You can install a door over the front card cage of the PTX5000. Captive thumbscrews secure the door in a closed position.

> **NOTE**: If you plan to install the PTX5000 in an open-frame rack, you can install the door before the chassis is mounted in the rack. However, this procedure assumes that the router has been installed in the rack and grounded. If you install the door before grounding the router, ensure that you use proper site grounding.

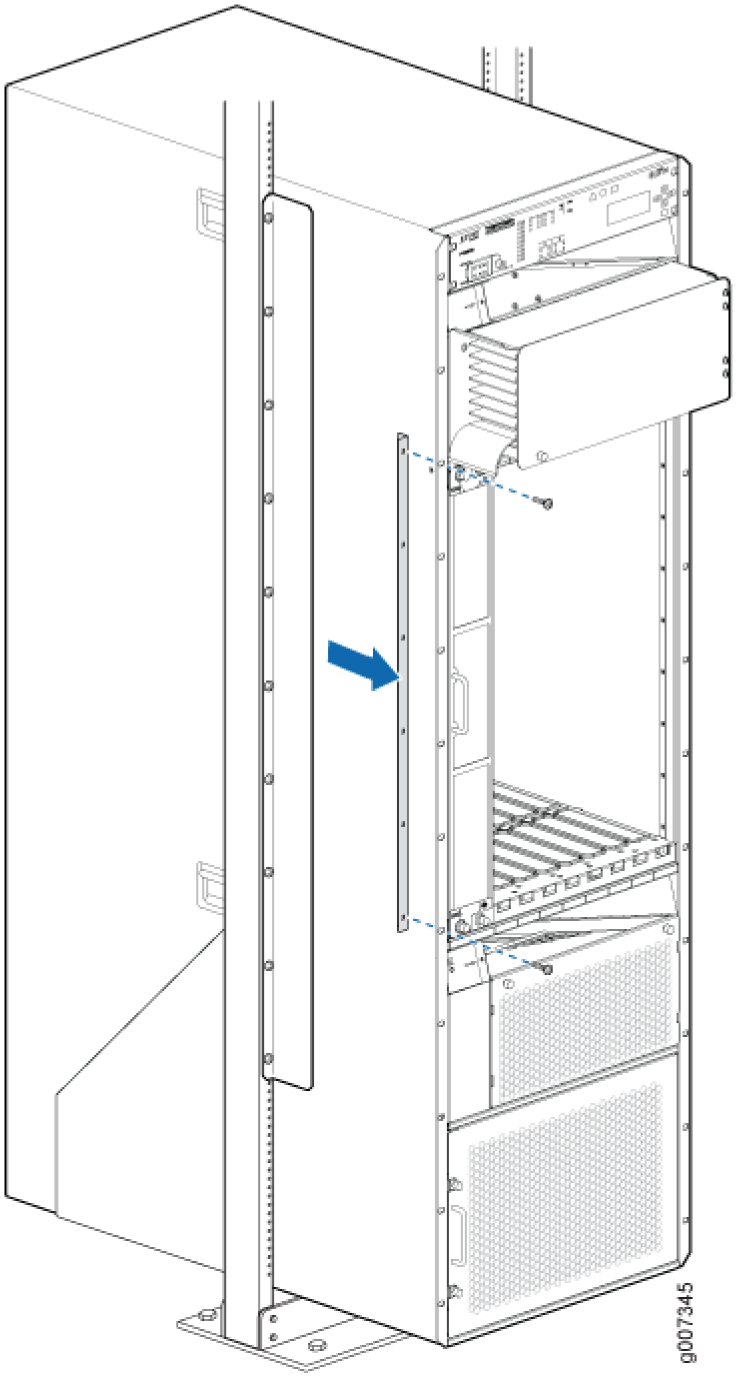
Before you begin, ensure that you have the following parts and tools available to install the front door on a PTX5000 in an open-frame rack.

- Electrostatic discharge (ESD) grounding strap
- Phillips (+) screwdriver, number 2

To install the front door on a PTX5000 in an open-frame rack (see Figure 144 on page 277 and Figure 145 on page 278):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to the approved ESD site grounding point.
2. Using the provided UNC 12–24 screws, attach the long mounting brackets to the rear of each front-mounting flange. Insert screws only at the top and bottom of each bracket. The top screw should be inserted at the third front-mounting flange hole from the top of the chassis. Line up the edge of the mounting bracket with the flange edge of the router chassis. Tighten the screws completely using the Phillips (+) screwdriver.

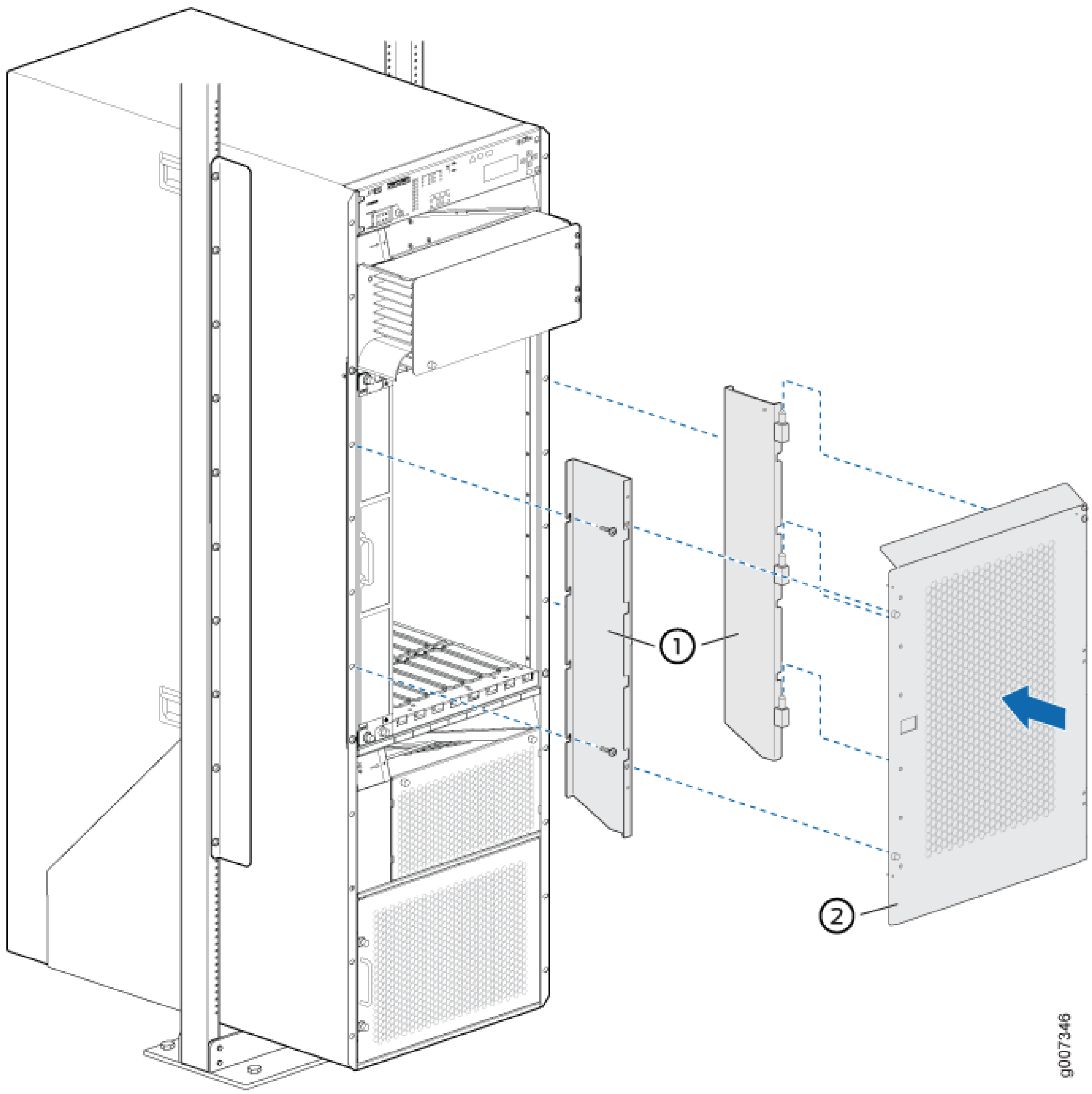
Figure 144: Installing Brackets on the Front-Mounting Flanges



3. Partially install the remaining screws, and attach the side panels to the front mounting flanges. Use the cutouts in the side panel mounting holes to slide the panel behind the partially installed screws (seeFigure 145 on page 278). Tighten the screws completely.
4. Attach the door to the side panels by placing the door on the hinges. Ensure that the door opens and closes properly, and the captive screws on the door align correctly with the holes in the side panels.

NOTE: If the door is not aligned properly, loosen the screws securing the side panels to the front-mounting flanges, and adjust the panels until the door closes correctly, then tighten the screws completely using the screwdriver.

Figure 145: Installing the Front Door on a PTX5000 Router in an Open-Frame Rack



1– Side panels	2– Door

Powering the PTX5000 On and Off

IN THIS SECTION

Powering On the Three-Phase AC-Powered PTX5000

To power on the AC-powered PTX5000 with three-phase delta AC PDUs or three-phase wye AC PDUs, and with AC PSMs:

NOTE: After powering off a PDU, you must wait at least 60 seconds before powering it on again.

1. Verify that the power distribution units (PDUs) and power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on the faceplates are tightened.
2. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

   NOTE: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation using devices connected to the **AUXILIARY** or **CONSOLE** ports.

3. Turn on power to the external management device.
4. Switch on the customer-site circuit breakers to provide voltage to the AC power cords.
5. Verify that the PDUs are receiving power.

- On the three-phase wye AC PDUs, verify that the green **220-240 V/346-415 V 30 A 50-60 Hz** LED is lit steadily green.
- On the three-phase delta AC PDUs, verify that the green **200-240 V~ 60 A 50-60 Hz** LED is lit steadily green.

6. Switch the circuit breaker on one of the PDUs to the on (|) position.
7. Verify that the green **CB ON** LEDs on the PDU faceplate are lit steadily. The **CB ON** LEDs blink momentarily, then light steadily to indicate that the circuit breaker is on.

   NOTE: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

8. Move the **OUTPUT** power switch on the PDU to the on (|) position.
9. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is correctly installed and is functioning properly.

   NOTE: If the **PDU OK** LED does not light steadily, repeat the installation and cabling procedures.

10. Repeat steps 6 through 9 for the other PDU.
11. Check the LEDs on the PSMs. For each PSM, verify that the **AC IN OK** and **DC IN OK** LEDs are lit steadily green, and that the **Fault** LED is off.

   NOTE: If the **Input OK** and **Output OK** LEDs do not light steadily or if the **FAULT** LED is lit, see "Troubleshooting the PTX5000 Power System" on page 568 in the *PTX5000 Packet Transport Router Hardware Guide*.

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

Powering On the Single-Phase AC-Powered PTX5000

To power on the AC-powered PTX5000 with high-capacity single-phase AC PDUs, and with AC PSMs:

NOTE: After powering off a PDU, you must wait at least 60 seconds before powering it on again.

1. Verify that the PDUs and PSMs are fully inserted in the chassis and that the captive screws on the faceplates are tightened.
2. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

   NOTE: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation using devices connected to the **AUXILIARY** or **CONSOLE** ports.

3. Turn on power to the external management device.
4. Switch on the customer-site circuit breakers to provide voltage to the AC power cords.
5. Verify that the PDUs are receiving power. Verify that the green **PDU OK** LED is lit steadily green.
6. Switch on one of the PDUs to by turning its power switch to the on (|) position.

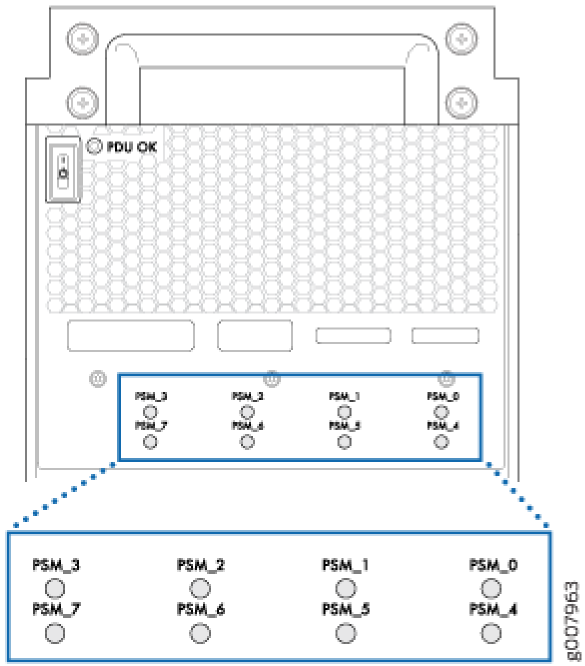
   NOTE: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

7. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, which indicates that the PDU is correctly installed and is functioning properly.

   NOTE: If the **PDU OK** LED does not light steadily, repeat the installation and cabling procedures.

8. Check the LEDs on the PSMs. For each PSM, verify that the **PSM** LEDs are lit steadily green.

Figure 146: PSM LEDs on the Single-Phase AC PDU



NOTE: If the **PSM** LED does not light steadily, see "Troubleshooting the PTX5000 Power System" on page 568 in the *PTX5000 Packet Transport Router Hardware Guide*.

9. Repeat steps 6 through 8 for the other PDU.
10. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

Powering On the DC Powered PTX5000 with 60-A DC PDUs and 60-A DC PSMs

To power on the DC-powered PTX5000 with 60-A DC PDUs and 60-A DC PSMs:

NOTE: After powering off a power supply, you must wait at least 60 seconds before powering it on again.

1. Verify that the power distribution units (PDUs) and power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on the faceplates are tightened.

2. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

> **NOTE**: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation using devices connected to the **AUXILIARY** or **CONSOLE** ports.

3. Turn on power to the external management device.
4. Switch on the customer-site circuit breakers to provide voltage to the DC power source cables.
5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
6. Verify that the green **DC IN** LEDs for both inputs on the PDU faceplate are lit steadily green, indicating that the inputs are receiving power.
7. Switch all the input power switches on one of the PDUs to the on (|) position.
8. Verify that the green **SW ON** LEDs on the PDU faceplate are lit steadily. The **SW ON** LEDs blink momentarily, then light steadily to indicate that the input power switches are on.

> **NOTE**: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

9. Move the **OUTPUT** power switch on the PDU to the on (|) position.
10. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily and that the **FAULT** LED is off, indicating that the PDU is correctly installed and is functioning properly.

> **NOTE**: If the **PDU OK** LED does not light steadily, repeat the installation and cabling procedures.

11. Check the LEDs on the PSMs. For each PSM, verify that the **Input OK** and **Output OK** LEDs are lit steadily green, and that the **Fault** LED is off.

> **NOTE**: If the **Input OK** and **Output OK** LEDs do not light steadily or if the **FAULT** LED is lit, see "Troubleshooting the PTX5000 Power System" on page 568 in the *PTX5000 Packet Transport Router Hardware Guide*.

12. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
13. Repeat steps 7 through 12 for the other PDU.

> **NOTE**: The Routing Engine boots as the PDU completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system, see "Powering Off the PTX5000" on page 287 in the *PTX5000 Packet Transport Router Hardware Guide*.
>
> After powering on a power supply, you must wait at least 60 seconds before powering it off.

Powering On the DC Powered PTX5000 with 120-A DC PDUs and 120-A DC PSMs

To power on the DC-powered PTX5000 with 120-A DC PDUs and 120-A DC PSMs:

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

1. Verify that the power distribution units (PDUs) and power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on the faceplates are tightened.
2. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

   > **NOTE**: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation using devices connected to the **AUXILIARY** or **CONSOLE** ports.

3. Turn on power to the external management device.
4. Switch on the customer-site circuit breakers to provide voltage to the DC power source cables.
5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
6. Verify that the green **–48 V 120 A** LEDs on the PDU faceplate are lit steadily green, indicating that the inputs are receiving power.
7. Switch all the circuit breakers on one of the PDUs to the on (|) position.

8. Verify that the green **CB ON** LEDs on the PDU faceplate are lit steadily. The **CB ON** LEDs blink momentarily, then light steadily to indicate that the circuit breakers are on.

   NOTE: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

9. Move the **OUTPUT** power switch on the PDU to the on (|) position.
10. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily and that the **FAULT** LED is off, indicating that the PDU is correctly installed and is functioning properly.

    NOTE: If the **PDU OK** LED does not light steadily, repeat the installation and cabling procedures.

11. Check the LEDs on the PSMs. For each PSM, verify that the **Input OK** and **Output OK** LEDs are lit steadily green, and that the **Fault** LED is off.

    NOTE: If the **Input OK** and **Output OK** LEDs do not light steadily or if the **FAULT** LED is lit, see "Troubleshooting the PTX5000 Power System" on page 568 in the *PTX5000 Packet Transport Router Hardware Guide*.

12. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
13. Repeat steps 7 through 12 for the other PDU.

NOTE: The Routing Engine boots as the PDU completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system, see the "Powering Off the PTX5000" on page 287 in the *PTX5000 Packet Transport Router Hardware Guide*.

After powering on a power supply, you must wait at least 60 seconds before powering it off.

Powering On the DC-Powered PTX5000 with High Capacity DC PDUs and High Capacity DC PSMs

To power on the DC-powered PTX5000 with High Capacity DC PDUs and High Capacity DC PSMs:

NOTE: After powering off a power supply, you must wait at least 60 seconds before powering it on again.

1. Verify that the power distribution units (PDUs) and power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on the faceplates are tightened.
2. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

   NOTE: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation using devices connected to the **AUXILIARY** or **CONSOLE** ports.

3. Turn on power to the external management device.
4. Switch on the customer-site circuit breakers to provide voltage to the DC power source cables.
5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
6. Switch the power switch on one of the PDUs to the on (|) position.
7. Verify that the green **PDU OK** LED is lit steadily green, indicating that the inputs are receiving power.
8. Verify that the **-1** and **-2** LEDs for each installed PSM are lit green. Also check the input **1 OK**, input **2 OK**, output **OK**, and fault
   (
   ⚠
) LEDs on each PSM.

   NOTE: The **-1** and **-2** LEDs are lit depending on the number of PSMs connected to each PDU. A minimum of three PSMs are required out of a maximum of eight per PDU. Also, each PSM has LEDs indicating input and output status.

   NOTE: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

> **NOTE**: If the **PDU OK** and PSM LEDs do not light steadily or if the fault
> (
> ⚠
>) LED on the PSM is lit, see "Troubleshooting the PTX5000 Power System" on page 568 in the *PTX5000 Packet Transport Router Hardware Guide*.

9. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
10. Repeat Step 6 through Step 8 for the other PDU.

> **NOTE**: The Routing Engine boots as the PDU completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system, see the "Powering Off the PTX5000" on page 287 in the *PTX5000 Packet Transport Router Hardware Guide*.
>
> After powering on a power supply, you must wait at least 60 seconds before powering it off.

Powering Off the PTX5000

IN THIS SECTION

Powering Off a PTX5000 with RE-DUO-C2600-16G Routing Engines

To power off a PTX5000 with RE-DUO-C2600-16G Routing Engines:

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

1. On an external management device connected to the PTX5000, issue the `request system halt both-routing-engines` operational mode command. The command shuts down the Routing Engines cleanly, so their state information is preserved. See *request system halt* in the Software Installation and Upgrade Guide for more information about the command.

If the PTX5000 contains only one Routing Engine, issue the `request system halt` command.

```
user@host> request system halt both-routing-engines
Halt the system ? [yes,no] (no) yes
```

Wait until a message appears on the console confirming that the operating system has halted.

```
*** FINAL System shutdown message from user@host ***

System going down IMMEDIATELY

Terminated

...

syncing disks... 11 8 done

The operating system has halted.

Please press any key to reboot.
```

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Move the power switch on the PDU to the off (**O**) position.
4. Perform these additional steps for your specific PDU:
   - 120-A DC PDU—Switch the circuit breakers on the PDU to the off (**O**) position.
   - 60-A DC PDU—Switch the power input switches on the PDU to the off (**O**) position.
   - Three-phase delta AC PDU or three-phase wye AC PDU—Switch the circuit breaker on the PDU to the off (**O**) position.
5. Repeat steps 3 and 4 for the other PDU.
6. Verify that the **PDU OK** LED on the PDU faceplate is off. Verify that these additional LEDs are off for your specific PDU:
   - 120-A DC PDU—Verify that the **CB ON** LED is off.
   - 60-A DC PDU—Verify that the **SW ON** LED is off.
   - Three-phase delta AC PDU or three-phase wye AC PDU—Verify that the **CB ON** LED is off.

NOTE: After powering off a power supply, you must wait at least 60 seconds before powering it on again.

Powering Off a PTX5000 with RE-PTX-X8-64G Routing Engines

To power off a PTX5000 with RE-PTX-X8-64G Routing Engines:

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

1. On an external management device connected to the PTX5000, issue the `request vmhost halt routing-engine both` operational mode command. The command shuts down the Routing Engines cleanly, so their state information is preserved. See *request vmhost halt* in the Software Installation and Upgrade Guide for more information about the command.

   If the PTX5000 contains only one Routing Engine, issue the `request vmhost halt` command.

   ```
   user@host> request vmhost halt routing-engine both
   ```

   Wait until a message appears on the console confirming that the operating system has halted.

   ```
   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.
   ```

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Move the power switch on the PDU to the off (**O**) position.

4. Perform these additional steps for your specific PDU:
   - 120-A DC PDU—Switch the circuit breakers on the PDU to the off (**O**) position.
   - 60-A DC PDU—Switch the power input switches on the PDU to the off (**O**) position.
   - Three-phase delta AC PDU or three-phase wye AC PDU—Switch the circuit breaker on the PDU to the off (**O**) position.
5. Repeat steps 3 and 4 for the other PDU.
6. Verify that the **PDU OK** LED on the PDU faceplate is off. Verify that these additional LEDs are off for your specific PDU:
   - 120-A DC PDU—Verify that the **CB ON** LED is off.
   - 60-A DC PDU—Verify that the **SW ON** LED is off.
   - Three-phase delta AC PDU or three-phase wye AC PDU—Verify that the **CB ON** LED is off.

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

RELATED DOCUMENTATION

PTX5000 AC Power Distribution Unit LEDs | 54
PTX5000 DC Power Distribution Unit LEDs | 91
PTX5000 AC Power Supply Module LEDs | 62
PTX5000 DC Power Supply Module LEDs | 97
PTX5000 AC Power Electrical Safety Guidelines | 667
PTX5000 DC Power Electrical Safety Guidelines | 670
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Understanding Normal-Capacity Power System Power Zones | 172
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Connecting the PTX5000 to DC Power | 245

Performing the Initial Software Configuration for the PTX5000

IN THIS SECTION

These procedures connect a PTX5000 to the network but do not enable it to forward traffic. For complete information about enabling the PTX5000 to forward traffic, including examples, see the Junos OS configuration guides.

You configure the PTX5000 by issuing Junos OS CLI commands, either on a console device attached to the **CONSOLE** port, or over a Telnet connection to a network connected to the **HOST/ETHERNET** port.

NOTE: These procedures enable you to use the **HOST/ETHERNET** management port. For the initial configuration, use a device attached to the **CONSOLE** port.

Preparing to Configure the PTX5000

Gather the following information before configuring the PTX5000:

- Name the PTX5000 will use on the network
- Domain name the PTX5000 will use
- IP address and prefix length information for the Ethernet interface
- IP address of a default router
- IP address of a DNS server

- Password for the root user

Entering Configuration Mode

1. Verify that the network device is powered on.
2. Log in as the root user. There is no password.

```
Amnesiac <ttyd0>
login: root
```

3. Start the CLI.

```
root@% cli
root>
```

4. Enter configuration mode.

```
root> configure
Entering configuration mode.
[edit]
root#
```

Configuring User Accounts and Passwords

For information about using an encrypted password or an SSH public key string (DSA or RSA), see *Configuring the Root Password* and *user*.

1. Add a password to the root administration user account. Enter a cleartext password.

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

2. Create a management console user account.

```
[edit]
root@host# set system login user user-name authentication plain-text-password
New Password: password
Retype new password: password
```

3. Set the user account class to `super-user`.

```
[edit]
root@host# set system login user user-name class super-user
```

Configuring System Attributes

1. Configure the name of the PTX5000. If the name includes spaces, enclose the name in quotation marks (“ ”).

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

NOTE: The DNS server does not use the hostname to resolve to the correct IP address. This hostname is used to display the name of the device in the CLI. For example, this hostname is displayed on the command-line prompt when the user is logged in to the CLI:

user-name@host-name>

2. Configure the IP address of the DNS server.

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

3. Configure the domain name of the PTX5000.

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

4. Configure the IP address and prefix length for the PTX5000 router's management Ethernet interface.

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

5. Configure the IP address of a backup router. The backup router allows the PTX5000 to install a route to the management network while the Routing Engine is booting and before the routing protocol process (rpd) is up and running. The backup router must be directly connected—that is, on the same subnet—through the management Ethernet interface.

```
[edit]
root@# set system backup-router address
```

6. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you must add a static route to that subnet within the routing table.

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

7. Configure the Telnet service at the `[edit system services]` hierarchy level.

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

Committing the Configuration

1. Display the configuration to verify that it is correct.

```
[edit]
root@# show
system {
    host-name host-name;
    domain-name domain-name;
    backup-router address;
    root-authentication {
        authentication-method (password | public-key);
    }
    name-server {
        address;
    }
}
interfaces {
    em0 {
        unit 0 {
            family inet {
                address address/prefix-length;
            }
        }
    }
}
```

2. Commit the configuration to activate it.

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

3. Optionally, configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them.

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

4. When you have finished the configuration, exit configuration mode.

```
[edit]
root@host# exit
root@host>
```

RELATED DOCUMENTATION

PTX5000 Routing Engine Description | 109

4

CHAPTER

Maintaining Components

Maintaining the PTX5000 Chassis

IN THIS SECTION

Routine Maintenance Procedures for the PTX5000

IN THIS SECTION

Purpose

For optimum performance, perform preventive maintenance procedures.

Action

On a regular basis:

- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the PTX5000 and into the air intake vents.
- Check the status-reporting devices on the craft interface: system alarms, LEDs, and the craft interface display.

- Inspect all air filters in the PTX5000 for dust and debris.

  As a general guideline, we recommended that you replace the filter elements every 6 months for routers operating in a typical environment. The filter elements degrade over time, and replacement intervals will vary by operating environment.

  > **NOTE**: Do not run the PTX5000 for more than a few minutes without all the air filters in place.

SEE ALSO

Maintaining the PTX5000 Air Filters | 316

Tools and Parts Required to Maintain PTX5000 Components

To maintain the hardware components, you need the following tools and parts:

- ESD grounding wrist strap
- Flat-blade (–) screwdriver
- Phillips (+) screwdriver, number 1
- Phillips (+) screwdriver, number 2

SEE ALSO

Maintaining the PTX5000 Control Boards | 461
Maintaining the PTX5000 Air Filters | 316
Maintaining the PTX5000 Fan Trays | 308
Maintaining the PTX5000 FPCs | 487
Maintaining the PTX5000 Host Subsystem | 441
Maintaining the PTX5000 PICs | 500
Maintaining the PTX5000 PIC Cables | 504
Maintaining the PTX5000 AC Power System | 332
Maintaining the PTX5000 DC Power System | 398

Tools and Parts Required for Replacing PTX5000 Hardware Components

To replace hardware components, you need the tools and parts listed in Table 81 on page 300.

Table 81: Tools and Parts Required for Component Replacement

Components	Tool or part
All	Electrostatic discharge (ESD) grounding wrist strap
AC PDU	Phillips (+) screwdrivers, number 2 1/5-in. (5.5-mm) slotted screwdriver
AC power cord	Phillips (+) screwdrivers, number 2 1/5-in. (5.5-mm) slotted screwdriver
Air filter	Phillips (+) screwdrivers, numbers 1 and 2
Control Board	Phillips (+) screwdrivers, numbers 1 and 2 Electrostatic bag or antistatic mat Blank panel (if component is not reinstalled)
CCG	Phillips (+) screwdrivers, numbers 1 and 2
Craft interface	Phillips (+) screwdrivers, numbers 1 and 2
DC PDU	Phillips (+) screwdrivers, numbers 1 and 2 7/16-in. (11-mm) nut driver **CAUTION**: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and the PDU input power trays.

Table 81: Tools and Parts Required for Component Replacement *(Continued)*

Components	Tool or part
DC power cable	7/16-in. (11-mm) nut driver **CAUTION**: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and the PDU input power trays.
Fan tray	Phillips (+) screwdrivers, numbers 1 and 2
FPC	Phillips (+) screwdrivers, numbers 1 and 2 Blank panel (if component is not reinstalled) Electrostatic bag or antistatic mat
PIC	Phillips (+) screwdrivers, numbers 1 and 2 Rubber safety cap for fiber-optic PICs or fiber-optic PIC cables Electrostatic bag or antistatic mat Blank panel (if component is not reinstalled)
Routing Engine	Phillips (+) screwdrivers, numbers 1 and 2 Electrostatic bag or antistatic mat Blank panel (if component is not reinstalled)
SIB	Phillips (+) screwdrivers, numbers 1 and 2 Electrostatic bag or antistatic mat Blank panel (if component is not reinstalled)

Replacing a PTX5000 Craft Interface

IN THIS SECTION

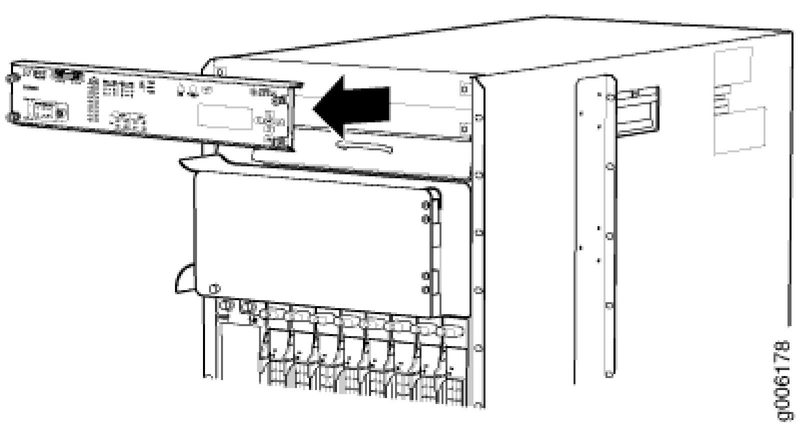
Removing a PTX5000 Craft Interface

The craft interface is located on the upper front of the PTX5000 chassis. The craft interface weighs approximately 2.6 lb (1.2 kg). The craft interface is hot-insertable and hot-removable.

To remove the craft interface (see Figure 1):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the screws at the four corners of the craft interface, using a number 2 Phillips (+) screwdriver.
3. Grasp the craft interface, and support it a few inches in front of the chassis.
4. Locate the ribbon cable behind the left side of the craft interface.
5. Squeeze the latches on either side of the ribbon cable connector where it attaches to the rear of the craft interface, and gently disconnect the cable.

Figure 147: Removing the Craft Interface



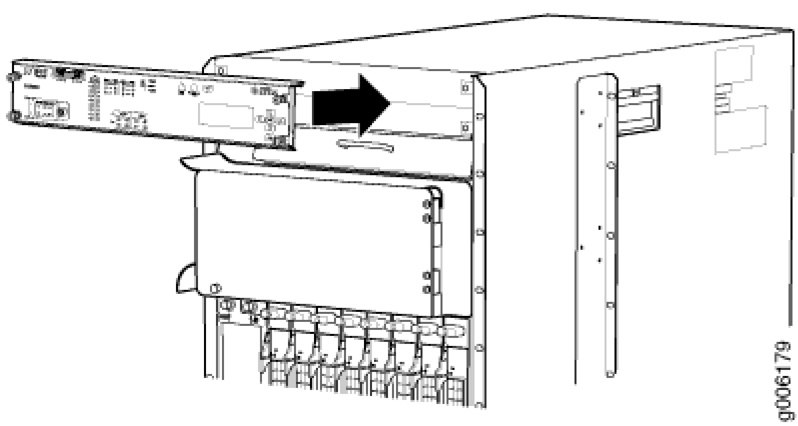
Installing a PTX5000 Craft Interface

To install the craft interface (see Figure 148 on page 303):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Locate the ribbon cable on the left side.
3. Squeeze the latches on either side of the ribbon cable connector where it attaches to the rear of the craft interface, and connect the cable.
4. Grasp the craft interface, and press it into the chassis.
5. Tighten the screws at the four corners of the craft interface, using a number 2 Phillips (+) screwdriver.

NOTE: After you install the craft interface in an operating PTX5000, allow several minutes for the LEDs on the craft interface to reflect the current state of the PTX5000.

Figure 148: Installing a Replacement Craft Interface



Maintaining the PTX5000 Centralized Clock Generators

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the CCGs.

Action

On a regular basis:

- Check the CCG LEDs. For more information, see "PTX5000 Centralized Clock Generator LEDs" on page 30.

  During normal operations:

  - The green **OK** LED on the CCG faceplate is lit.
  - The yellow **FAIL** LED on the CCG faceplate is not lit.

- Issue the `show chassis environment ccg` command to display information about the CCGs.

Replacing a PTX5000 Centralized Clock Generator

IN THIS SECTION

Removing a Centralized Clock Generator

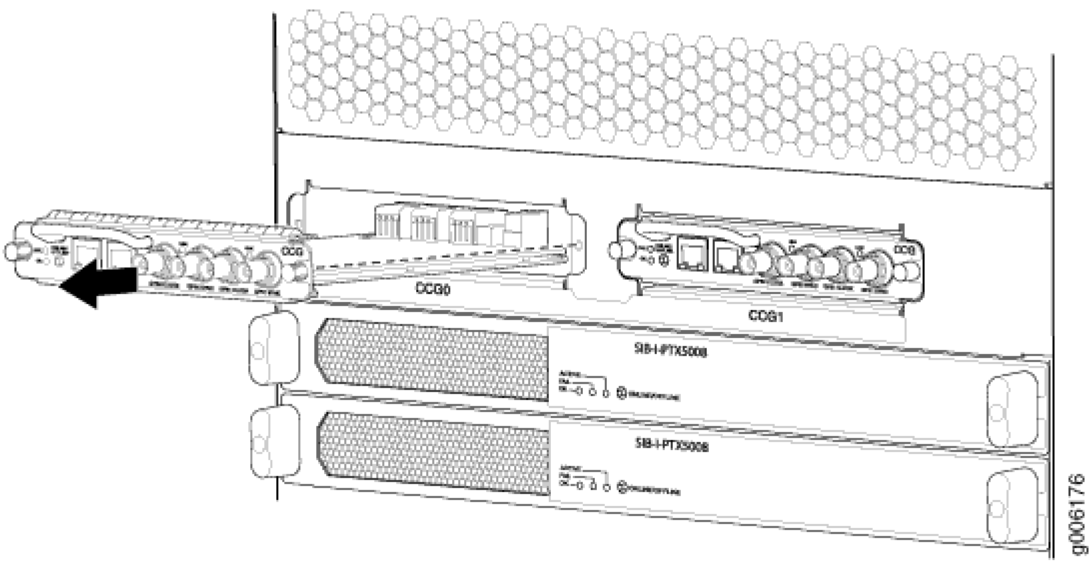
The PTX5000 can have one or two CCGs installed. The CCGs are located in the upper rear of the chassis, above the Control Boards and Routing Engines. Each CCG weighs approximately 1.9 lb (0.9 kg).

A nonredundant CCG is hot-pluggable. For redundant CCGs, the primary CCG is hot-pluggable. The backup CCG is hot-removable and hot-insertable if the primary CCG is functioning. Removing the backup CCG does not affect the functioning of the PTX5000. Taking the primary CCG offline might result in a brief loss of SONET clock lock while the backup CCG becomes the primary.

To remove a CCG (see Figure 3):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Press the online/offline button on the CCG faceplate and hold it down until the LED goes out (about 5 seconds).
4. Loosen the captive screws on the edges of the CCG faceplate.
5. Grasp the CCG by the handle on the faceplate and slide it out of the chassis.
6. Place the CCG on the antistatic mat.

Figure 149: Removing a CCG



Installing a Centralized Clock Generator

To install a replacement CCG (see Figure 150 on page 306):

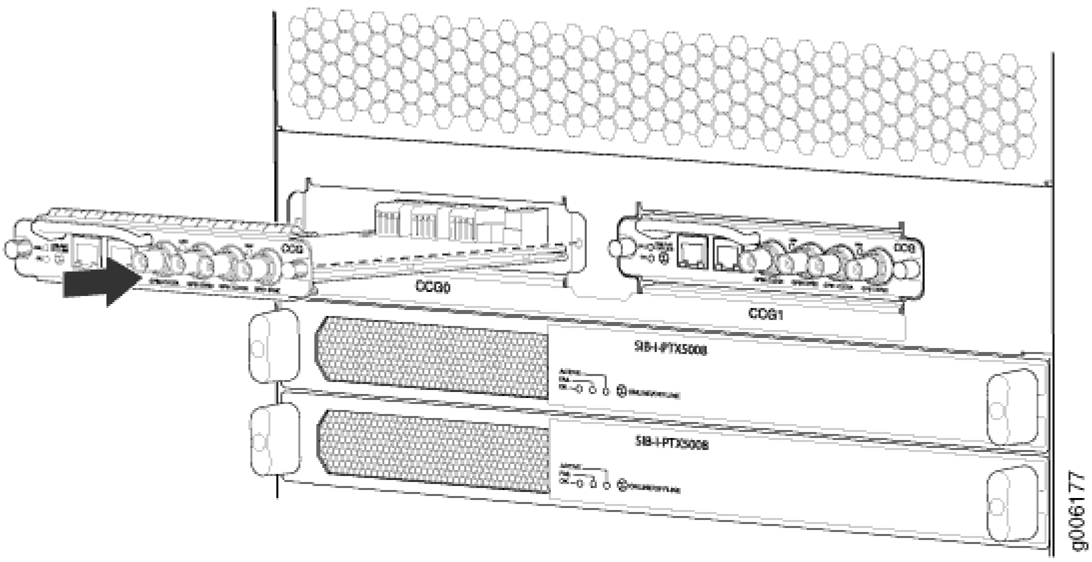
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Carefully align the sides of the CCG with the guides in the CCG slot.
3. Grasp the CCG by its handle and slide it straight into the chassis until it contacts the midplane.
4. Tighten the captive screws on the corners of the CCG faceplate.
5. To bring the CCG online, press the online/offline button until the green **OK** LED lights.

6. To verify that the CCG is installed correctly and is functioning normally, check the LEDs on the CCG faceplate. The green **OK** LED should light steadily. If the CCG is the primary, the blue **MASTER** LED should also light steadily.

   To check the status of the CCGs, use the following CLI command:

```
user@host> show chassis environment ccg
```

Figure 150: Installing a CCG



Replacing a Cable Between a PTX5000 CCG and an External Clocking Device

IN THIS SECTION

Removing a Cable for an External Clocking Device From a PTX5000 CCG

To remove a cable with RJ-48 connectors from a **BITS A** or **BITS B** port on the CCG:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Disconnect the cable from the T1 external clocking device.
3. Disconnect the cable from the **BITS A** or **BITS B** port on the CCG.

Installing a Cable Between an External Clocking Device and a PTX5000 CCG

To connect a cable with RJ-48 connectors to an **BITS A** or **BITS B** port on the CCG:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Plug one end of the cable into the appropriate **BITS A** or **BITS B** port on the CCG.
3. Plug the other end of the cable into the T1 external clocking device.
4. Verify that the **LINK** LED for the port is lit steadily green, and that the **FAULT** LED is not lit.
5. Issue the `show chassis synchronization` command to check the status of the port.

```
user@host> show chassis synchronization
user@host> show chassis synchronization
Clock Synchronization Status :
  Clock module on CCG 0
    Current state             : Online - Master
    Current clock state       : internal
      Selected for            : 1 hour, 27 minutes, 26 seconds
      Selected since          : 2011-12-09 11:21:07 PST
      Deviation (in ppm)      : +0.51
      Last deviation (in ppm): +0.51
```

RELATED DOCUMENTATION

PTX5000 Craft Interface Description | 19
PTX5000 Craft Interface LEDs | 22
PTX5000 Centralized Clock Generator Description | 28
PTX5000 Centralized Clock Generator LEDs | 30
Troubleshooting the PTX5000 Centralized Clock Generators | 548
Prevention of Electrostatic Discharge Damage

Maintaining the PTX5000 Cooling System

IN THIS SECTION

Maintaining the PTX5000 Fan Trays

IN THIS SECTION

Purpose

For optimum cooling, verify the condition of the fan trays.

Action

On a regular basis:

- Check the fan tray LEDs on the craft interface. During normal operation, the LEDs are lit green to indicate that the cooling system is functioning normally.

- Place your hand near the exhaust vents at the rear of the chassis to determine whether the fans are pushing air out of the chassis.
  - Zone 0: The air exhausts from the left side of the SIBs.
  - Zone 1: The exhaust vent is located at the upper rear of the chassis.
  - Power system: The air exhausts from the power supply modules (PSMs).
- Monitor the status of the fans. During normal operation, the fans in each fan tray are functioning at less than full speed.

  The fan trays each contain multiple fans that work in unison to cool the router's components. If one fan fails, the host subsystem adjusts the speed of the remaining fans to maintain proper cooling. A red alarm is triggered when a fan fails, and a yellow alarm is triggered when a fan tray is removed.

  To display the status of the fans, issue the `show chassis fan` command.

Replacing a PTX5000 Horizontal Fan Tray

IN THIS SECTION

Removing a PTX5000 Horizontal Fan Tray

The upper horizontal fan tray is located below the craft interface, and the lower horizontal fan tray is located above the horizontal air filter. Each horizontal fan tray weighs about 16.3 lb (7.4 kg).

> **CAUTION**: After removing a fan tray, make sure to immediately insert the new fan tray. Do not remove both horizontal fan trays at the same time. Removing both front fan trays might cause the PTX5000 to shut down.

To remove a horizontal fan tray (see Figure 1 and Figure 2):

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

2. Loosen the captive screw on the left side of the fan tray faceplate, using a number 2 Phillips (+) screwdriver.
3. Grasp the handle and pull the fan tray until it stops (approximately 1.5 inches out of the chassis).

> **WARNING**: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

4. When the fans stop spinning, press the release latch located on the left side of the fan tray.
5. Grasp the handle and pull the fan tray completely out of the chassis.

Figure 151: Removing an Upper Horizontal Fan Tray

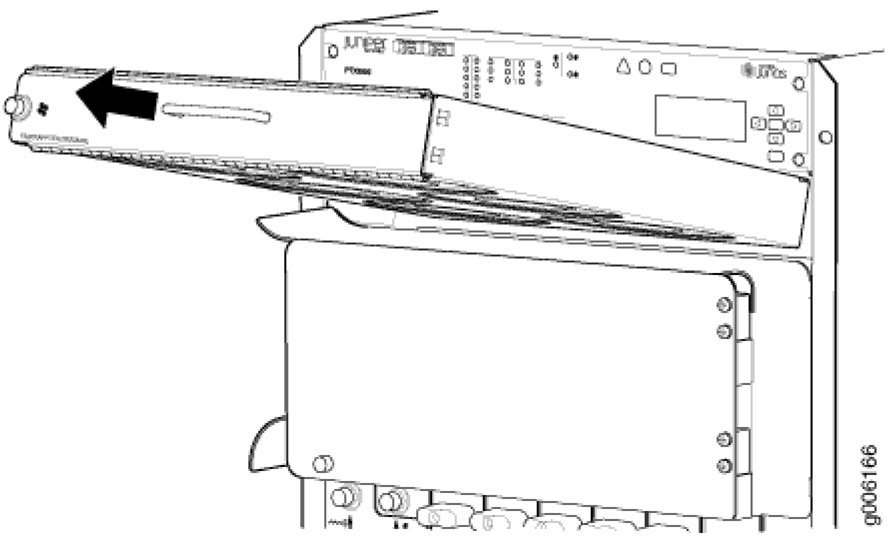
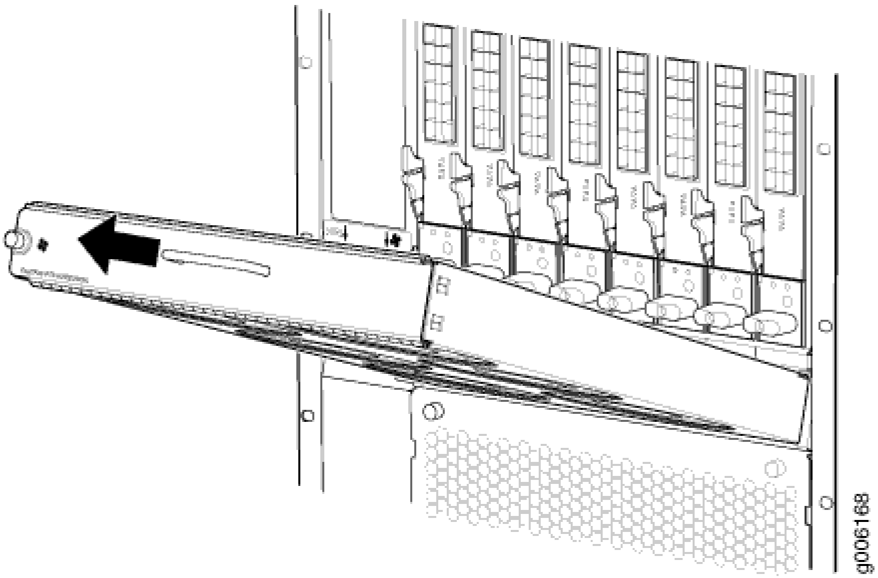


Figure 152: Removing a Lower Horizontal Fan Tray



Installing a PTX5000 Horizontal Fan Tray

To install a horizontal fan tray (see Figure 153 on page 312 and Figure 154 on page 312):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray by its handle and insert it straight into the chassis.
3. Tighten the captive screw on the left side of the fan tray faceplate to secure it in the chassis, using a number 2 Phillips (+) screwdriver.

Figure 153: Installing an Upper Horizontal Fan Tray

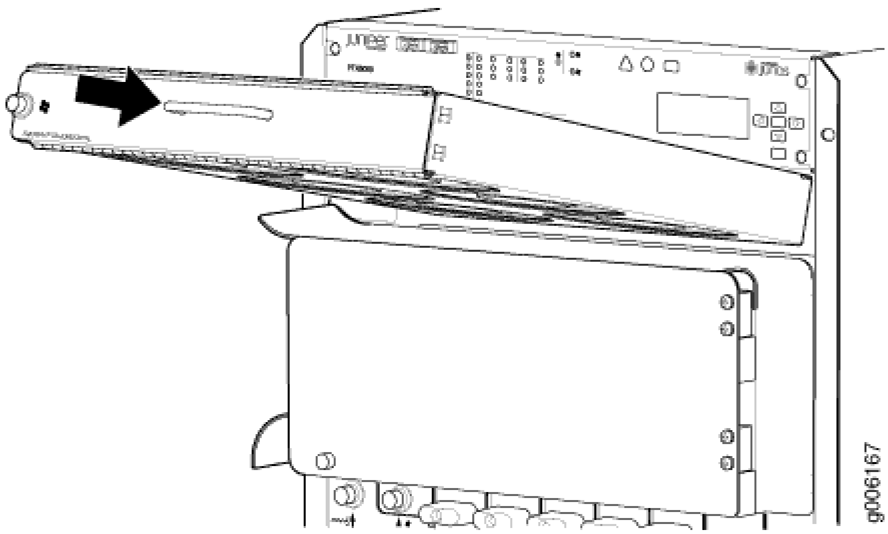
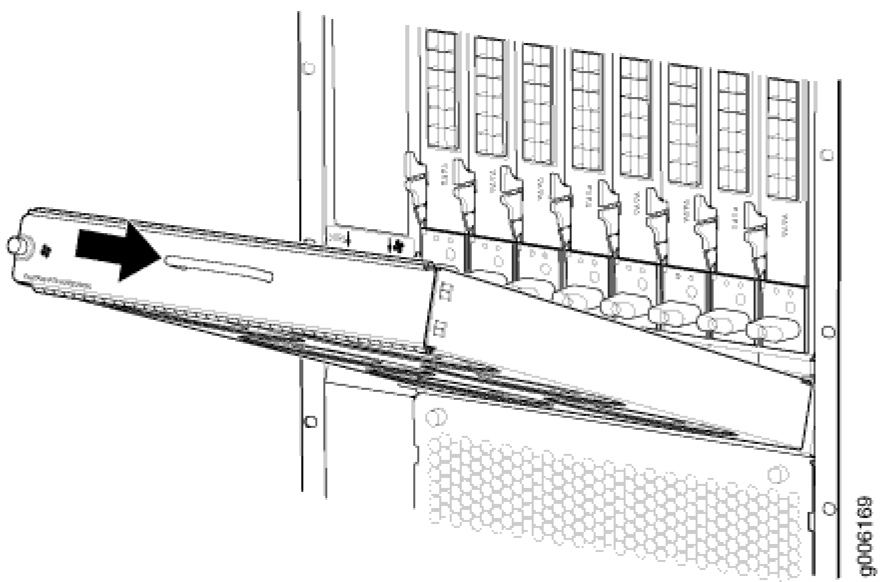


Figure 154: Installing a Lower Horizontal Fan Tray



Replacing a PTX5000 Vertical Fan Tray

IN THIS SECTION

Removing a PTX5000 Vertical Fan Tray

The vertical fan tray is located in the front of the chassis. The vertical fan tray contains fourteen fans and weighs about 26.8 lb (12.2 kg).

CAUTION: To maintain proper cooling, do not operate the PTX5000 with the fan trays removed for more than one minute.

To remove the vertical fan tray (see Figure 5):

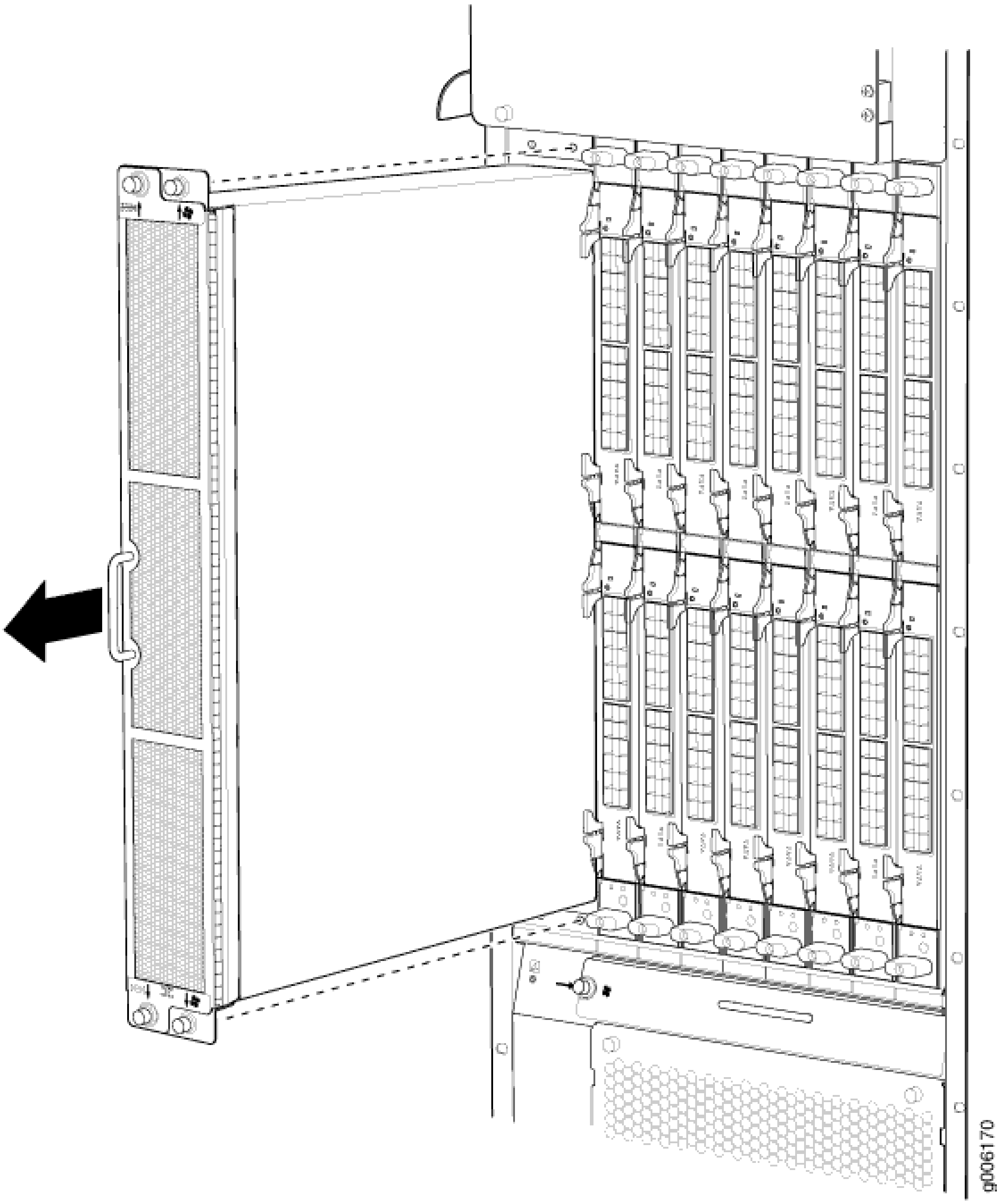
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws at the right of the fan tray faceplate, using a number 2 Phillips (+) screwdriver.

   NOTE: The two captive screws on the left are for the vertical air filter.

3. Grasp the handle and pull the fan tray until it stops (approximately 1.5 inches).
4. Place one hand under the fan tray to support it and pull the fan tray completely out of the chassis.

   WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

Figure 155: Removing the Vertical Fan Tray



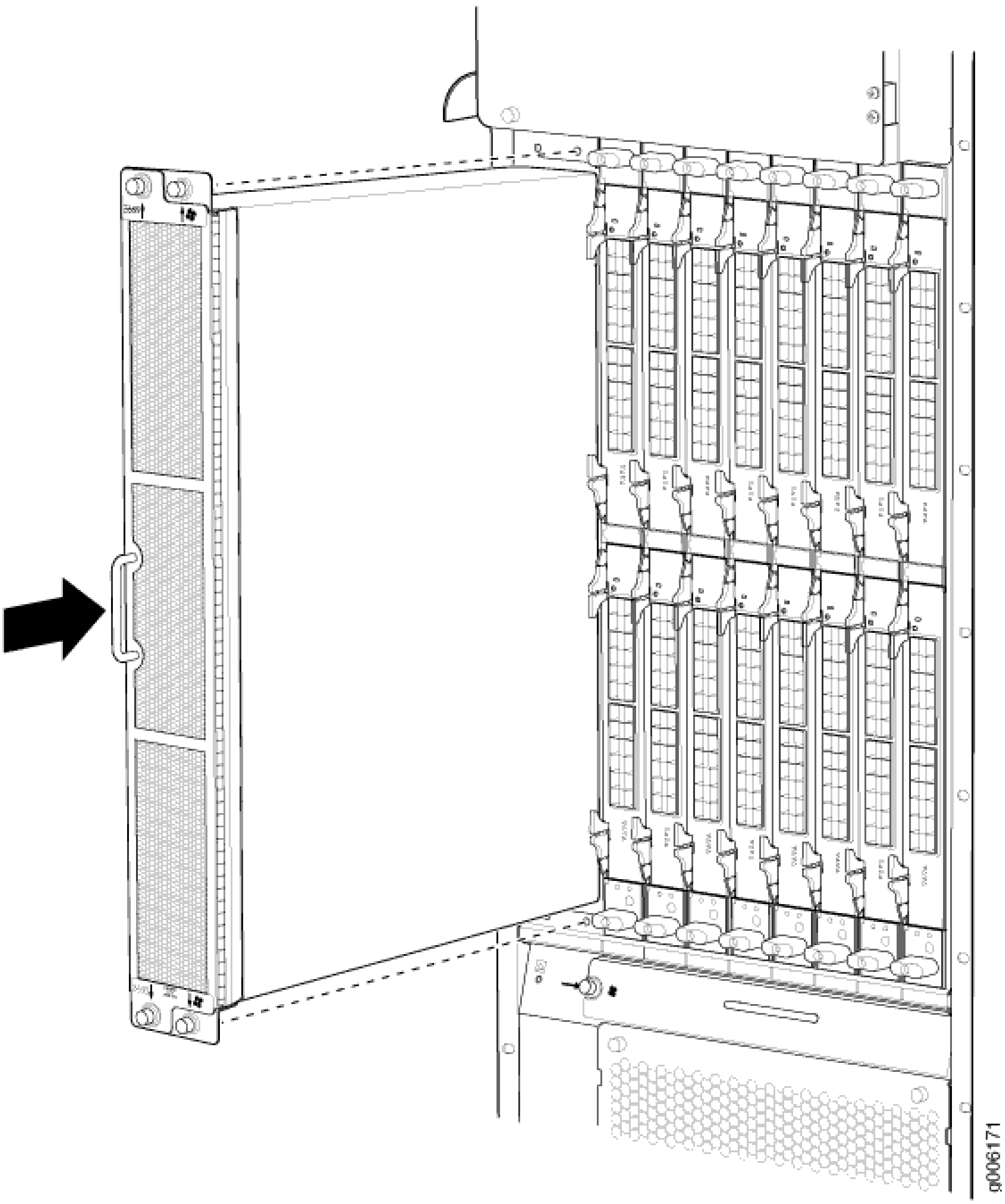
Installing a PTX5000 Vertical Fan Tray

To install a replacement vertical fan tray (see Figure 156 on page 315):

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

2. Grasp the fan tray handle and insert it straight into the chassis.
3. Tighten the captive screw on the bottom of the fan tray faceplate to secure it in the chassis, using a number 2 Phillips (+) screwdriver.

Figure 156: Installing a Vertical Fan Tray



Maintaining the PTX5000 Air Filters

IN THIS SECTION

Purpose

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

Action

On a regular basis:

- Check the air filters for dust and debris.

  As a general guideline, we recommended that you replace the filter elements every 6 months for routers operating in a typical environment. The filter elements degrade over time, and replacement intervals will vary by operating environment.

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

CAUTION: Always keep the air filters in place while the PTX5000 is operating. The fans are very powerful, and could pull small bits of wire or other materials into the PTX5000 through the unfiltered air intake. This could damage the router's components.

Replacing a PTX5000 Horizontal Air Filter

IN THIS SECTION

Removing a PTX5000 Horizontal Air Filter

The horizontal air filter is located below the lower horizontal fan tray. The horizontal air filter weighs approximately 7.1 lb (3.2 kg).

To remove the horizontal air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the two captive screws on the horizontal air filter tray.
3. Grasp the head of the loosened screws, and pull to remove the air filter tray (see Figure 7).
4. Locate the two areas, near each rear corner, where the air filter tray is exposed. Using these air filter tray frame access areas, slide the air filter toward the air filter tray faceplate, and pull up on the air filter to release the rear edge of the air filter from the air filter tray (see Figure 8).
5. Remove air filter from the air filter tray.
6. Discard the air filter.

Figure 157: Removing a Horizontal Air Filter Tray

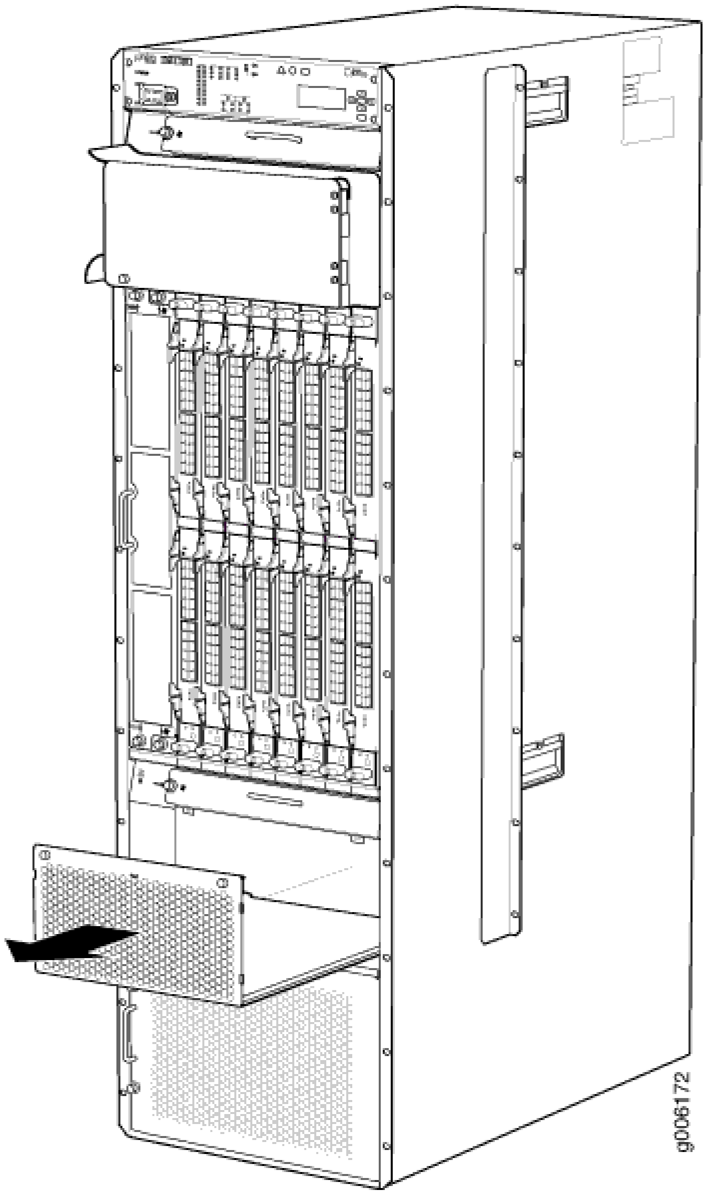
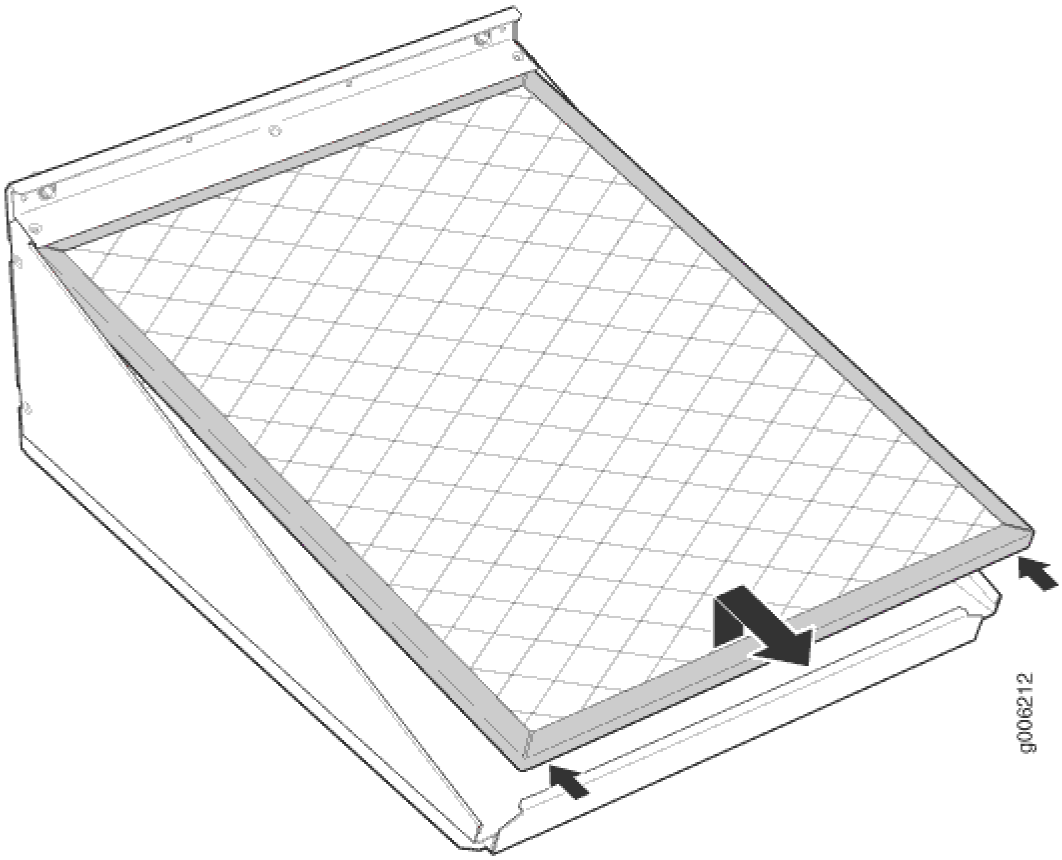


Figure 158: Removing a Horizontal Air Filter



Installing a PTX5000 Horizontal Air Filter

To install the horizontal air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Locate markings on the side of the frame indicating airflow direction.
3. Position the air filter over the air filter tray. Note the correct orientation for airflow direction. The airflow direction is through the perforated faceplate and up through the filter.
4. Engage the edge nearest the perforated faceplate under the front flange, and slide the filter further toward the faceplate.

   Engage the opposite filter edge under the retainer bracket at the rear of the air filter tray and snap the air filter into place (see Figure 159 on page 320).
5. Reinstall the horizontal air filter tray into chassis (see Figure 160 on page 321).
6. Tighten captive screws to secure the air filter tray.

Figure 159: Inserting a Horizontal Fan Tray Air Filter

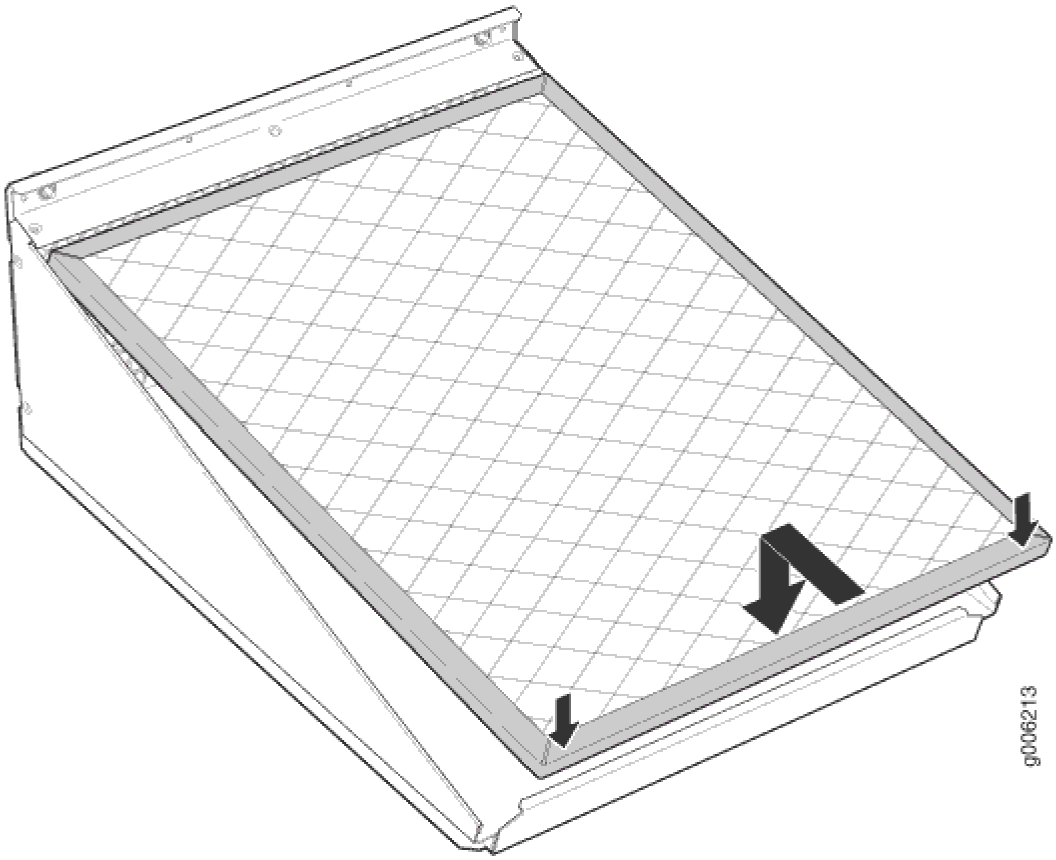
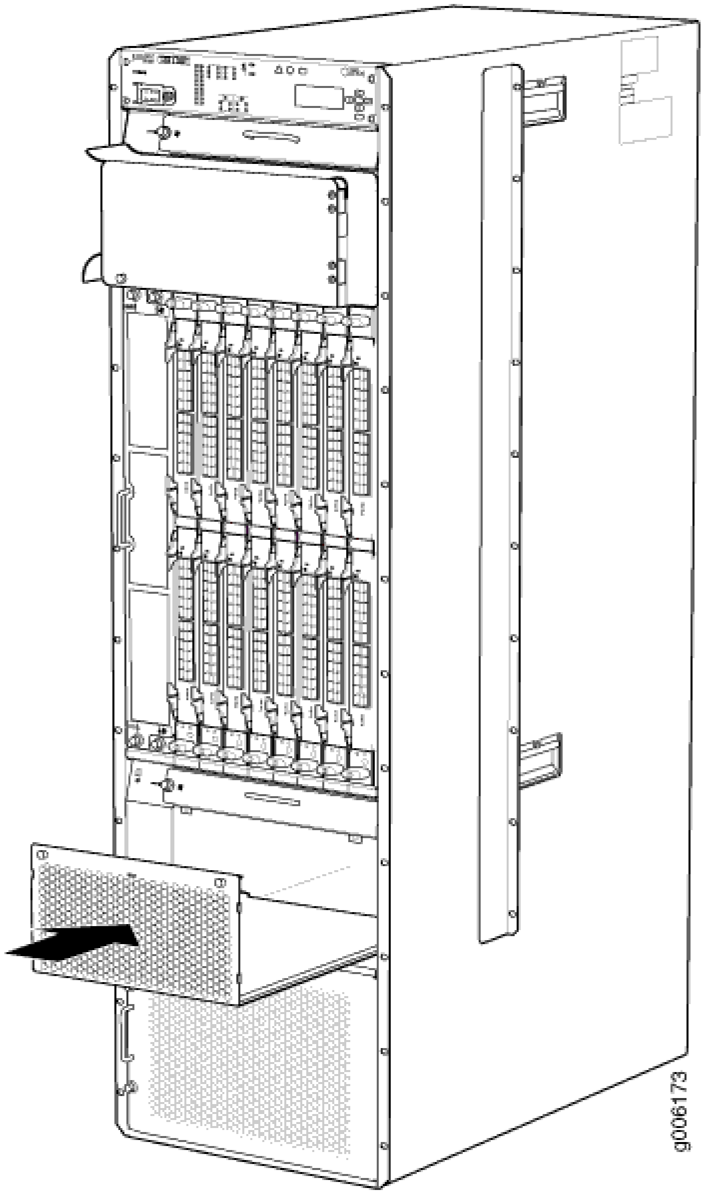


Figure 160: Installing the Horizontal Air Filter



Replacing a PTX5000 Vertical Air Filter

IN THIS SECTION

Removing a PTX5000 Vertical Air Filter

The vertical air filter is located with the vertical fan tray **fan tray 0**. The vertical air filter weighs approximately 7.6 lb (3.5 kg).

To remove the vertical air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the two captive screws on the vertical air filter tray.
3. Grasp the head of the loosened screws, and pull to remove the air filter tray (see Figure 11).
4. Locate the two areas near each rear corner, where the air filter tray is exposed. Using these air filter tray frame access areas, slide the air filter toward the air filter tray faceplate, and pull up on the air filter to release the rear edge of the air filter from the air filter tray (see Figure 12).
5. Remove the air filter from the air filter tray.
6. Discard the air filter.

Figure 161: Removing a Vertical Air Filter Tray

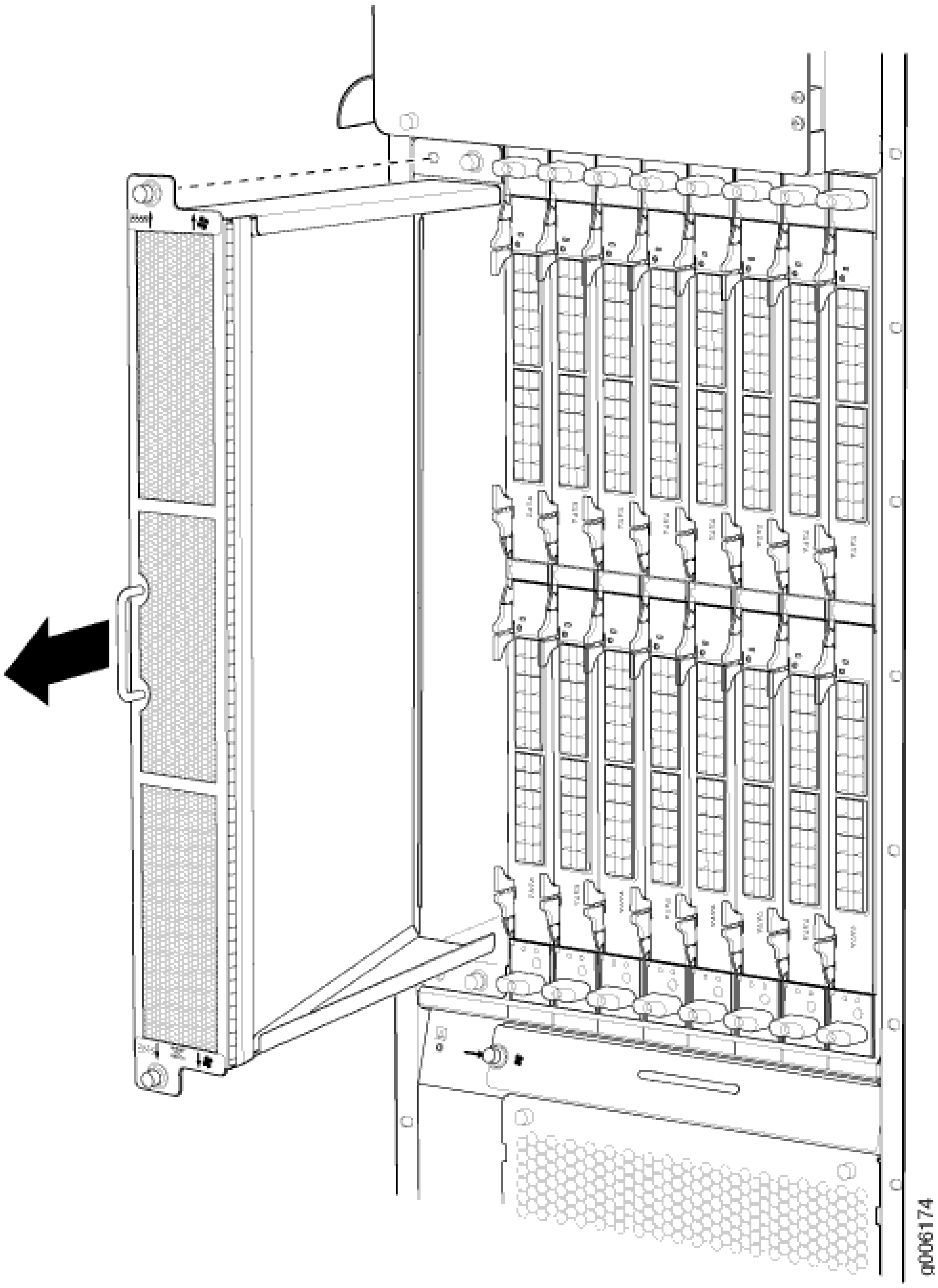
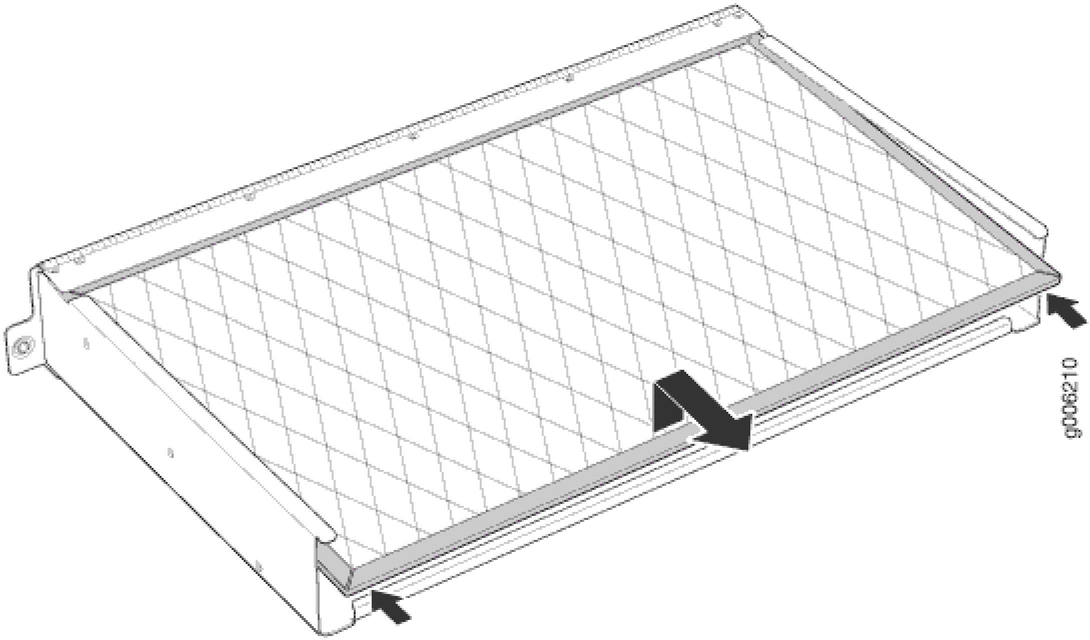


Figure 162: Removing a Vertical Air Filter



Installing a PTX5000 Vertical Air Filter

To install the vertical air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Locate markings on the side of the frame indicating airflow direction.
3. Position the air filter over the air filter tray. Note the correct orientation for airflow direction. The airflow direction is front to rear, through the perforated faceplate, and up through the filter.
4. Engage the edge nearest the perforated faceplate under the front flange, and slide the filter further toward the faceplate (see Figure 163 on page 325).

   Engage the opposite filter edge under the retainer bracket at the rear of the air filter tray and snap the air filter into place.
5. Reinstall the vertical air filter tray into chassis (Figure 164 on page 326).
6. Tighten the captive screws to secure the air filter tray.

Figure 163: Inserting a Vertical Air Filter

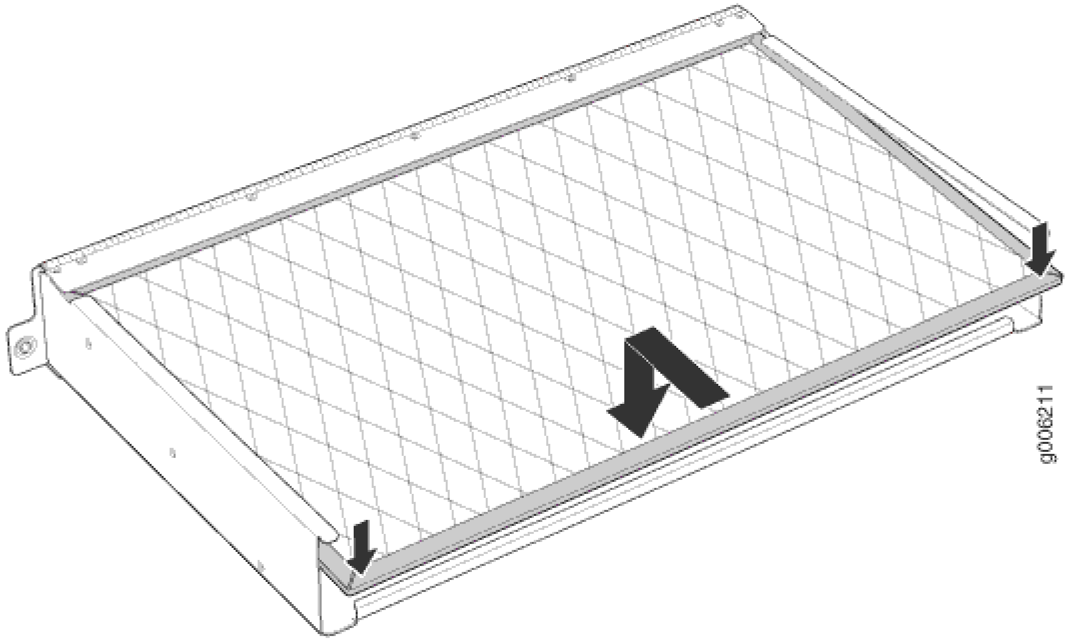
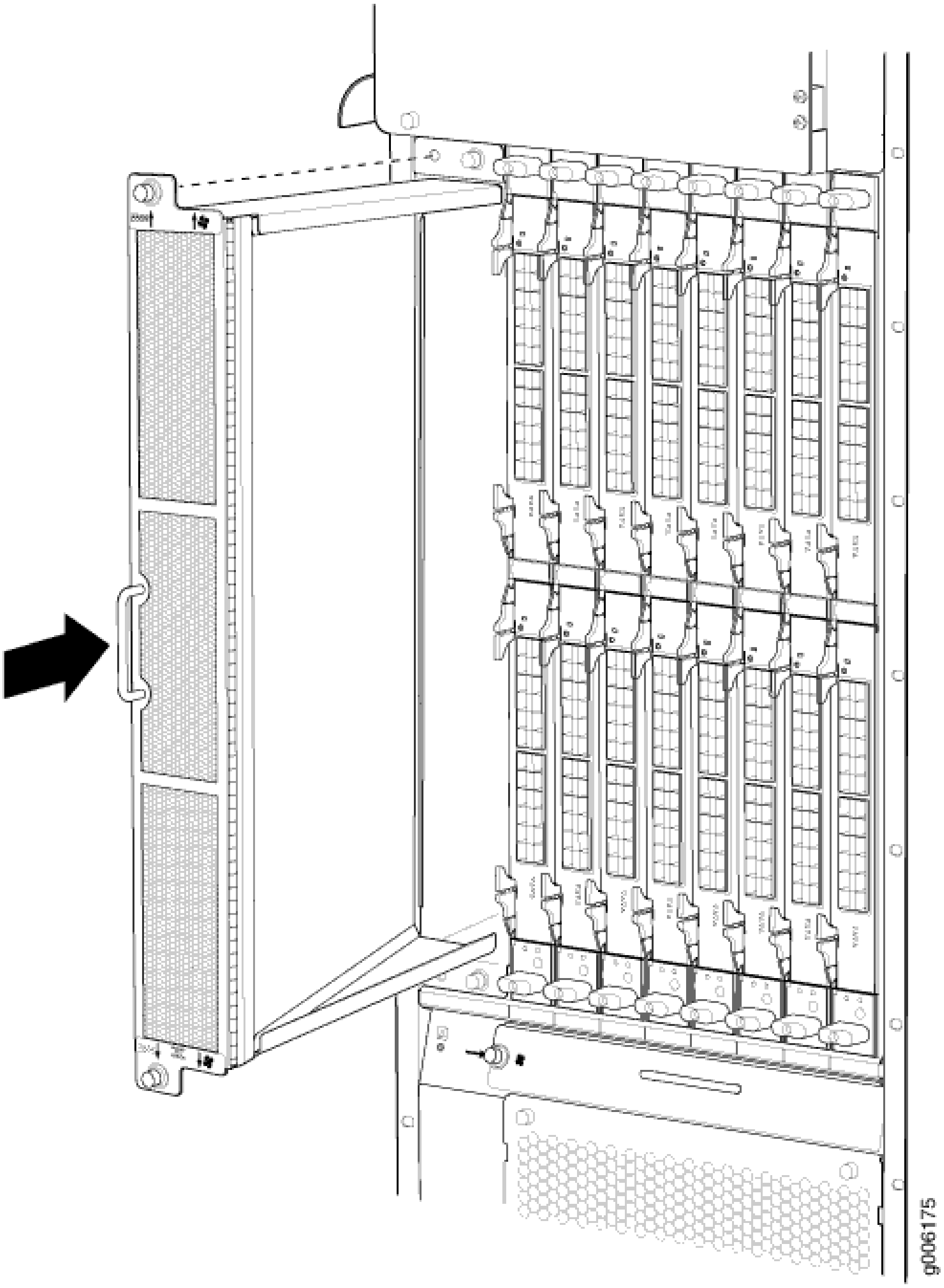


Figure 164: Installing a Vertical Air Filter Tray



Replacing a PTX5000 Power Supply Module Air Filter

IN THIS SECTION

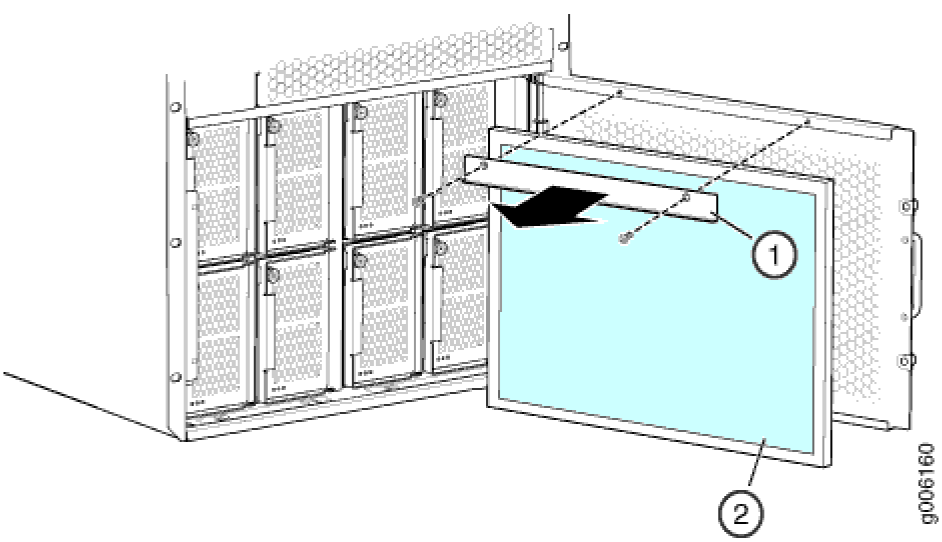
Removing a PTX5000 Power Supply Module Air Filter

The PSM air filter is located inside the PSM door.

To remove the PSM air filter (see Figure 15):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the PSM door, and open the door.
3. Inside the PSM door, locate the air filter retaining bracket at the top of the door. Using a number 2 Phillips (+) screwdriver, remove the 2 screws from the air filter retaining bracket, and remove the bracket.
4. Remove the air filter.
5. Discard the air filter.

Figure 165: Removing a PSM Door Air Filter



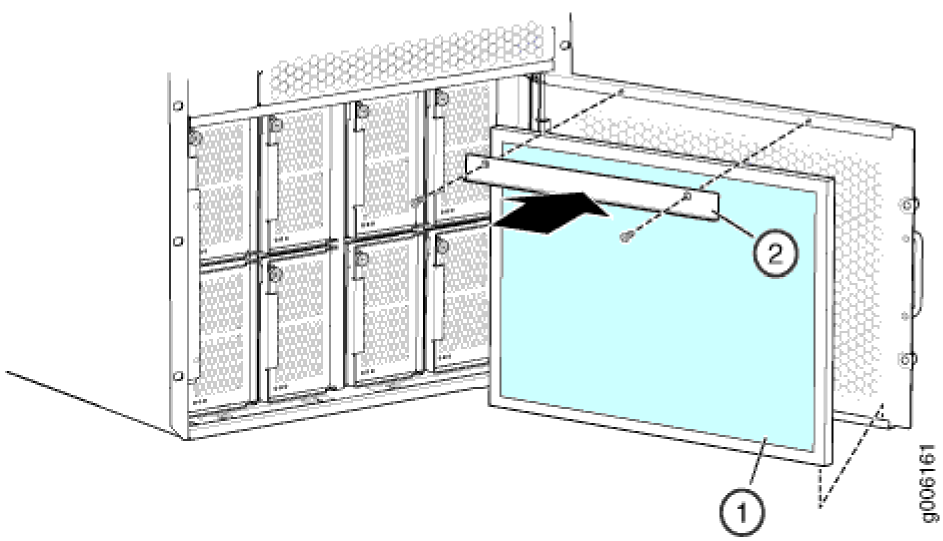
1– Air filter retaining bracket	2– Air filter

Installing a PTX5000 Power Supply Module Air Filter

To install the PSM air filter (see Figure 166 on page 328):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Locate markings on the side of the frame indicating airflow direction.
3. Install the air filter into the door. Note that the correct orientation for airflow direction is through the perforated door and into the PSMs.
4. Engage the edge nearest the perforated faceplate under the front flange, and slide the air filter further toward the faceplate.
5. Reinstall the air filter retainer bracket and secure with two screws.
6. Tighten the captive screws to secure the PSM door.

Figure 166: Installing a PSM Door Air Filter



1– Air filter	2– Air filter retaining bracket

Replacing a PTX Series PIC Air Filter

IN THIS SECTION

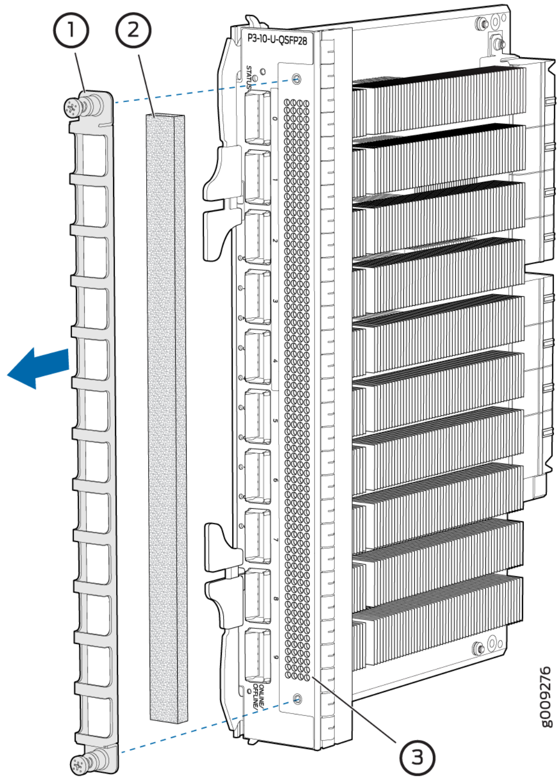
Removing a PTX Series PIC Air Filter

The 10-port 10-Gigabit Ethernet/40-Gigabit Ethernet/100-Gigabit Ethernet PIC with QSFP28 (P3-10-U-QSFP28) has air vents on the PIC faceplate, and has a field-replaceable air filter cover over the air vents.

To remove the PIC air filter (see Figure 17):

1.
2. Loosen the thumbscrews that secure the air filter cover to the PIC faceplate.
3. Pull to remove the air filter cover and air filter.
4. Remove the air filter from the air filter cover.
5. Discard the air filter.

Figure 167: Removing a PIC Air Filter



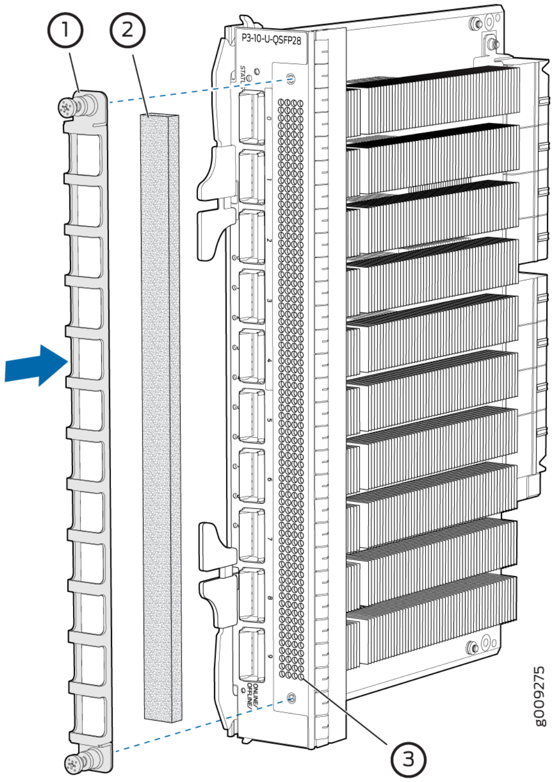
1– Air filter cover	3– Air vent
2– Air filter	

Installing a PTX Series PIC Air Filter

To install the PIC air filter (see Figure 168 on page 331):

1.
2. Place the air filter in the air filter cover.
3. Reinstall the air filter cover on to the PIC faceplate.
4. Tighten the thumbscrews that secure the air filter cover to the PIC faceplate.

Figure 168: Installing a PIC Air Filter



1– Air filter cover	3– Air vent
2– Air filter	

RELATED DOCUMENTATION

PTX5000 Craft Interface LEDs | 22
PTX5000 Cooling System | 31
Troubleshooting the PTX5000 Cooling System | 551
Prevention of Electrostatic Discharge Damage

Maintaining the PTX5000 AC Power System

IN THIS SECTION

Maintaining the PTX5000 AC Power System

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the power distribution units (PDUs), power supply modules (PSMs), AC power cords, and grounding cables.

Action

On a regular basis:

- Periodically inspect the site to ensure that the grounding and AC power cords connected to the PTX5000 are securely in place and that no moisture is accumulating near the PTX5000. To review grounding and site wiring requirements for the PTX5000, see "PTX5000 Chassis Grounding Cable and Lug Specifications" on page 154 and *Site Electrical Wiring Guidelines*.

- Check the status of the PDUs by issuing the `show chassis environment pdu` command.

- Make sure that the AC power cords are arranged so that they do not obstruct access to other router components.

- Routinely check the status LEDs on the PDU and PSM faceplates and the craft interface to verify that the power system is functioning normally.

  For more information about the PDU and PSM LEDs, see "PTX5000 AC Power Distribution Unit LEDs" on page 54 and "PTX5000 AC Power Supply Module LEDs" on page 62.

- Check the red and yellow alarm LEDs and the LCD display on the craft interface. PDU and PSM failure or removal triggers an alarm that causes one or both of the LEDs to light and an error message to appear on the LCD display. You can display the associated error messages by issuing the following CLI command:

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

  For a list of possible alarm messages, see "Troubleshooting the PTX5000 Power System" on page 568.

- The power system requires an unobstructed airflow at both the front and rear of the chassis. Periodically check the site to ensure that both the air intake at the bottom front of the chassis and the exhaust from the PSM faceplates are unobstructed.

- To check the power usage in watts for all PDUs and PSMs, issue the `show chassis power` command .

```

Chassis Power          Input(V)      Used(W)

Total Power                           3810

  PDU 0                               3810
    PSM 0
      Input 1               54         331
    PSM 1
      Input 1               54         661
    PSM 2
      Input 1               54        1432
```

```
    PSM 3
      Input 1            54         1386
```

Issue the `show chassis power detail` command to check the power usage in watts for hardware components such as FPCs, fan trays, Routing Engine and Control Board, and SIB, CCG, and craft interface.

```
user@host> show chassis power detail
Chassis Power        Used(W)

Total Power            4890

  PDU 0                2447
    PSM 0              1292
    PSM 1               702
    PSM 2               210
    PSM 3               243

  PDU 1                2443
    PSM 0              1291
    PSM 1               685
    PSM 2               196
    PSM 3               271

Item                 Used(W)
  Fan Tray 0            194
  Fan Tray 1            482
  Fan Tray 2            488
  RE0/CB0               107
  RE1/CB1               108
  SIB/CCG/FPD            63
  FPC 0                   0
  FPC 1                   0
  FPC 2                   0
  FPC 3                   0
  FPC 4                   0
  FPC 5                   0
  FPC 6                   8
  FPC 7                   0
```

Replacing a PTX5000 Three-Phase Delta AC PDU

IN THIS SECTION

Removing a PTX5000 Three-Phase Delta AC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The PDU weighs 51.2 lb (23.2 kg).

To remove a three-phase delta PDU:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Switch the circuit breaker and the power **OUTPUT** switch located on the faceplate of the PDU to the off (**O**) position.
3. Disconnect the AC power cord from the power source.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the **200-240 V ~ 60 A 50-60 Hz** LED on the PDU faceplate is off.
5. Remove the power supply modules (PSMs) in the front of the chassis from the PDU to be removed (see Figure 1).

   a. Loosen the captive screws on the door covering the PSMs and open the door.

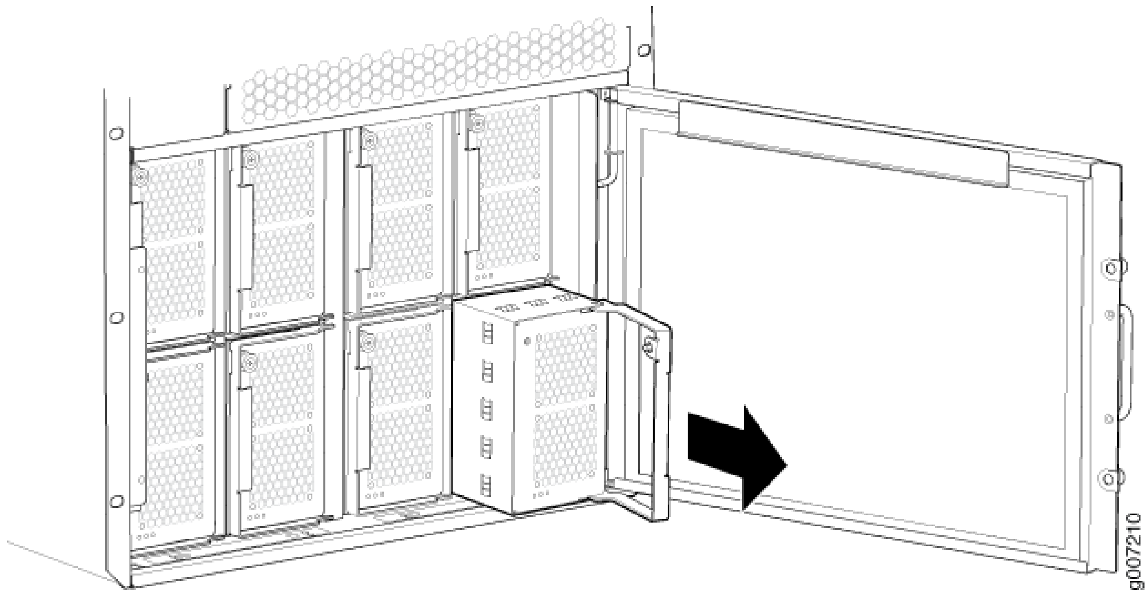
   b. Loosen the captive screw on the PSM ejector handle.

   c. Grasp the ejector handle and pull to eject the PSM.

   d. Slide the PSM halfway out of the chassis. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

   e. Repeat these steps for the remaining PSMs in the PDU.

Figure 169: Removing the AC Power Supply Modules



6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
7. Open the door of the metal wiring compartment.
8. Disconnect the wires from the AC terminal block on the three-phase delta AC power supply (Figure 2). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, and remove each wire from the input terminal or grounding point.

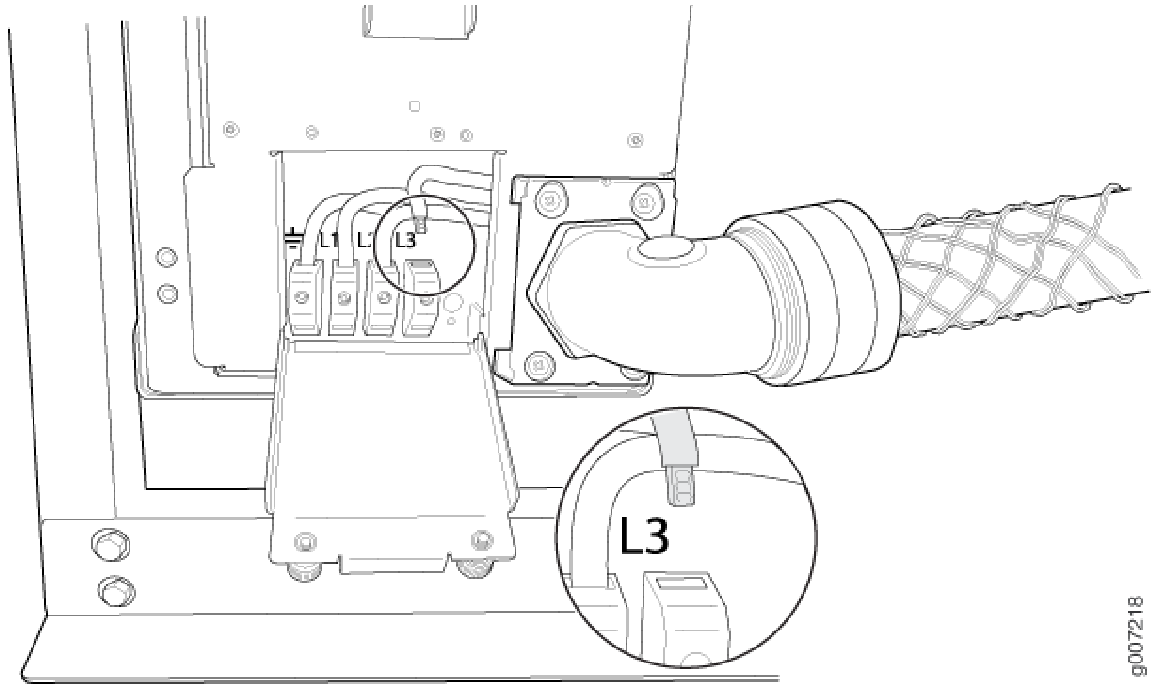
   a. Remove the wire labeled **L3** from the **L3** input terminal.

   b. Remove the wire labeled **L2** from the **L2** input terminal.

   c. Remove the wire labeled **L1** from the **L1** input terminal.

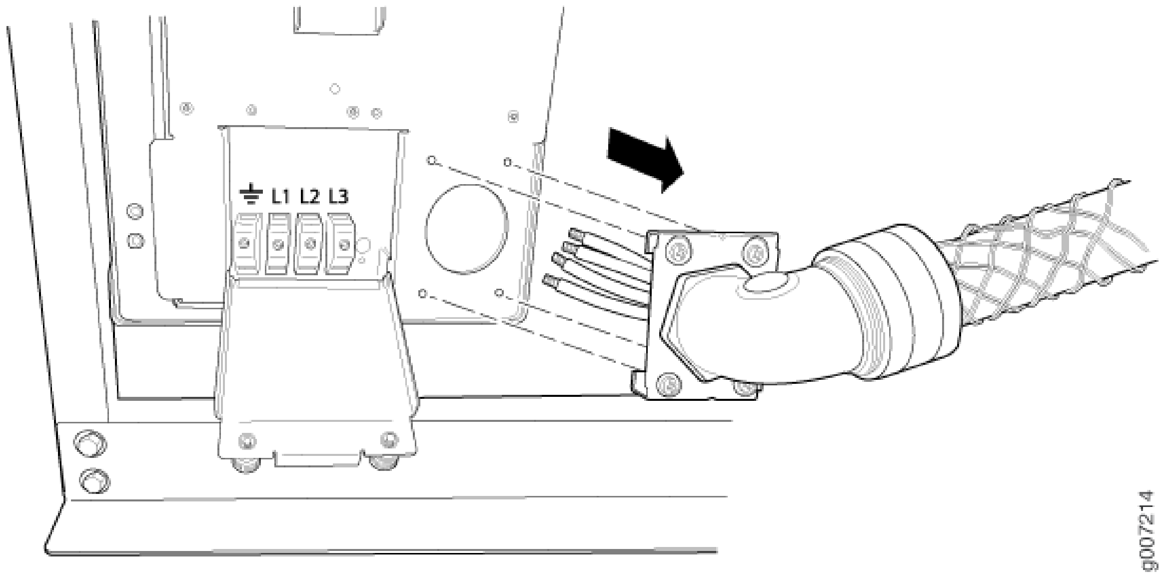
   d. Remove the wire labeled **GND** from the grounding point.

Figure 170: Disconnecting AC Power Wires from a Three-Phase Delta AC Power Supply



9. Using a number 2 Phillips (+) screwdriver, loosen the captive screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 3.

Figure 171: Removing the Metal Retaining Bracket and AC Power Cord



10. Loosen the four captive screws attaching the front PDU handle to the PDU and chassis.
11. Grasp the front PDU handle on the PDU faceplate and pull firmly down toward you. Slide the PDU halfway out of the chassis until you can reach the installation handle located on top of the PDU. (See Figure 5).

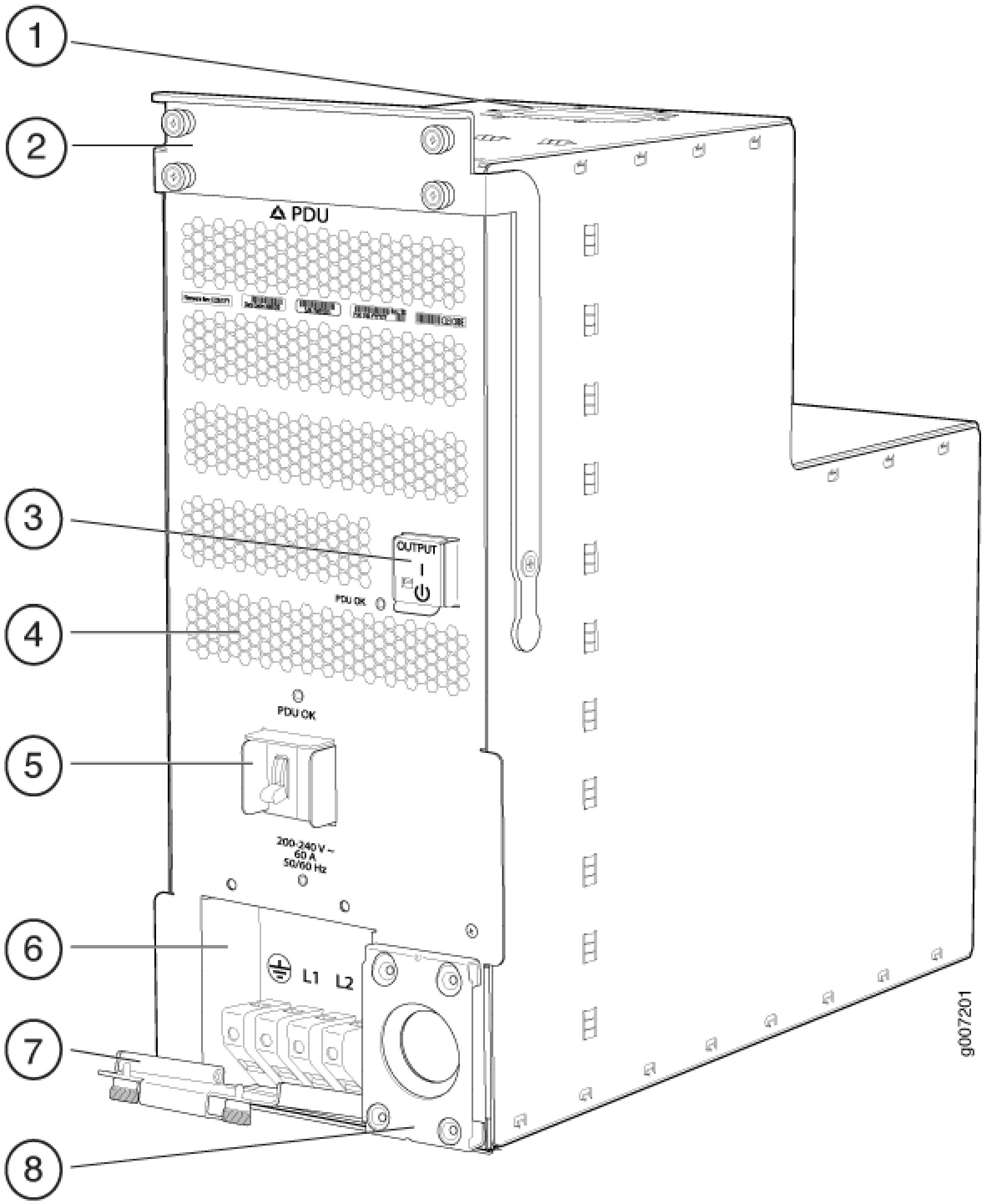
> **CAUTION**: Each PDU weighs approximately 63.3 lb (28.7 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

12. Use the installation handle to slide the PDU completely out of the chassis.
13. Use the captive screws on the metal retaining bracket to reattach it to the PDU being removed.

> **WARNING**: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

> **CAUTION**: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

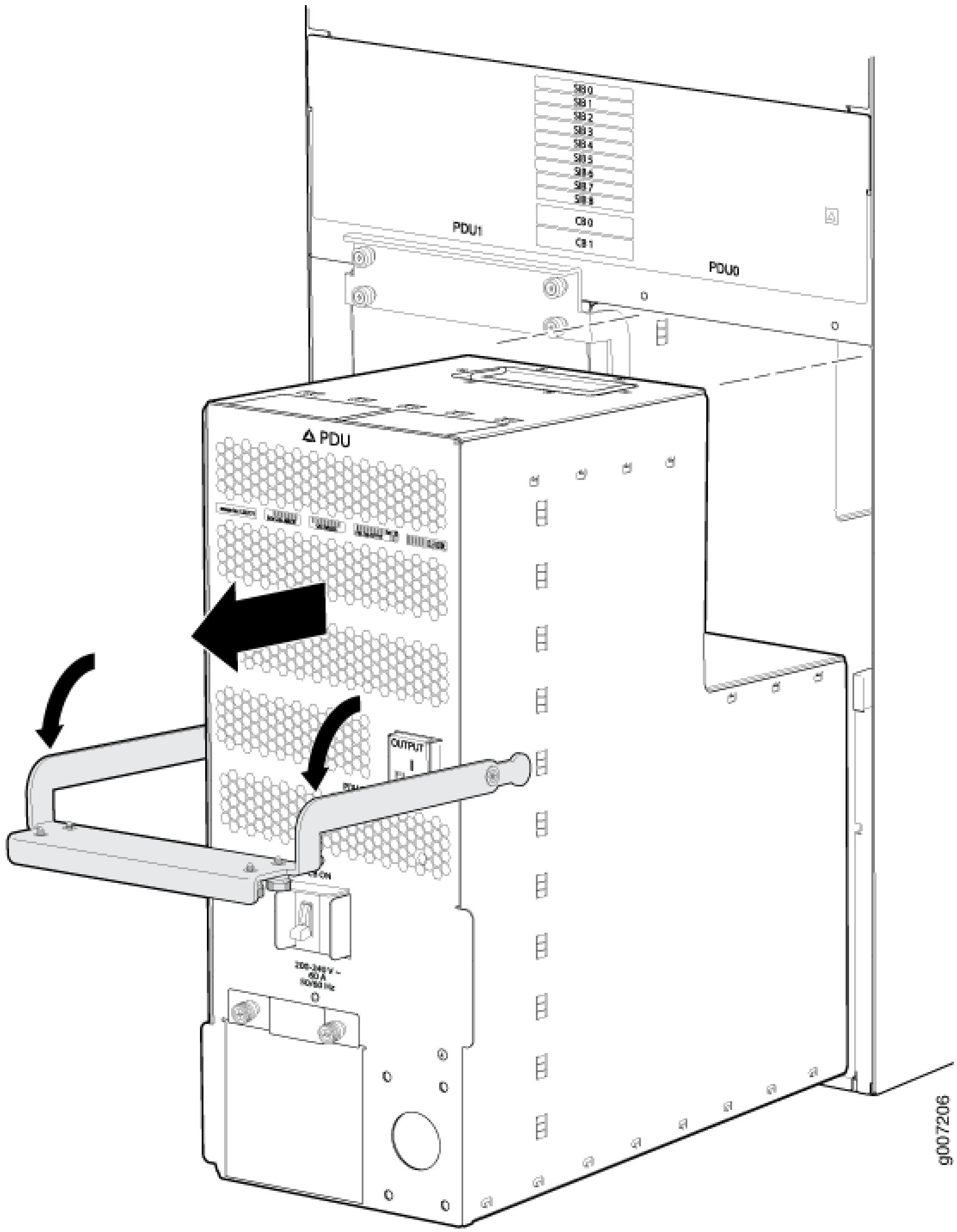
Figure 172: Three-Phase Delta AC Power Supply



1– Top installation handle	5– Circuit breaker
2– Front installation handle	6– Metal wiring compartment
3– Output power switch	7– Metal wiring compartment door

4– Air exhaust ventilation	8– Metal retaining bracket

Figure 173: Removing a Three-Phase Delta AC PDU

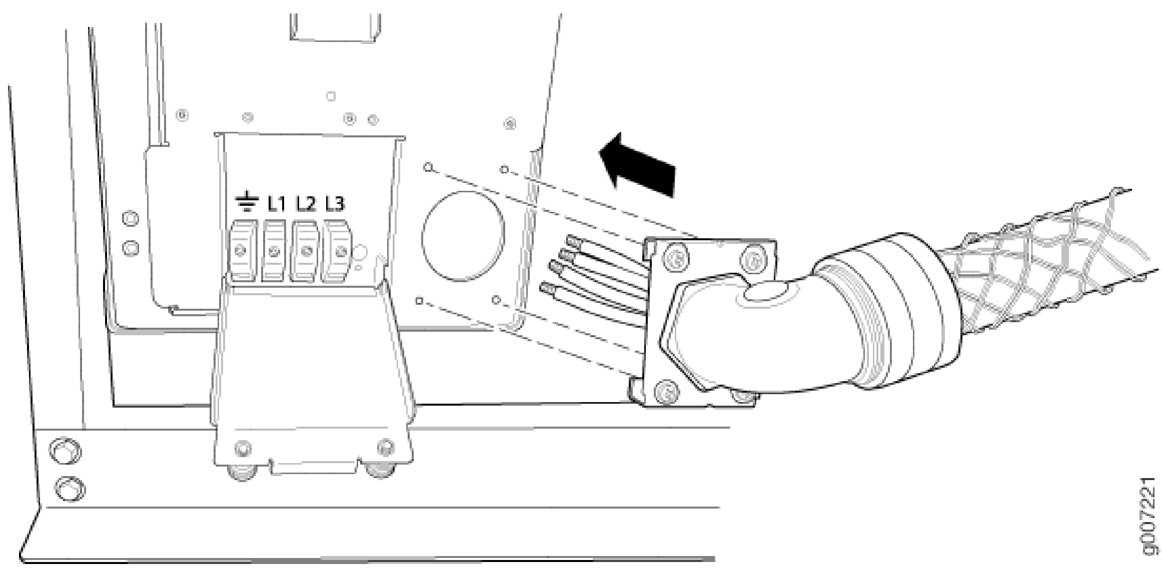


Installing a PTX5000 Three-Phase Delta AC PDU

To install a three-phase delta AC PDU:

1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker and the power **OUTPUT** switch located on the faceplate of the PDU to the off (**O**) position.
3. Grasp the front installation handle and top installation handle, and insert the PDU into the PDU slot.
4. Using both hands, slide the PDU into the chassis until you feel resistance.
5. Push the front installation handle up toward the PDU, and secure the handle with the captive screws.
6. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws that secure the metal retaining bracket to the newly installed PDU. Remove the metal retaining bracket from the PDU.
7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment of the replacement PDU. Open the metal door of the metal AC wiring compartment.
8. Using a number 2 Phillips (+) screwdriver, use the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU.

Figure 174: Connecting the Metal Retaining Bracket and AC Power Cord to the Three-Phase Delta PDU



9. Connect the wires to the AC terminal block on the three-phase delta AC PDU (Figure 175 on page 342). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw.

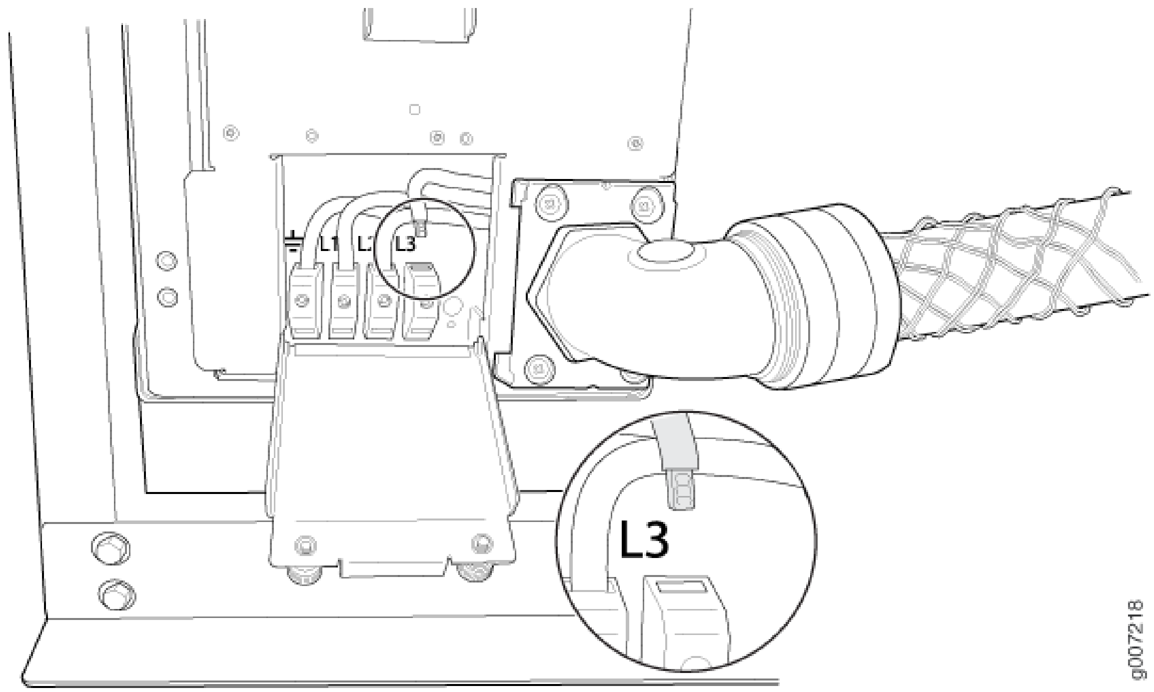
a. Insert the wire labeled **GND** into the grounding point.

b. Insert the wire labeled **L1** into the **L1** input terminal.

c. Insert the wire labeled **L2** into the **L2** input terminal.

d. Insert the wire labeled **L3** into the **L3** input terminal.

Figure 175: Connecting Grounding and AC Power Wires to a Three-Phase Delta AC Power Supply



10. Verify that the AC power and grounding wiring connections are correct.
11. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
12. Verify that the AC power cord is not touching or blocking access to PTX5000 components, and that it does not drape where people could trip on it.
13. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

14. Switch on the customer-site circuit breaker to the PDU.
15. Verify that the **200-240 V ~ 60 A 50-60 Hz** LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
16. Reinstall the PSMs into the PDU.

a. Loosen the captive screws on the door covering the PSMs and open the door.

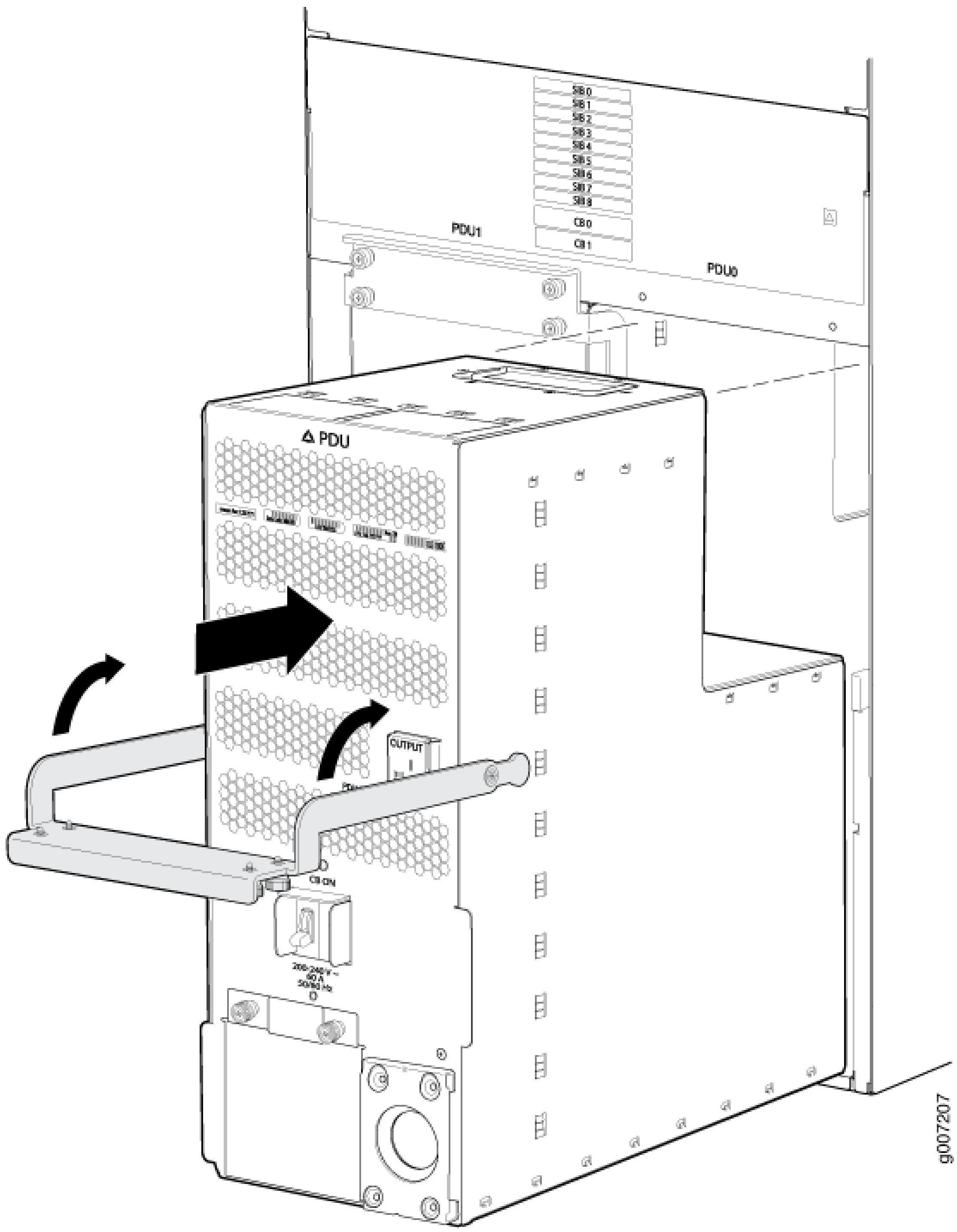
b. Place one hand underneath the PSM to support it and slide it into the PSM slot.

c. Push the ejector handle toward the PSM, and tighten the captive screw on the ejector handle to secure it to the PSM.

d. Repeat these steps for the other PSMs in the PDU.

17. Move the circuit breaker on the PDU to the on (|) position.
18. Verify that the **CB ON** LED on the PDU faceplate is lit steadily.
19. Move the power **OUTPUT** switch on the PDU to the on (|) position.
20. Verify that the **AC IN** LED and **DC IN** LED on the faceplate of each PSM in the PDU are lit steadily, indicating that each PSM is receiving power. Verify that the **FAULT** LED is off.
21. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Figure 176: Installing a Three-Phase Delta AC PDU



Replacing a PTX5000 Three-Phase Delta AC PDU Power Cord

IN THIS SECTION

Removing a PTX5000 Three-Phase Delta AC PDU Power Cord

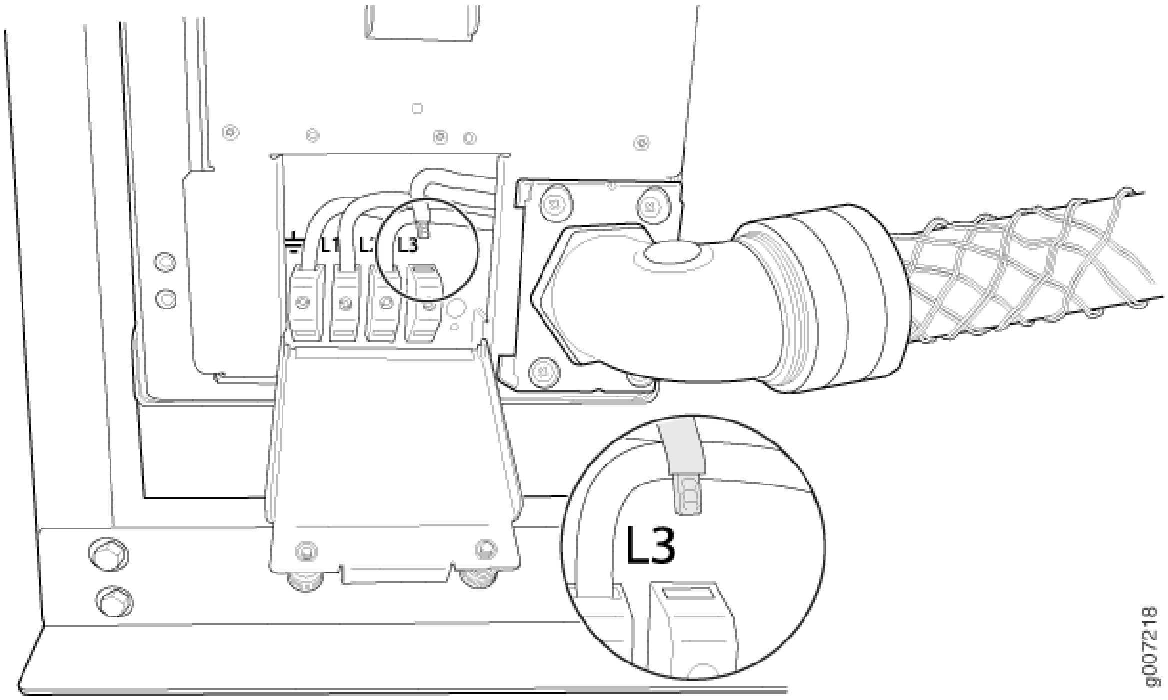
To remove a three-phase delta PDU power cord:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Move the circuit breaker and power **OUTPUT** switch located on the faceplate of the PDU to the off (**O**) position.
3. Disconnect the AC power cord from the power source.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

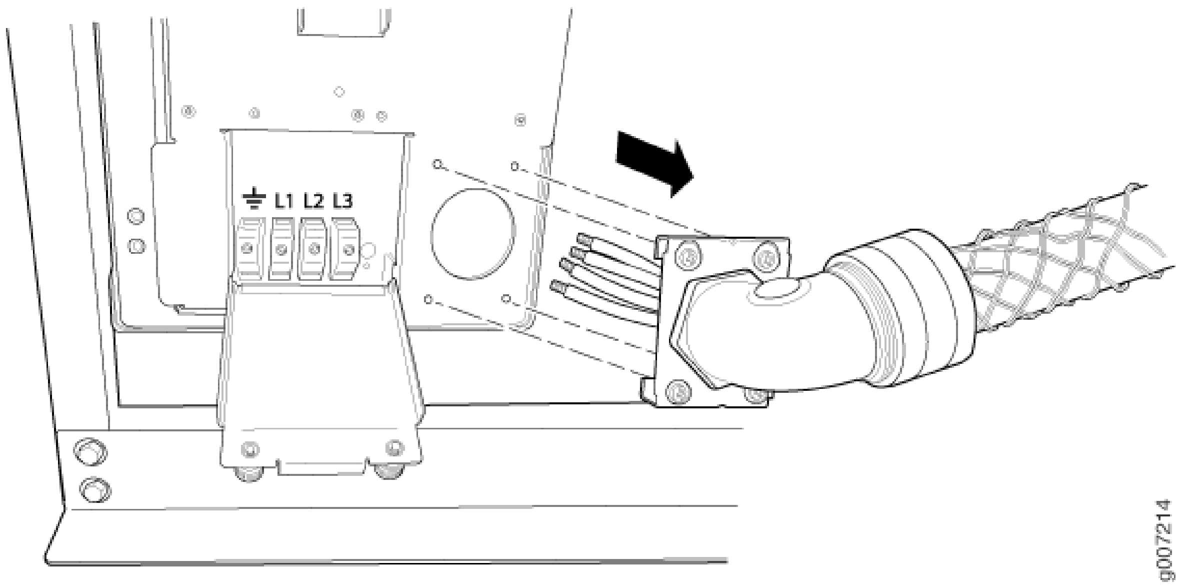
4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the **200-240 V ~ 60 A 50-60 Hz** LED on the PDU faceplate is off.
5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
6. Open the door of the metal wiring compartment. Disconnect the wires from the AC terminal block on the three-phase delta AC power supply (Figure 9). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, and remove each wire from the input terminal or grounding point.
   a. Remove the wire labeled **L3** from the **L3** input terminal.
   b. Remove the wire labeled **L2** from the **L2** input terminal.
   c. Remove the wire labeled **L1** from the **L1** input terminal.
   d. Remove the wire labeled **GND** into the grounding point.

Figure 177: Disconnecting AC Power Wires from a Three-Phase Delta AC PDU



7. Using a number 2 Phillips (+) screwdriver, loosen the captive screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 10.

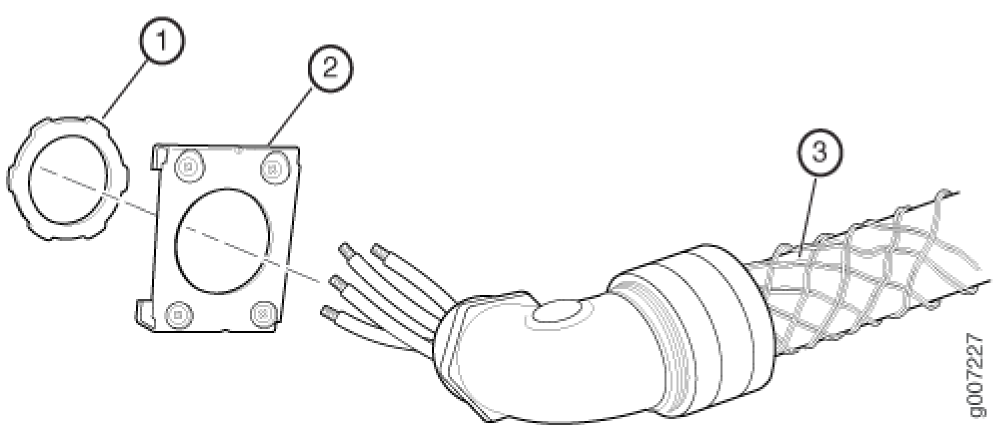
Figure 178: Removing the Metal Retaining Bracket and AC Power Cord



8. Unscrew the retaining nut from the AC power cord, and detach the AC power cord from the metal retaining bracket.

> **NOTE**: Reserve the retaining nut to attach the metal retaining bracket to the replacement AC power cord.

Figure 179: Removing the Metal Retaining Bracket from the AC Power Cord



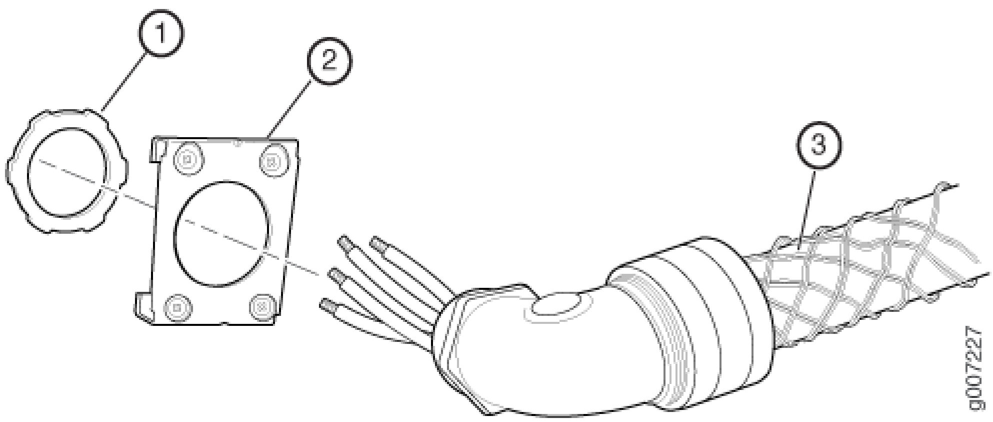
1– Retaining nut	3– Three-phase delta AC power cord
2– Metal retaining bracket	

Installing a PTX5000 Three-Phase Delta AC PDU Power Cord

To install a three-phase delta AC power cord:

1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker and power **OUTPUT** switch on the PDU to the off (**O**)position.
3. Gently push the AC power cord wires through the hole in the metal retaining bracket. Screw the retaining nut onto the AC power cord to secure the metal retaining bracket to the replacement AC power cord.

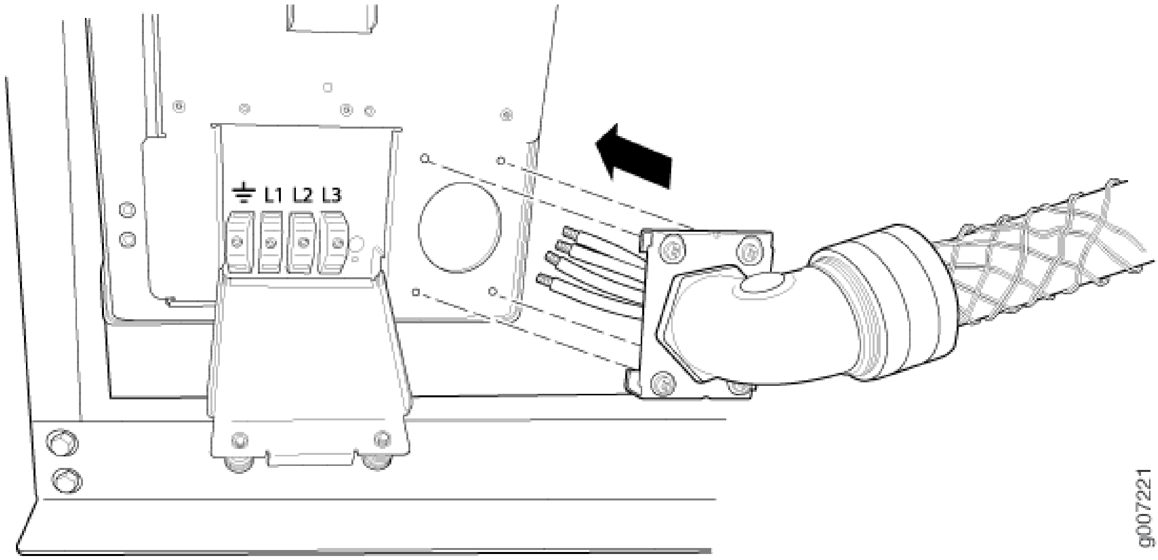
Figure 180: Attaching the Metal Retaining Bracket to the Three-Phase Delta AC Power Cord



1– Retaining nut	3– Three-phase delta AC power cord
2– Metal retaining bracket	

4. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment. Open the metal door of the metal AC wiring compartment.
5. Gently push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.
6. Using a number 2 Phillips (+) screwdriver, use the four screws on the metal retaining bracket to secure the AC power cord to the PDU.

Figure 181: Connecting the Metal Retaining Bracket and AC Power Cord to the Three-Phase Delta PDU



7. Connect the wires to the AC terminal block on the three-phase delta AC PDU (Figure 182 on page 350). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw.

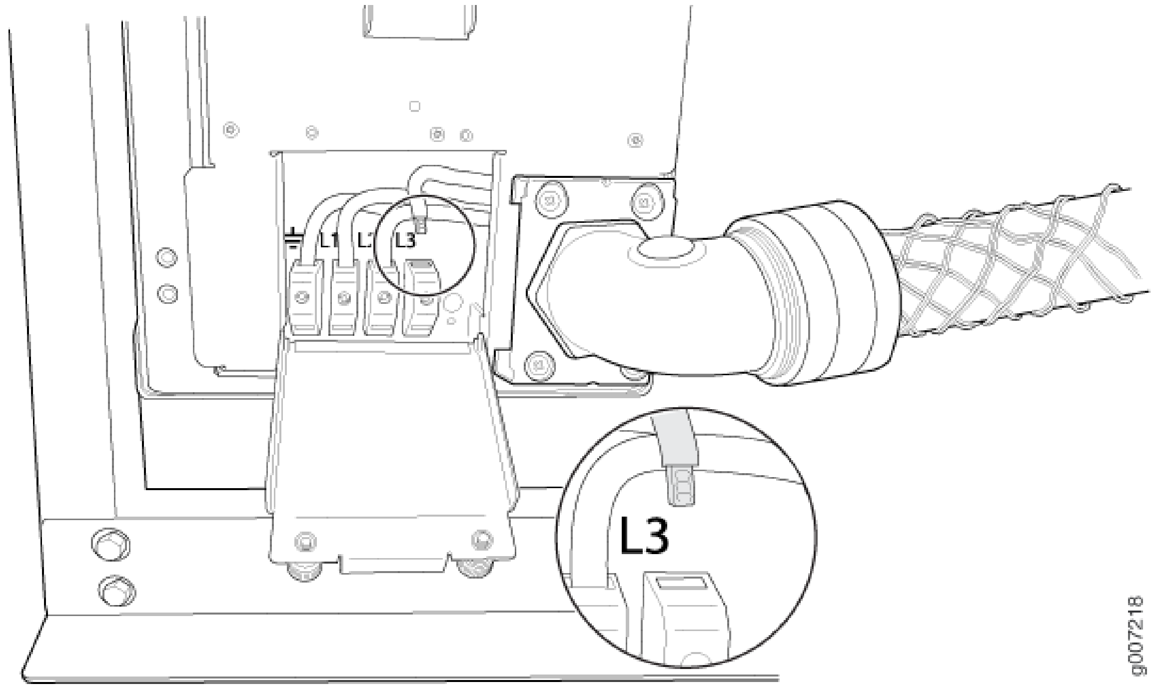
   a. Insert the wire labeled **GND** into the grounding point.

   b. Insert the wire labeled **L1** into the **L1** input terminal.

   c. Insert the wire labeled **L2** into the **L2** input terminal.

   d. Insert the wire labeled **L3** into the **L3** input terminal.

Figure 182: Connecting Grounding and AC Power Wires to a Three-Phase Delta AC Power Supply



8. Verify that the AC power and grounding wiring connections are correct.
9. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
10. Verify that the AC power cord is not touching or blocking access to PTX5000 components, and that it does not drape where people could trip on it.
11. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

12. Switch on the customer-site circuit breaker to the PDU.
13. Verify that the **200-240 V ~ 60 A 50-60 Hz** LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
14. Move the circuit breaker on the PDU to the on (|) position.
15. Verify that the **CB ON** LED on the PDU faceplate is lit steadily.
16. Move the power **OUTPUT** switch on the PDU to the on (|) position.
17. Verify that the **AC IN** LED and **DC IN** LED on the faceplate of each PSM in the PDU are lit steadily, indicating that each PSM is receiving power. Verify that the **FAULT** LED is off.
18. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Replacing a PTX5000 Three-Phase Wye AC PDU

IN THIS SECTION

Removing a PTX5000 Three-Phase Wye AC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The PDU weighs 51.2 lb (23.2 kg).

To remove a three-phase wye PDU:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Move the circuit breaker and power **OUTPUT** switch located on the faceplate of the PDU to the off (**O**) position.
3. Disconnect the AC power cord from the power source.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the **200-240 V/346-415 ~ 30 A 50-60 Hz** LED on the PDU faceplate is off.
5. Remove the power supply modules (PSMs) in the front of the chassis from the PDU to be removed (see Figure 15).

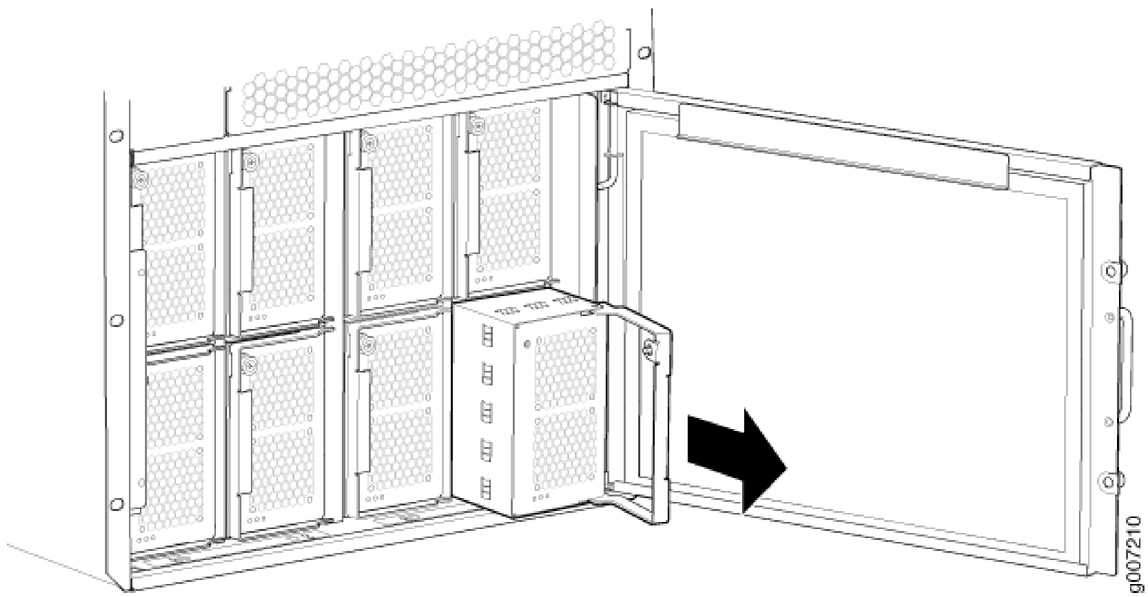
   a. Loosen the captive screws on the door covering the PSMs and open the door.

   b. Loosen the captive screw on the PSM ejector handle.

   c. Grasp the ejector handle and pull to eject the PSM. Slide the PSM halfway out of the chassis. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

   d. Repeat these steps for the remaining PSMs in the PDU.

Figure 183: Removing the AC Power Supply Modules



6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.

7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws to the metal wiring compartment door. Open the door of the metal wiring compartment. Disconnect the wires from the AC terminal block on the three-phase wye AC PDU (Figure 16). Using 1/5-in. (5.5-mm) slotted screw, loosen the input terminal or grounding point screw, and remove each wire from the input terminal or grounding point.

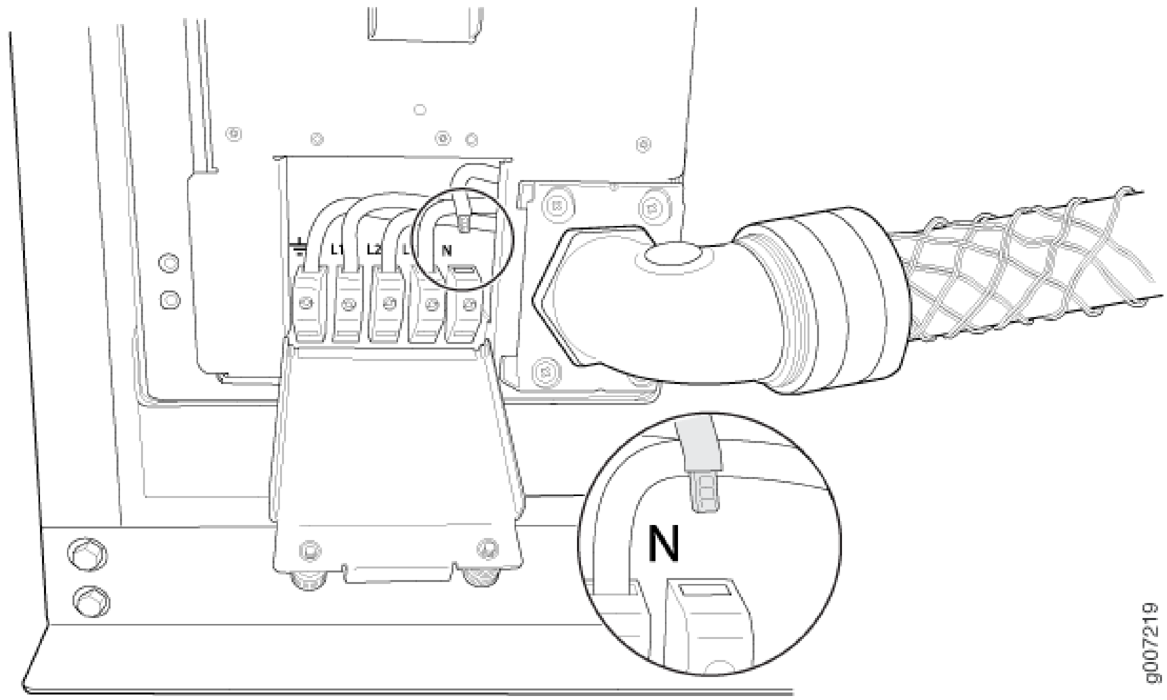
   a. Remove the wire labeled **L3** from the **L3** input terminal.

   b. Remove the wire labeled **L2** from the **L2** input terminal.

   c. Remove the wire labeled **L1** from the **L1** input terminal.

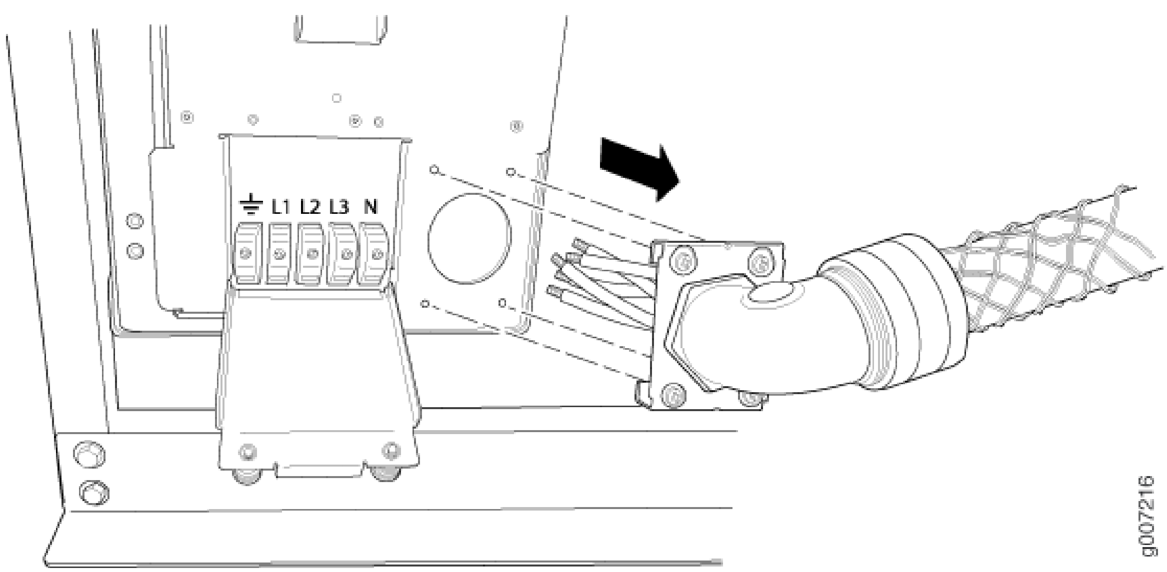
   d. Remove the wire labeled **GND** into the grounding point.

Figure 184: Disconnecting AC Power Wires from a Three-Phase Wye AC PDU



8. Using a number 2 Phillips (+) screwdriver, loosen the screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 17.

Figure 185: Removing the Metal Retaining Bracket and AC Power Cord



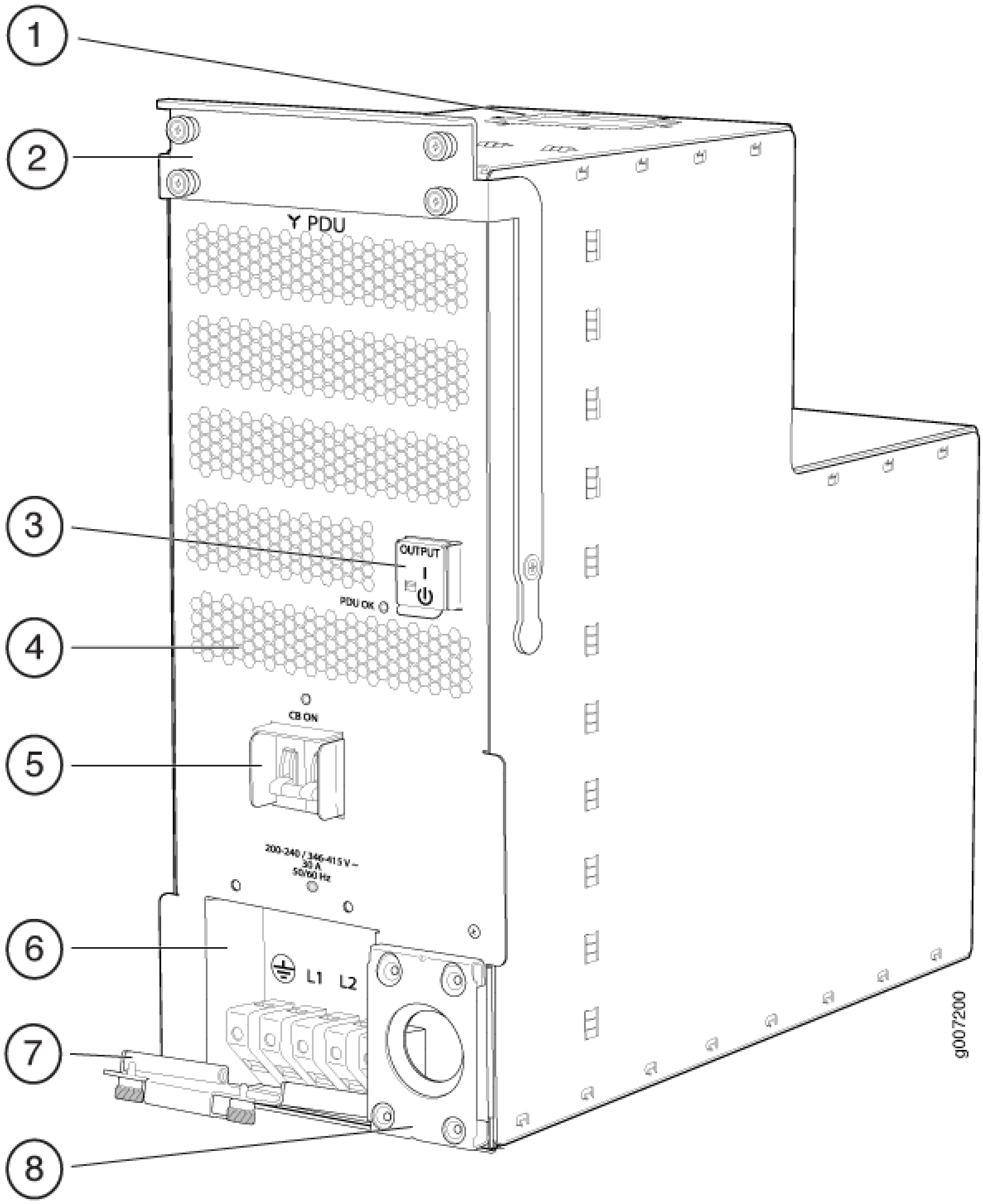
9. Loosen the four captive screws attaching the front PDU handle to the PDU and chassis.
10. Grasp the front installation handle on the PDU faceplate and pull the handle firmly down toward you. Slide the PDU halfway out of the chassis until you can reach the top installation handle. (See Figure 19.)
11. Use the top and front installation handle to slide the PDU completely out of the chassis.

> **CAUTION**: Each PDU weighs approximately 51.2 lb (23.2 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

> **WARNING**: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

> **CAUTION**: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

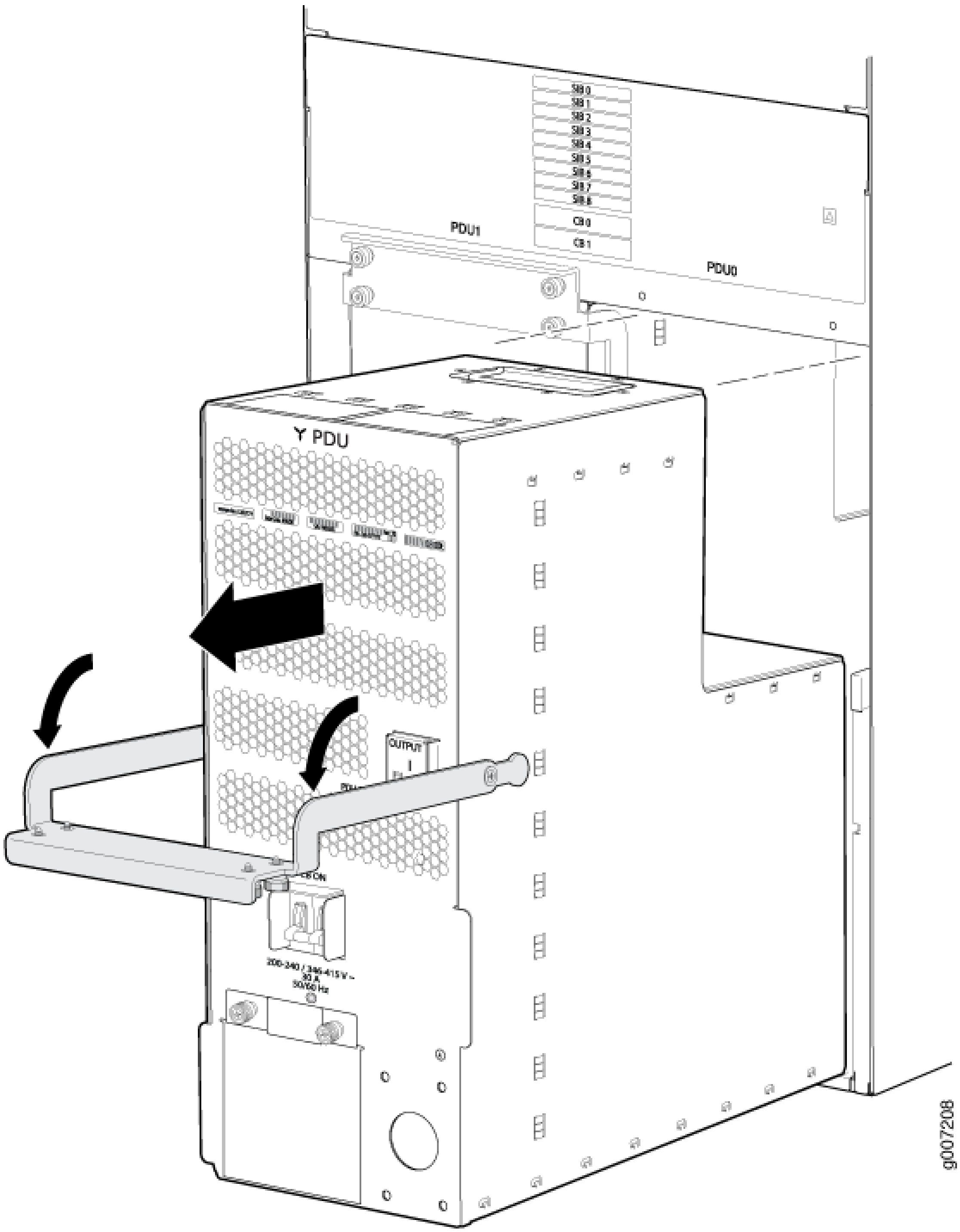
Figure 186: Three-Phase Wye AC PDU



1– Top installation handle	5– Circuit breaker
2– Front installation handle	6– Metal wiring compartment
3– Power **OUTPUT** switch	7– Metal wiring compartment door

4– Air exhaust ventilation	8– Metal retaining bracket

Figure 187: Removing a Three-Phase Wye AC PDU

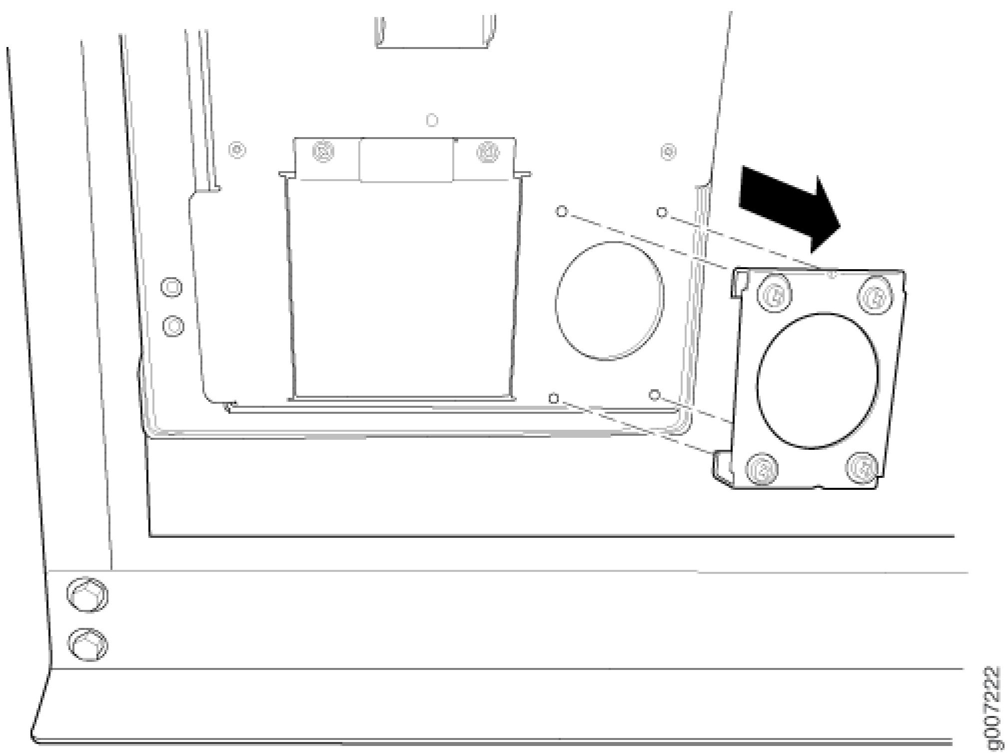


Installing a PTX5000 Three-Phase Wye AC PDU

To install a three-phase wye AC PDU:

1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker on the PDU to the off (O) position.
3. Grasping both the front and top installation handle, insert the replacement PDU into the PDU slot.
4. Using both hands, slide the PDU into the chassis until you feel resistance.
5. Push the front installation handle up toward the PDU. Using a number 2 Phillips (+) screwdriver, tighten the captive screws on the handle.
6. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws on the metal retaining bracket located on the lower right of the newly installed PDU. Remove the metal retaining bracket from the PDU.

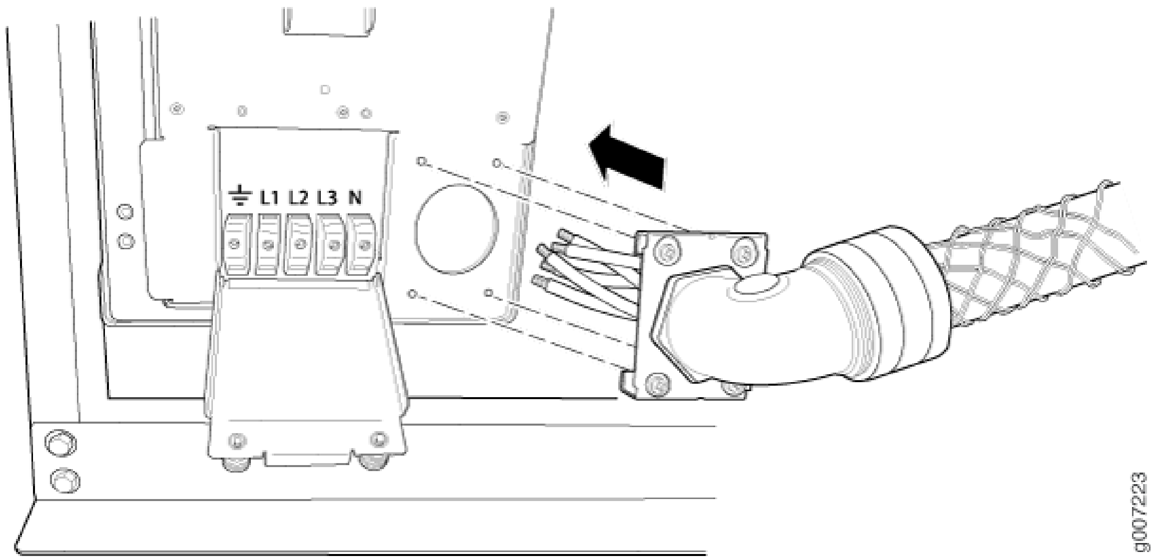
Figure 188: Removing the Metal Retaining Bracket from the Three-Phase Wye PDU



7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment of the replacement PDU. Open the metal door of the metal AC wiring compartment.
8. Gently push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.

9. Using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU.

Figure 189: Connecting the Metal Retaining Bracket and AC Power Cord to the Three-Phase Wye PDU



10. Connect the wires to the AC terminal block on the three-phase wye AC PDU (Figure 190 on page 359). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, and insert each wire into the grounding point or input terminal, and tighten the screw.

    a. Insert the wire labeled **GND** into the grounding point.

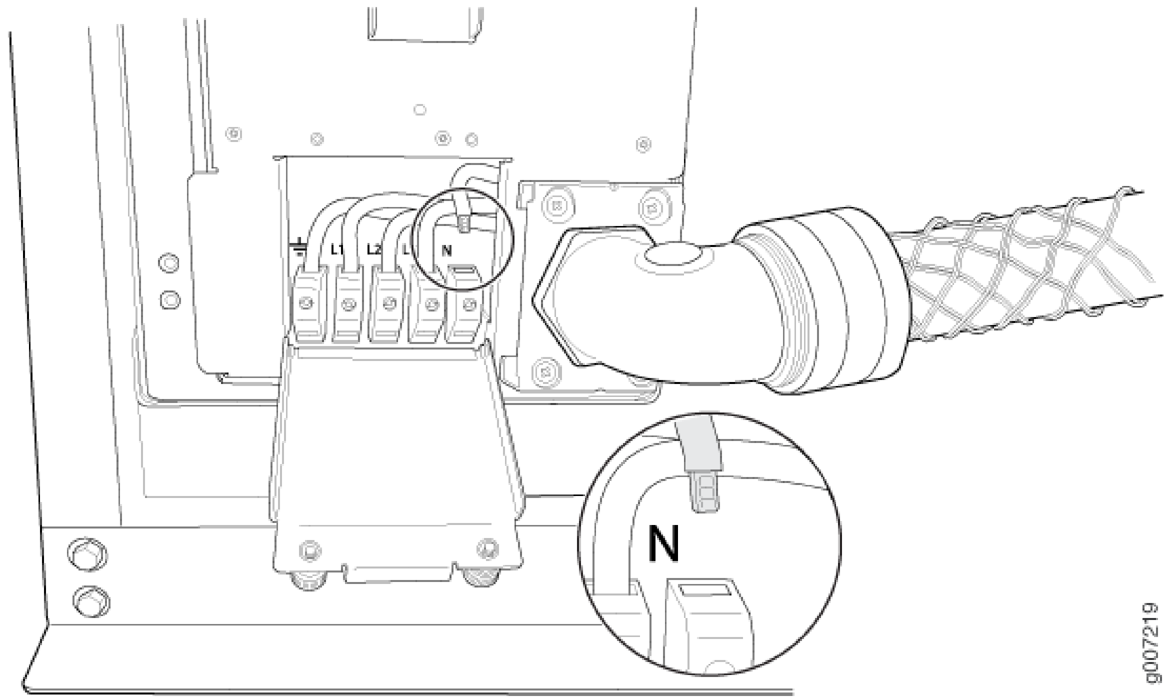
    b. Insert the wire labeled **L1** into the **L1** input terminal.

    c. Insert the wire labeled **L2** into the **L2** input terminal.

    d. Insert the wire labeled **L3** into the **L3** input terminal.

    e. Insert the wire labeled **N** into the **N** input terminal.

Figure 190: Connecting Grounding and AC Power Wires to a Three-Phase Wye AC PDU



11. Verify that the AC power and grounding wire connections are correct.
12. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
13. Verify that the AC power cord is not touching or blocking access to chassis components, and that it does not drape where people could trip on it.
14. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

15. Switch on the customer-site circuit breaker to the PDU.
16. Verify that the AC input (~) LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
17. Reinstall the PSMs into the PDU.

    a. Loosen the captive screws on the door covering the PSMs and open the door.

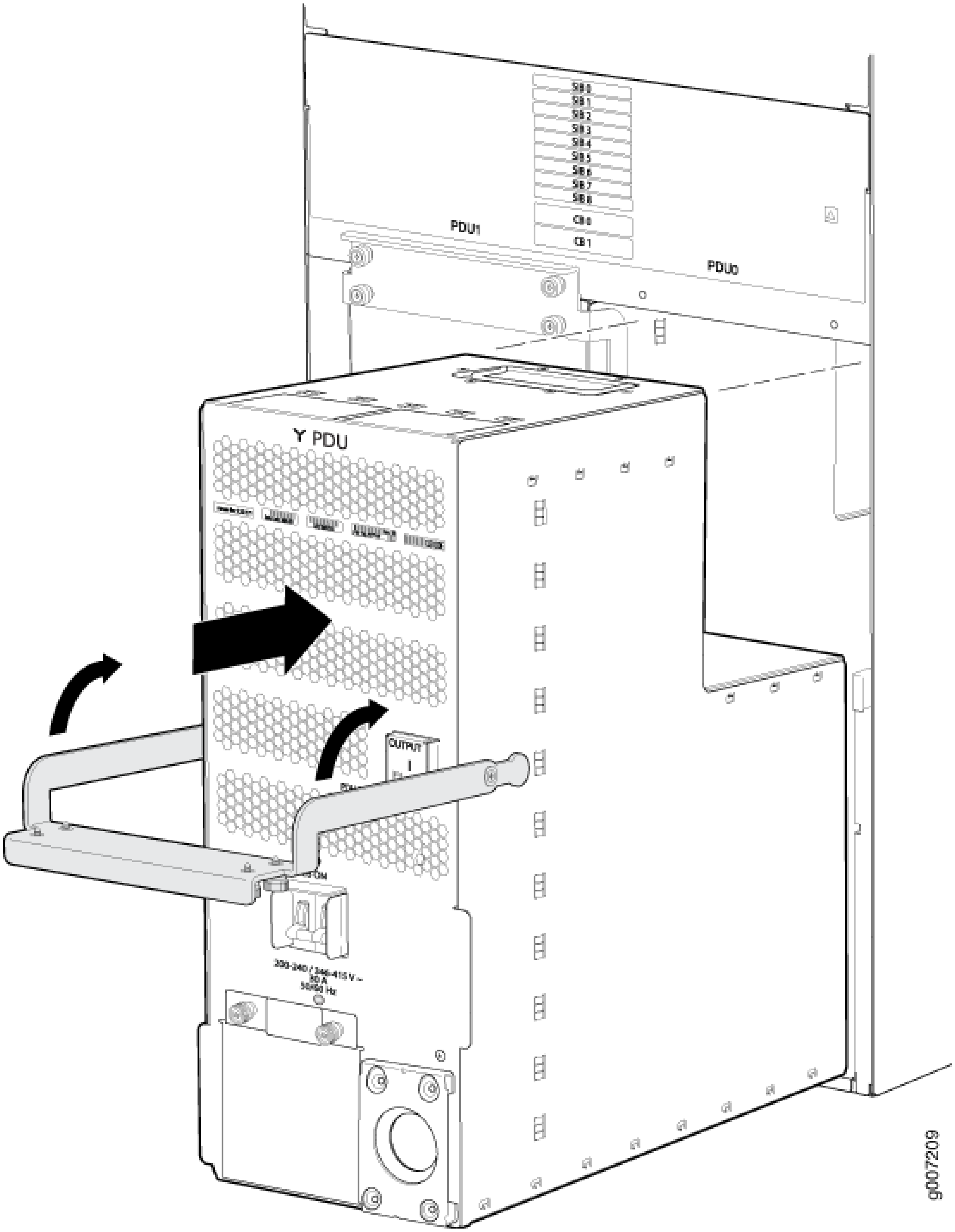
    b. Place one hand underneath the PSM to support it and slide it into the PSM slot.

    c. Push the ejector handle toward the PSM, and tighten the captive screw on the ejector handle to secure it to the PSM.

    d. Repeat these step for the other PSMs in the PDU.

18. Move the circuit breaker on the PDU to the on (|) position.
19. Verify that the **CB ON** LED on the PDU faceplate is lit steadily.
20. Move the power **OUTPUT** switch on the PDU to the on (|) position.
21. Verify that the **AC IN** LED and **DC IN** LED on the faceplate of each PSM in the PDU are lit steadily, indicating that each PSM is receiving power. Verify that the **FAULT** LED is off.
22. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Figure 191: Installing a Three-Phase Wye AC PDU



Replacing a PTX5000 Three-Phase Wye AC PDU Power Cord

IN THIS SECTION

Removing a PTX5000 Three-Phase Wye AC PDU Power Cord

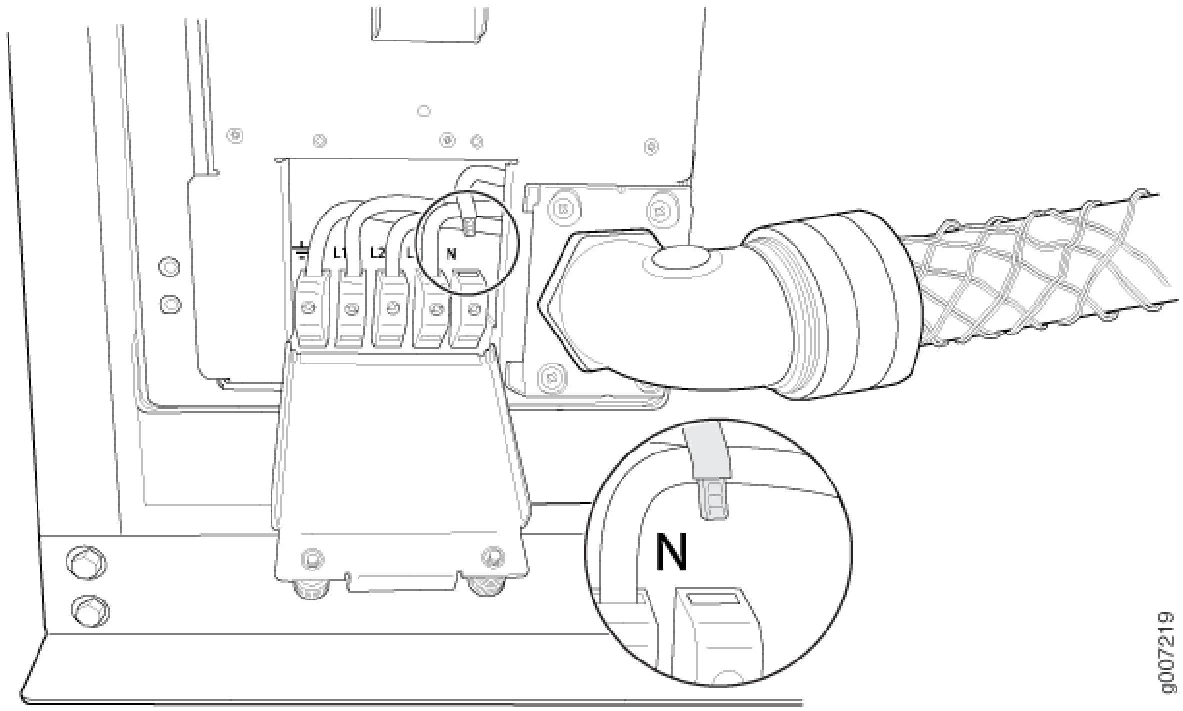
To remove a three-phase wye PDU power cord:

1. Switch off the customer-site circuit breakers to the PDU for the AC power cord being removed.
2. Move the circuit breaker and output power switch located on the faceplate of the PDU to the off (**O**) position.
3. Disconnect the AC power cord from the power source.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

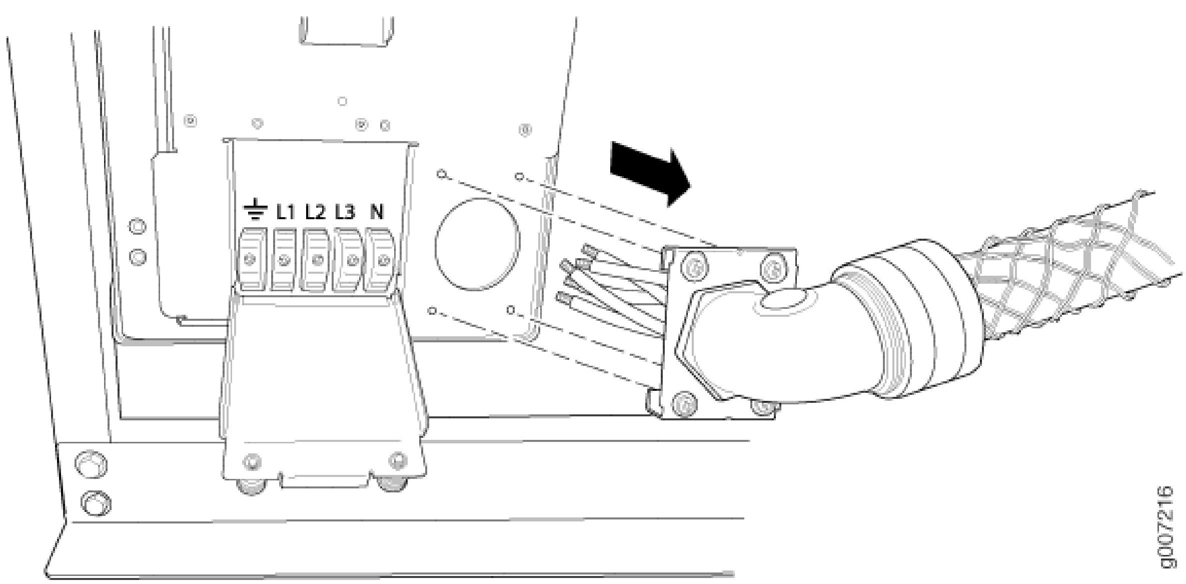
4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the **200-240 V/346-415 ~ 30 A 50-60 Hz** LED on the PDU faceplate is off.
5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
6. Open the door of the metal wiring compartment.
7. Disconnect the wires from the AC terminal block on the three-phase delta AC power supply (Figure 24). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal or grounding point screw, and remove each wire from the input terminal or grounding point.
   a. Remove the wire labeled **N** from the **N** input terminal.
   b. Remove the wire labeled **L3** from the **L3** input terminal.
   c. Remove the wire labeled **L2** from the **L2** input terminal.
   d. Remove the wire labeled **L1** from the **L1** input terminal.
   e. Remove the wire labeled **GND** into the grounding point.

Figure 192: Disconnecting AC Power Wires from a Three-Phase Wye AC Power Supply



8. Using a number 2 Phillips (+) screwdriver, loosen the captive screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 25.

Figure 193: Removing the Metal Retaining Bracket and AC Power Cord

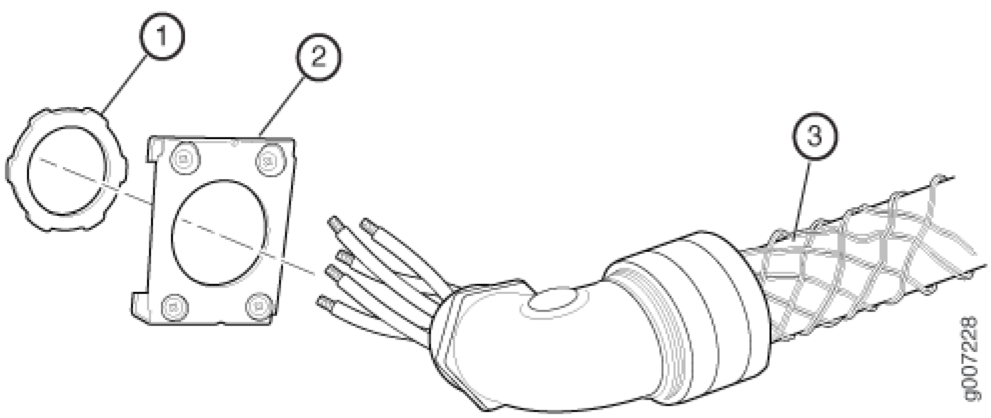


Installing a PTX5000 Three-Phase Wye AC PDU Power Cord

To install a three-phase wye AC power cord:

1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Switch the circuit breaker and power **OUTPUT** switch on the PDU to the off (**O**) position.
3. Gently push the AC power cord wires through the hole in the metal retaining bracket. Screw the retaining nut onto the AC power cord to secure the metal retaining bracket to the replacement AC power cord (see Figure 194 on page 364).

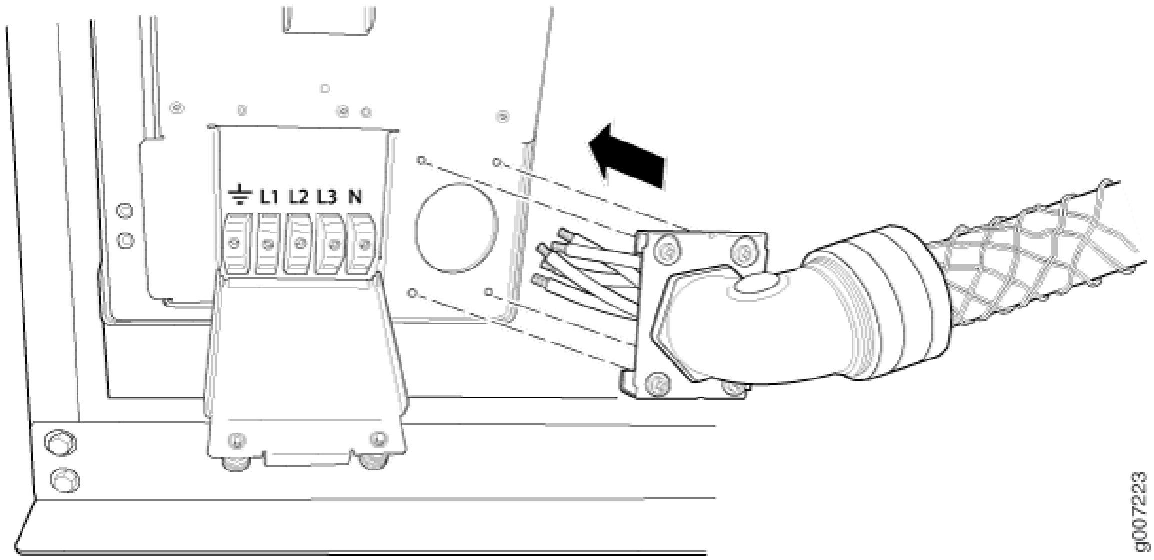
Figure 194: Attaching the Metal Retaining Bracket to the AC Power Cord



1– Retaining nut	3– Three-phase wye AC power cord
2– Metal retaining bracket	

4. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment. Open the metal door of the metal AC wiring compartment.
5. Gently push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment. Using a number 2 Phillips (+) screwdriver, use the four screws on the metal retaining bracket to secure the AC power cord to the PDU (see Figure 195 on page 365).

Figure 195: Connecting the Metal Retaining Bracket and AC Power Cord to the Three-Phase Wye PDU



6. Connect the wires to the AC terminal block on the three-wye AC PDU (Figure 196 on page 366). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen each of the input terminals or grounding point screws, insert each wire into the grounding point or input terminal, and tighten the screw.

   a. Insert the wire labeled **GND** into the grounding point.

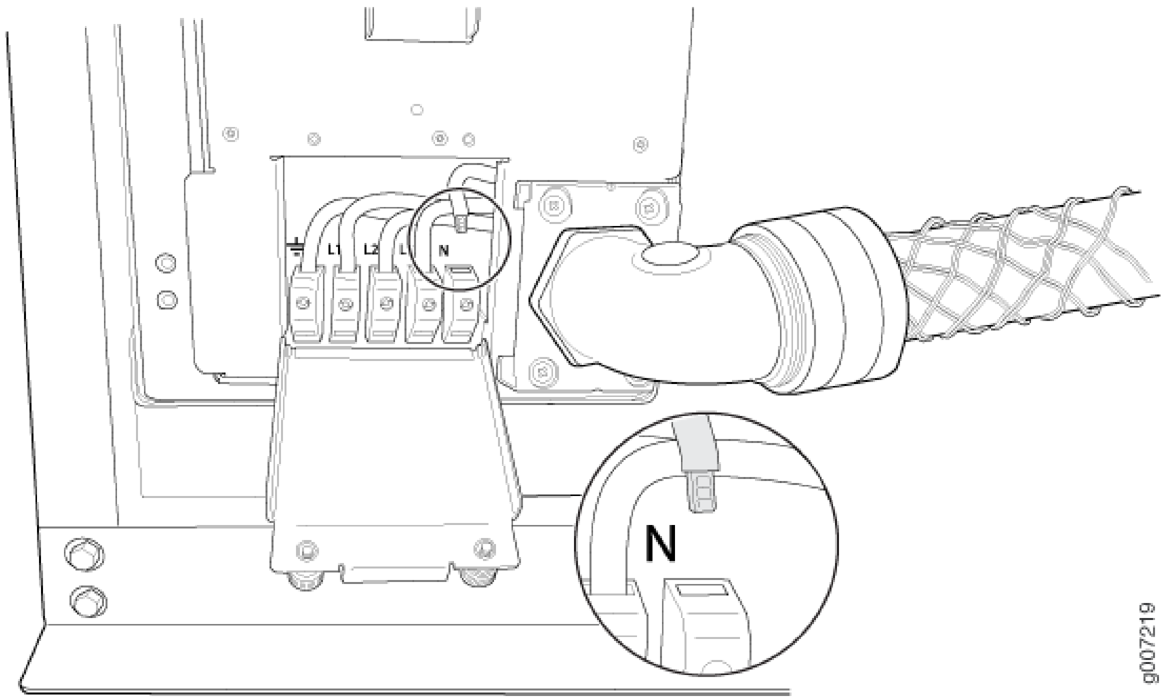
   b. Insert the wire labeled **L1** into the **L1** input terminal.

   c. Insert the wire labeled **L2** into the **L2** input terminal.

   d. Insert the wire labeled **L3** into the **L3** input terminal.

   e. Insert the wire labeled **N** into the **N** input terminal.

Figure 196: Connecting Grounding and AC Power Wires to a Three-Phase Wye AC Power Supply



7. Verify that the AC power and grounding wiring connections are correct.
8. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
9. Verify that the AC power cord is not touching or blocking access to PTX5000 components, and that it does not drape where people could trip on it.
10. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

11. Switch on the customer-site circuit breaker to the PDU.
12. Verify that the **200-240 V/346-415 ~ 30 A 50-60 Hz** LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
13. Move the circuit breaker on the PDU to the on (|) position.
14. Verify that the **CB ON** LED on the PDU faceplate is lit steadily.
15. Move the power **OUTPUT** switch on the PDU to the on (|) position.
16. Verify that the **AC IN** LED and **DC IN** LED on the faceplate of each PSM in the PDU are lit steadily, indicating that each PSM is receiving power. Verify that the **FAULT** LED is off.
17. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Replacing a PTX5000 Normal-Capacity AC PSM

IN THIS SECTION

Removing a PTX5000 AC PSM

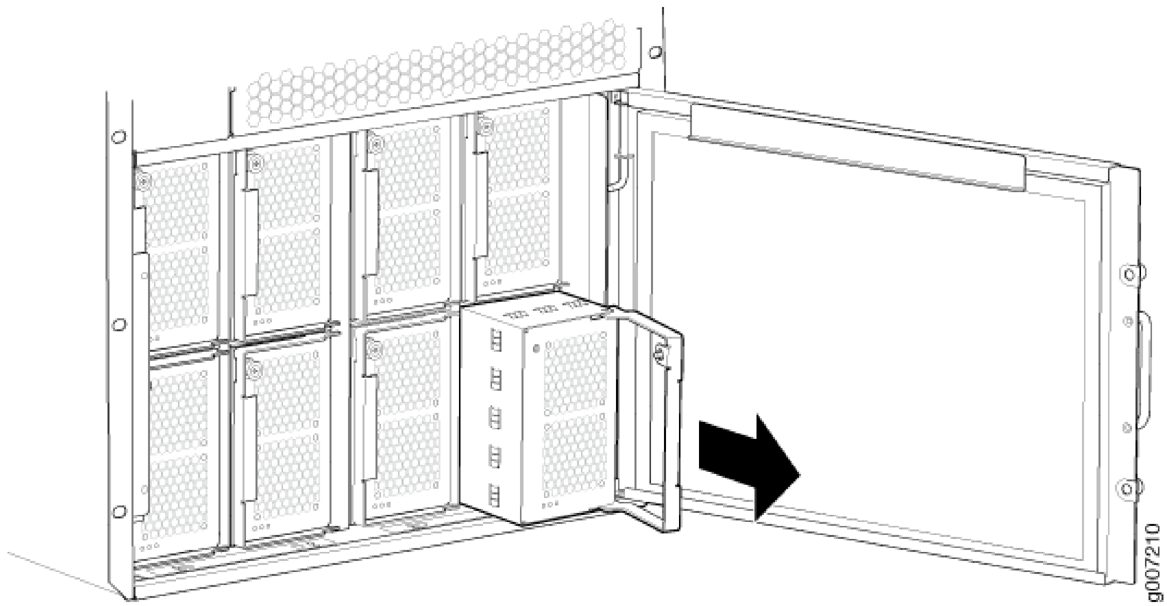
To remove an AC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the door covering the PSM and open the door.
3. Loosen the captive screw on the PSM ejector handle.
4. Grasp the ejector handle and pull to eject the PSM. Slide it halfway out of the chassis (see Figure 29).

> **CAUTION**: Each AC PSM weighs approximately 10.5 lb (4.8 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

5. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

Figure 197: Removing a PSM

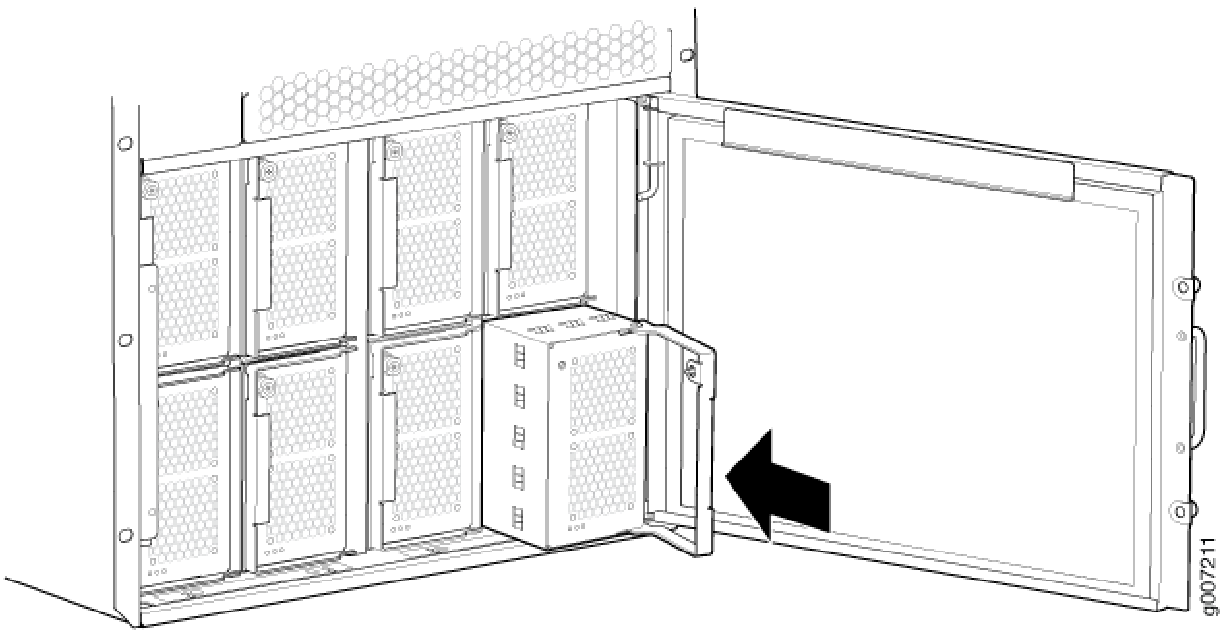


Installing a PTX5000 AC PSM

To install an AC PSM:

1. Using both hands, slide the PSM into the chassis until you feel resistance . Each AC PSM weighs approximately 10.5 lb (4.8 kg).
2. Push the ejector handle toward the PSM, and tighten the captive screw on the PSM.
3. Verify that the **AC IN OK** LED on the PSM faceplate is lit steadily, indicating that the PSM is receiving power.
4. Verify that the **DC IN OK** LED on the PSM faceplate is lit steadily.

Figure 198: Installing a PSM



Replacing a PTX5000 High Capacity Delta AC PDU

IN THIS SECTION

Removing a PTX5000 High Capacity Delta AC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The High Capacity Delta AC PDU weighs 63.3 lb (28.7 kg).

To remove a High Capacity Delta AC PDU:

1. Switch off the customer-site circuit breakers to the PDU that is being removed.
2. Move the power switch located on the faceplate of the PDU to the standby
   (

⏻
) position.

3. Disconnect the AC power cord from the power source.

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

4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the AC input LED on the PDU faceplate is off.
5. Remove the power supply modules (PSMs) in the front of the chassis from the PDU to be removed (see Figure 31).

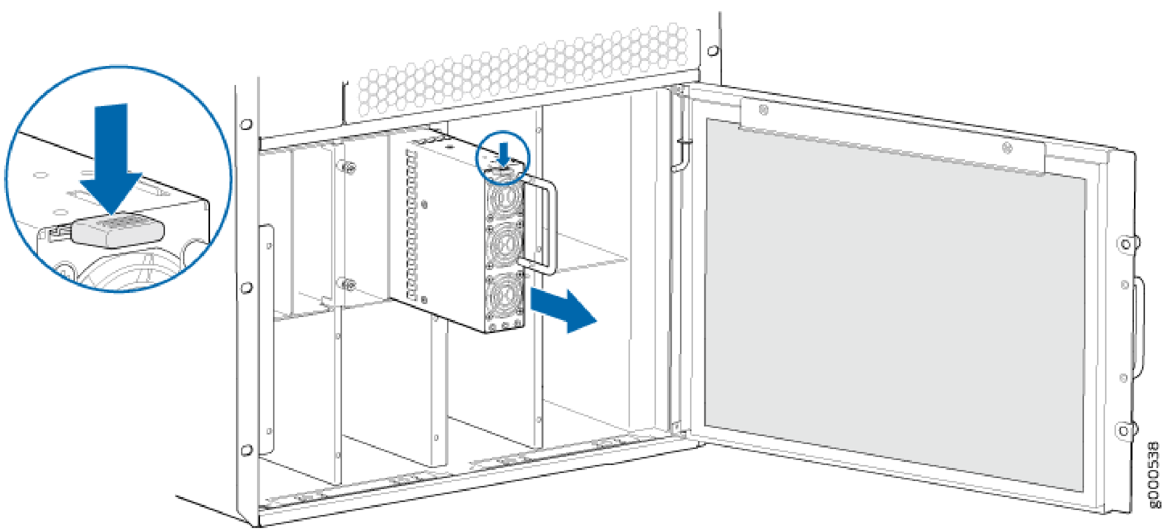
   a. Loosen the captive screws on the door covering the PSMs and open the door.

   b. Press down the locking tab and then pull out the PSM by using the ejector handle. Grasp the ejector handle and pull to eject the PSM.

   c. Slide the PSM halfway out of the chassis. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

   d. Repeat these steps for the remaining PSMs in the PDU.

Figure 199: Removing the High Capacity AC Power Supply Modules



WARNING: Each High Capacity AC PSM weighs approximately 9.8 lb (4.5 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
7. Open the door of the metal wiring compartment.
8. Disconnect the wires from the AC terminal block on the High Capacity Delta AC PDU (Figure 32). Using a 5/16-in. (8-mm) slotted screwdriver, loosen the input terminal screws and the grounding point screw, and remove each wire from the input terminal and the grounding point.

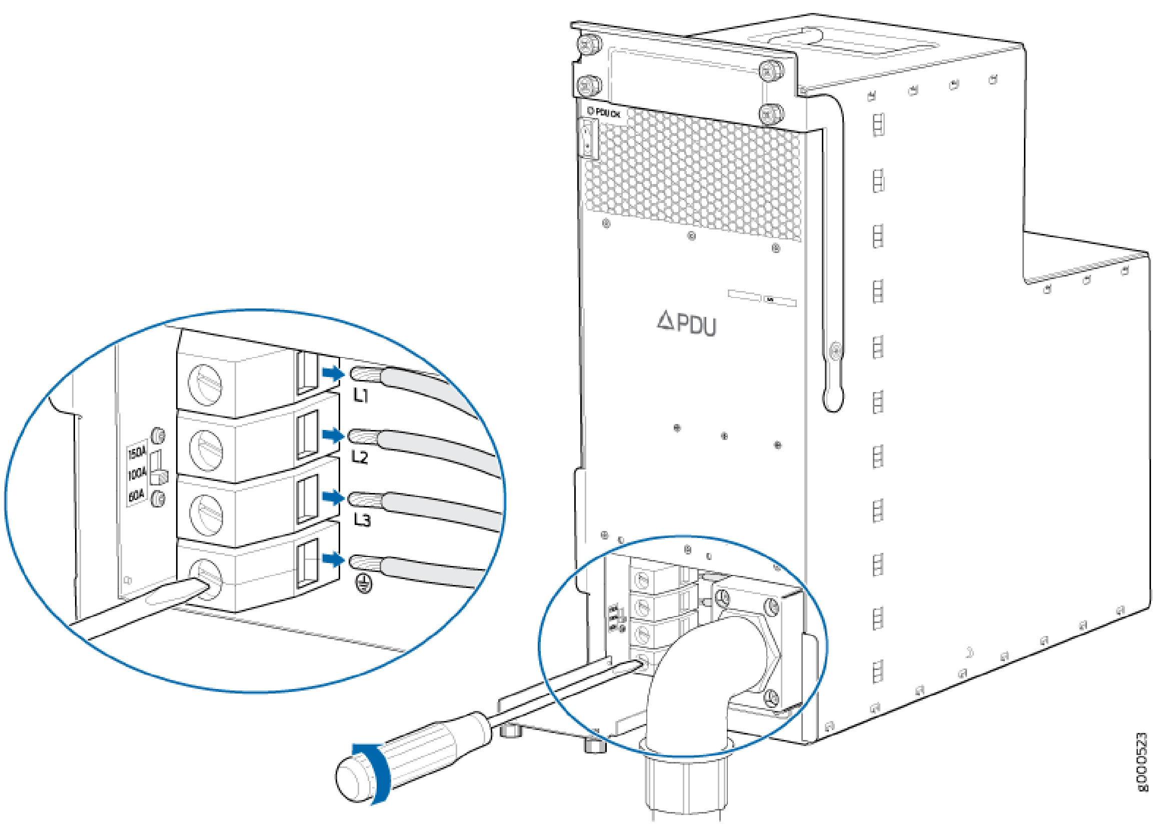
   a. Remove the wire labeled **L3** from the **L3** input terminal.

   b. Remove the wire labeled **L2** from the **L2** input terminal.

   c. Remove the wire labeled **L1** from the **L1** input terminal.

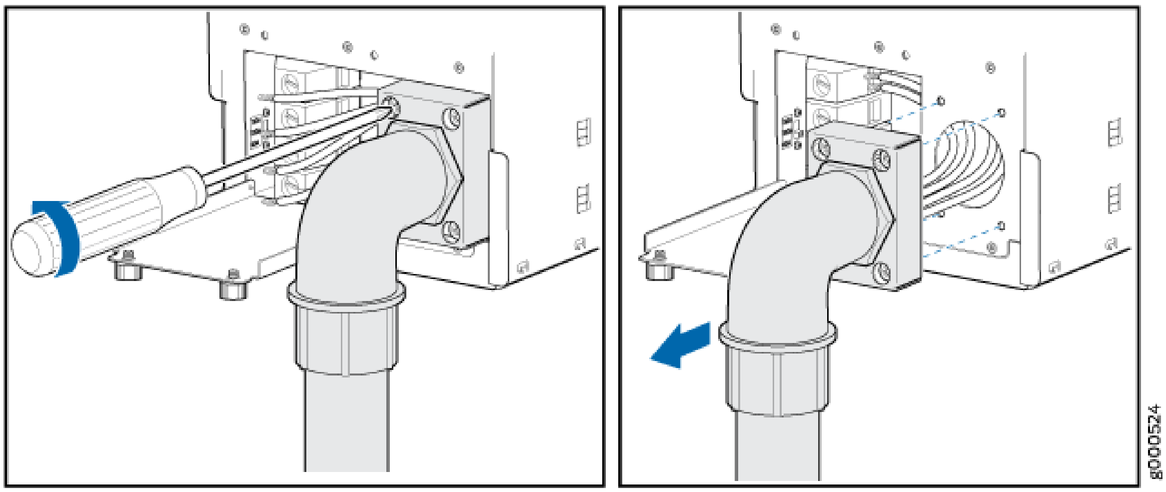
   d. Remove the wire labeled **GND** from the grounding point.

Figure 200: Disconnecting AC Power Wires from a High Capacity Delta AC PDU



9. Using a number 2 Phillips (+) screwdriver, loosen the captive screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 33.

Figure 201: Removing the Metal Retaining Bracket and AC Power Cord

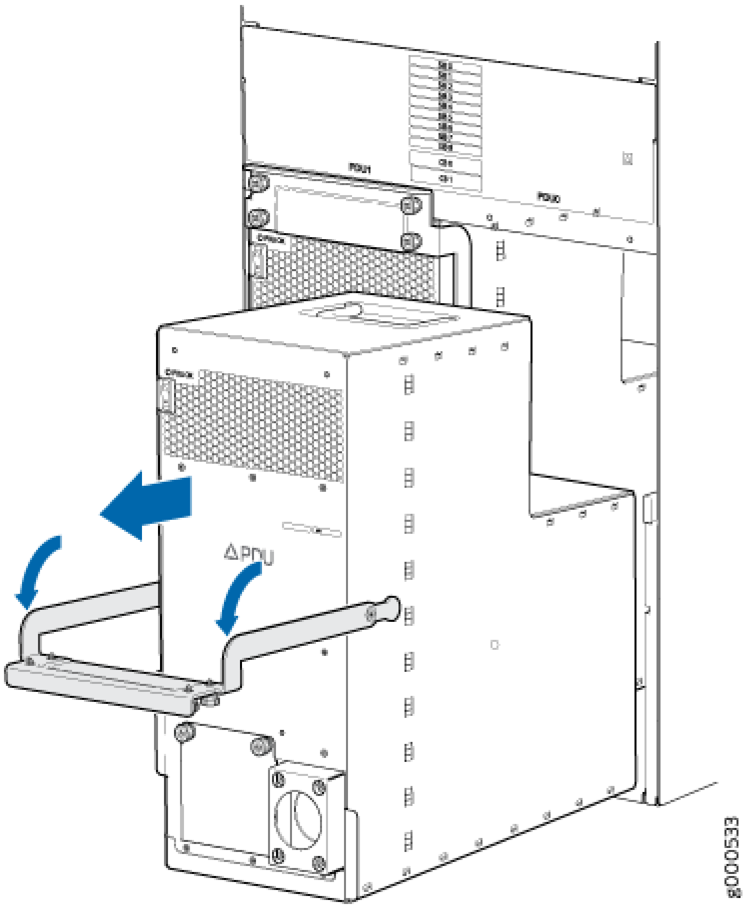


10. Loosen the four captive screws attaching the front PDU handle to the PDU and chassis.
11. Grasp the front PDU handle on the PDU faceplate and pull firmly down toward you. Slide the PDU halfway out of the chassis until you can reach the installation handle located on top of the PDU. (See Figure 34).

> **WARNING**: Each PDU weighs approximately 63.3 lb (28.7 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

12. Use the installation handle to slide the PDU completely out of the chassis.

Figure 202: Removing a High Capacity Delta AC PDU



13. Use the captive screws on the metal retaining bracket to reattach it to the PDU being removed.

WARNING: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

CAUTION: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

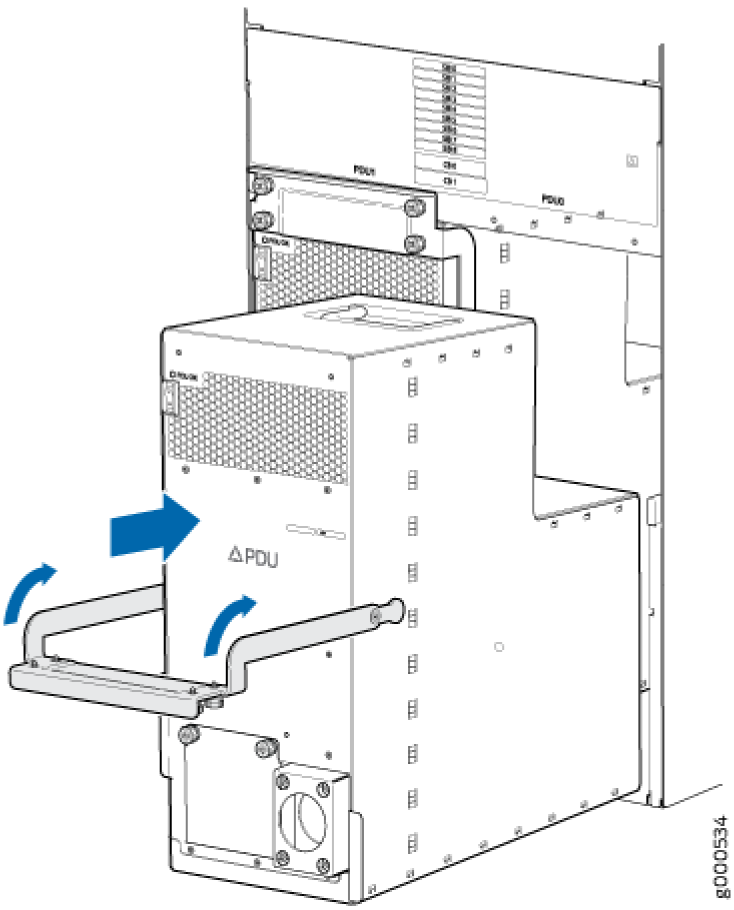
Installing a PTX5000 High Capacity Delta AC PDU

To install a High Capacity Delta AC PDU:

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

2. Move the power switch located on the faceplate of the PDU to the standby (⏻) position.
3. Grasp the front installation handle and top installation handle, and insert the PDU into the PDU slot. See Figure 203 on page 374.

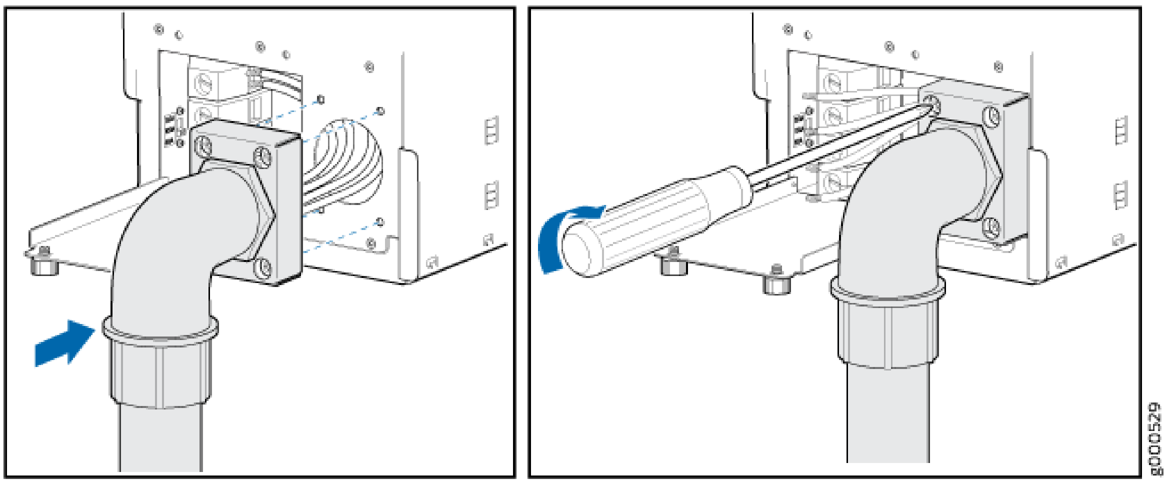
Figure 203: Installing a High Capacity Delta AC PDU



4. Using both hands, slide the PDU into the chassis until you feel resistance.
5. Push the front installation handle up toward the PDU, and secure the handle with the captive screws.
6. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws that secure the metal retaining bracket to the newly installed PDU. Remove the metal retaining bracket from the PDU.
7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment of the replacement PDU. Open the metal door of the metal AC wiring compartment.

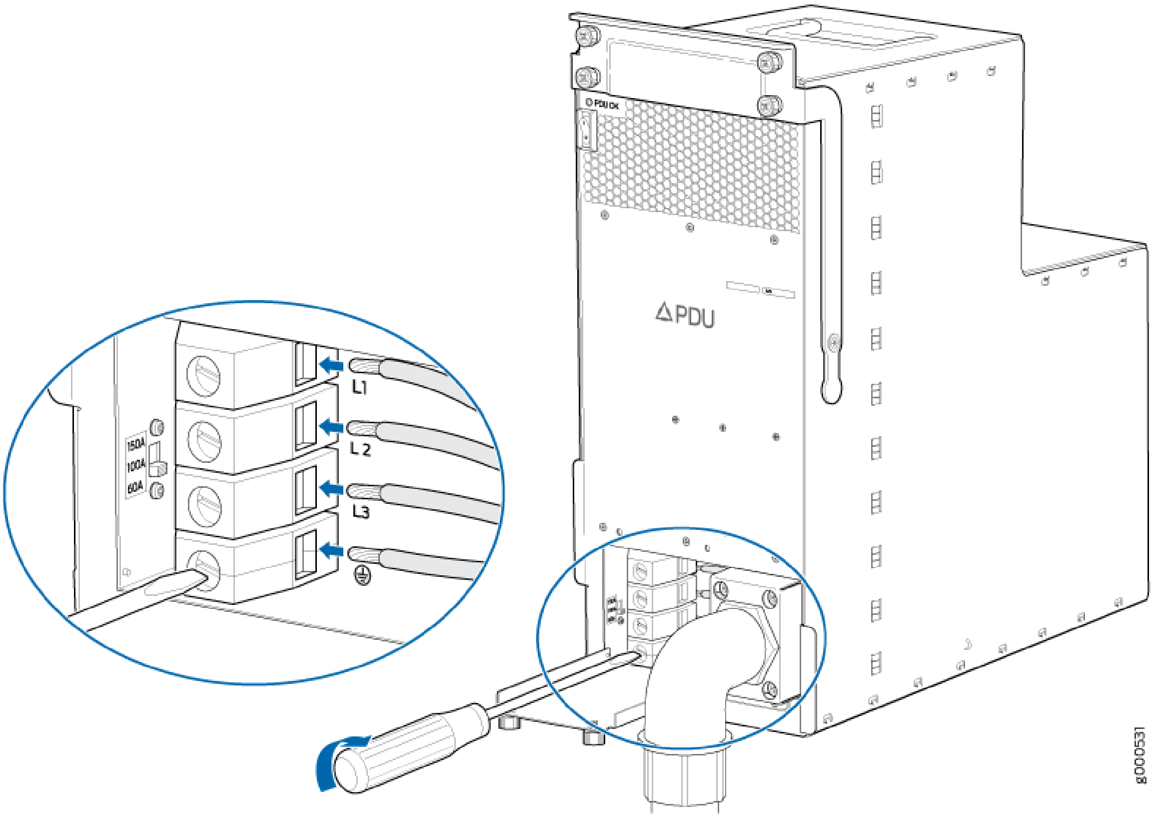
8. Gently push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.
9. Using a number 2 Phillips (+) screwdriver, use the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU. See Figure 204 on page 375.

Figure 204: Connecting the Metal Retaining Bracket and AC Power Cord to the High Capacity Delta PDU



10. Connect the wires to the AC terminal block on the High Capacity Delta AC PDU (Figure 205 on page 376). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal screws and the grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screws.
    a. Insert the wire labeled **GND** into the grounding point.
    b. Insert the wire labeled **L1** into the **L1** input terminal.
    c. Insert the wire labeled **L2** into the **L2** input terminal.
    d. Insert the wire labeled **L3** into the **L3** input terminal.

Figure 205: Connecting Grounding and AC Power Wires to a High Capacity Delta AC Power Supply



11. Verify that the AC power and grounding wiring connections are correct.
12. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
13. Verify that the AC power cord does not touch or block access to chassis components, and that it does not drape where people could trip on it.
14. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

15. Switch on the customer-site circuit breaker to the PDU.
16. Verify that the AC input LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
17. Reinstall the PSMs into the PDU.
    a. Loosen the captive screws on the door covering the PSMs and open the door.
    b. Place one hand underneath the PSM to support it and slide it into the PSM slot.

c. Push the ejector handle toward the PSM, and tighten the captive screw on the ejector handle to secure it to the PSM.

d. Repeat these steps for the other PSMs in the PDU.

18. Move the power switch on the PDU to the on (|) position.
19. Verify that the input **OK** LED on the faceplate of each PSM in the PDU is lit steadily, which indicates that each PSM is receiving power. Verify that the fault
(
⚠
) LED is off.
20. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, which indicates that the PDU is functioning normally.

Replacing a PTX5000 High Capacity Wye AC PDU

IN THIS SECTION

Removing a PTX5000 High Capacity Wye AC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The High Capacity Wye AC PDU weighs 63.3 lb (28.7 kg).

To remove a High Capacity Wye AC PDU:

1. Switch off the customer-site circuit breakers to the PDU that is being removed.
2. Move the power switch located on the faceplate of the PDU to the standby
(
⏻
) position.
3. Disconnect the AC power cord from the power source.

NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process. Verify that the AC In (~) LED on the PDU faceplate is off.
5. Remove the power supply modules (PSMs) in the front of the chassis from the PDU to be removed (see Figure 38).

   a. Loosen the captive screws on the door covering the PSMs and open the door.

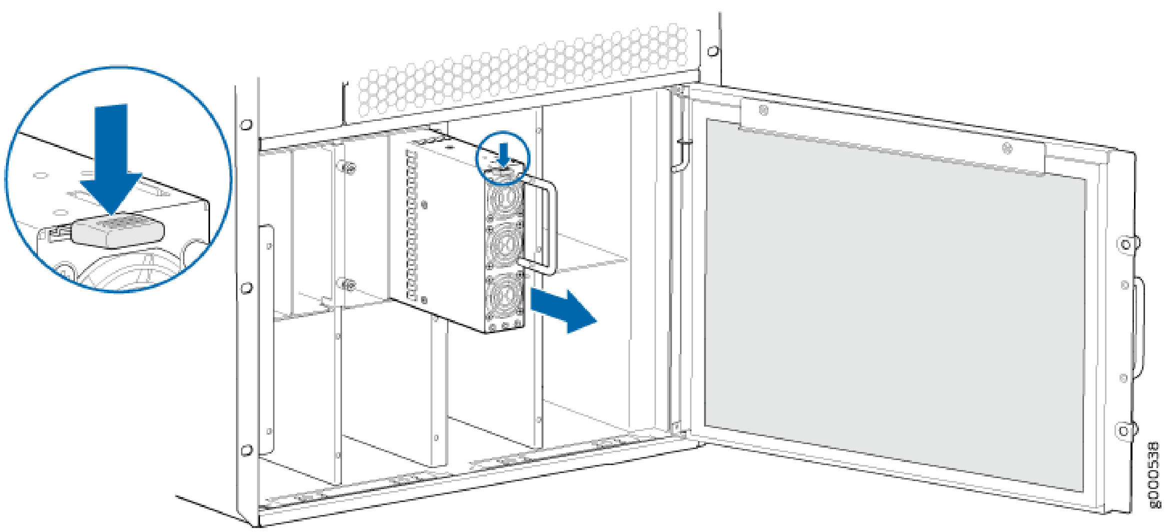
   b. Press down the locking tab and then pull out the PSM by using the ejector handle.

   c. Grasp the ejector handle and pull to eject the PSM. Slide the PSM halfway out of the chassis.

   d. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

   e. Repeat these steps for the remaining PSMs in the PDU.

Figure 206: Removing the High Capacity AC Power Supply Modules



WARNING: Each High Capacity AC PSM weighs approximately 9.8 lb (4.5 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.

7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws to the metal wiring compartment door. Open the door of the metal wiring compartment. Disconnect the wires from the AC terminal block on the High Capacity Wye AC PDU (Figure 39). Using 7/32-in. (5.5-mm) slotted screwdriver, loosen the input terminal screws and the grounding point screw, and remove each wire from the input terminal points and the grounding point.

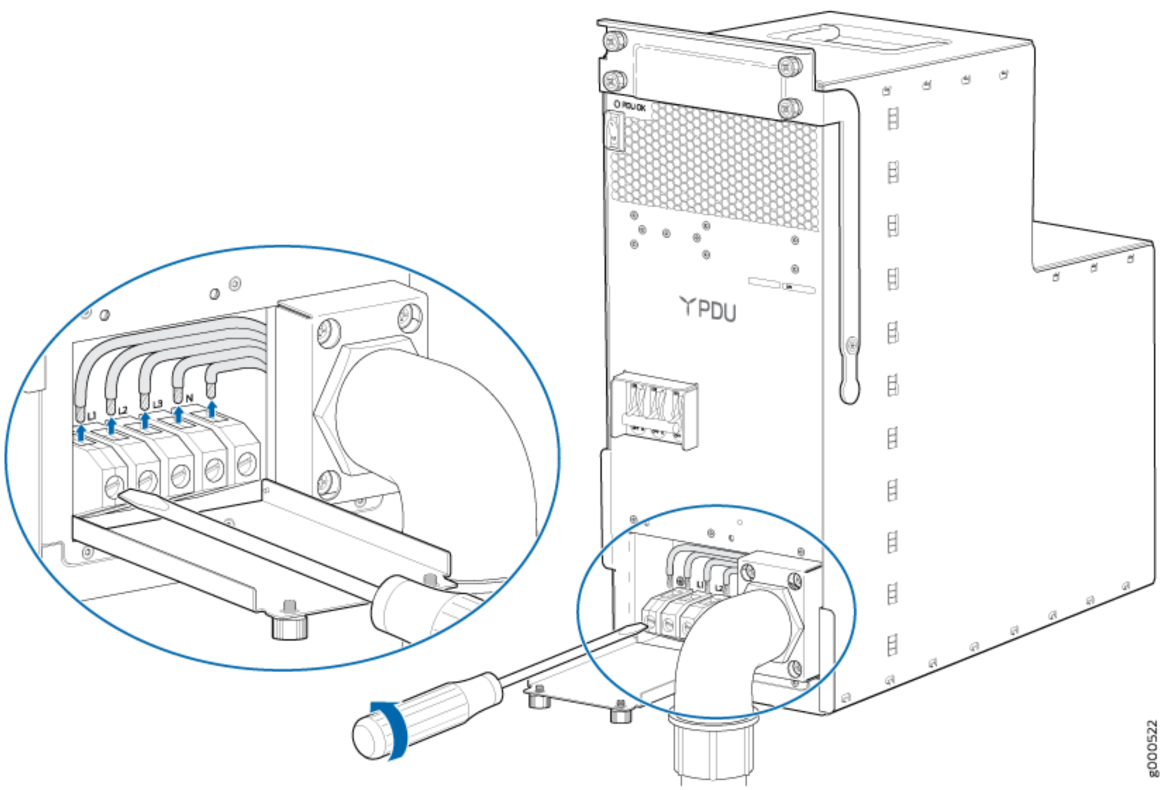
    a. Remove the wire labeled **L3** from the **L3** input terminal.

    b. Remove the wire labeled **L2** from the **L2** input terminal.

    c. Remove the wire labeled **L1** from the **L1** input terminal.

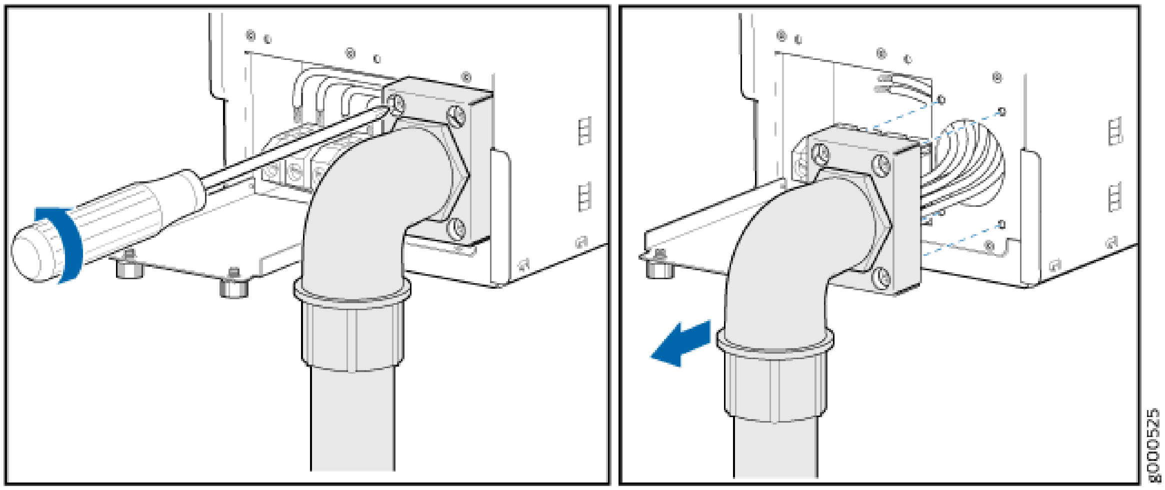
    d. Remove the wire labeled **GND** into the grounding point.

Figure 207: Disconnecting AC Power Wires from a High Capacity Wye AC PDU



8. Using a number 2 Phillips (+) screwdriver, loosen the screws that secure the metal retaining bracket and AC power cord to the PDU. While gently removing the wires of the AC power cord from the wiring compartment, remove the metal retaining bracket and AC power cord from the PDU. See Figure 40.

Figure 208: Removing the Metal Retaining Bracket and AC Power Cord



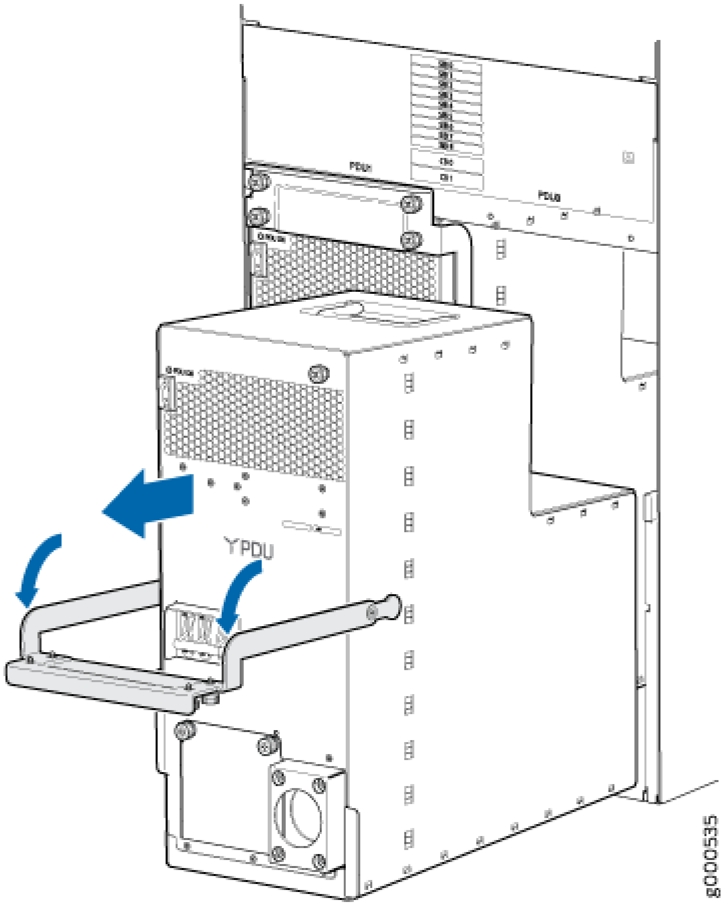
9. Loosen the four captive screws attaching the front PDU handle to the PDU and chassis.
10. Grasp the front installation handle on the PDU faceplate and pull the handle firmly down toward you. Slide the PDU halfway out of the chassis until you can reach the top installation handle. (See Figure 41.)
11. Use the top and front installation handle to slide the PDU completely out of the chassis.

> **CAUTION**: Each PDU weighs approximately 63.3 lb (28.7 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

> **WARNING**: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

> **CAUTION**: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

Figure 209: Removing a High Capacity Wye AC PDU

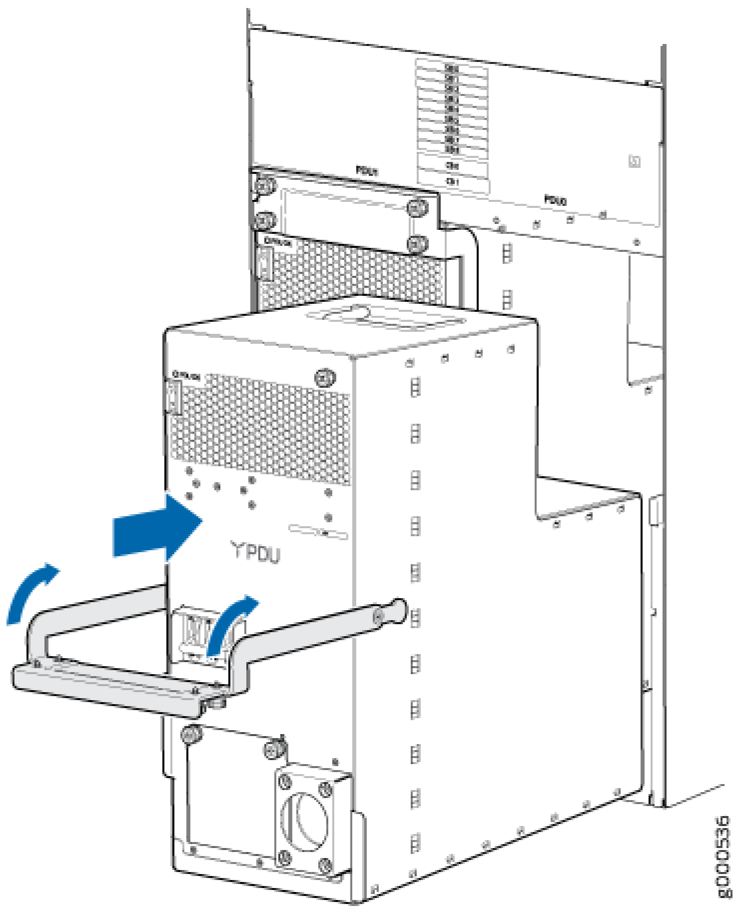


Installing a PTX5000 High Capacity Wye AC PDU

To install a High Capacity Wye AC PDU:

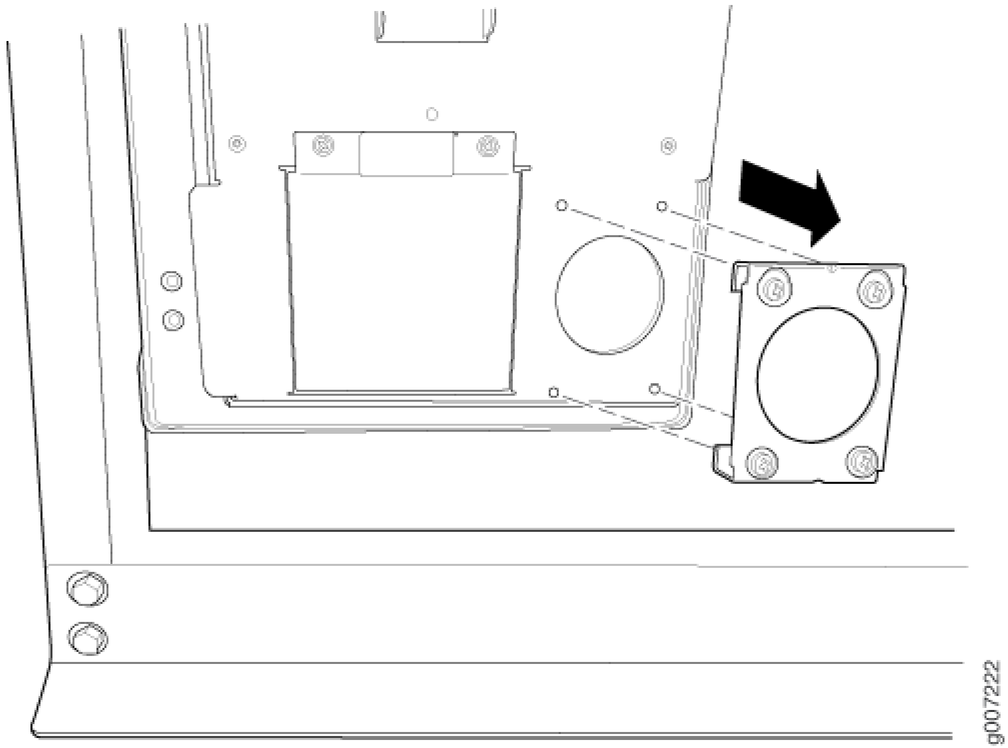
1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Move the power switch located on the faceplate of the PDU to the standby (⏻) position.
3. Grasping both the front and top installation handles, insert the replacement PDU into the PDU slot. See Figure 210 on page 382.

Figure 210: Installing a High Capacity Wye AC PDU



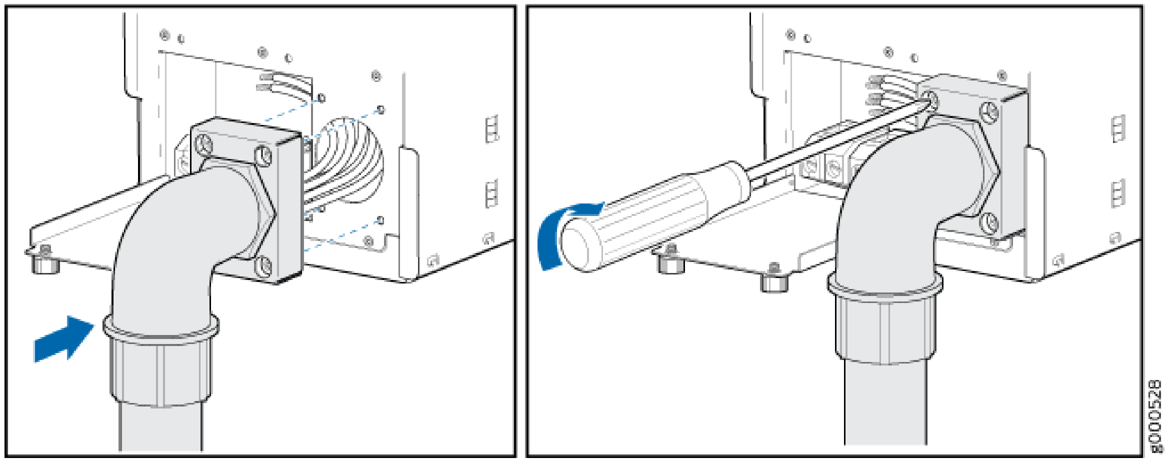
4. Using both hands, slide the PDU into the chassis until you feel resistance.
5. Push the front installation handle up toward the PDU. Using a number 2 Phillips (+) screwdriver, tighten the captive screws on the handle.
6. Using a number 2 Phillips (+) screwdriver, loosen the four captive screws on the metal retaining bracket located on the lower right of the newly installed PDU. Remove the metal retaining bracket from the PDU. See Figure 211 on page 383.

Figure 211: Removing the Metal Retaining Bracket from the High Capacity Wye PDU



7. Using a number 2 Phillips (+) screwdriver, loosen the two captive screws on the metal AC wiring compartment of the replacement PDU. Open the metal door of the metal AC wiring compartment.
8. Gently push the wires of the AC power cord into the area for the metal retaining bracket, and pull the wires to the left toward the metal AC wiring compartment.
9. Using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal retaining bracket to secure the AC power cord to the PDU. See Figure 212 on page 384.

Figure 212: Connecting the Metal Retaining Bracket and AC Power Cord to the High Capacity Wye PDU



10. Connect the wires to the AC terminal block on the High Capacity Wye AC PDU (Figure 213 on page 385). Using a 1/5-in. (5.5-mm) slotted screwdriver, loosen the input terminal screws and the grounding point screw, and insert each wire into the grounding point or input terminal, and tighten the screw.

    a. Insert the wire labeled **GND** into the grounding point.

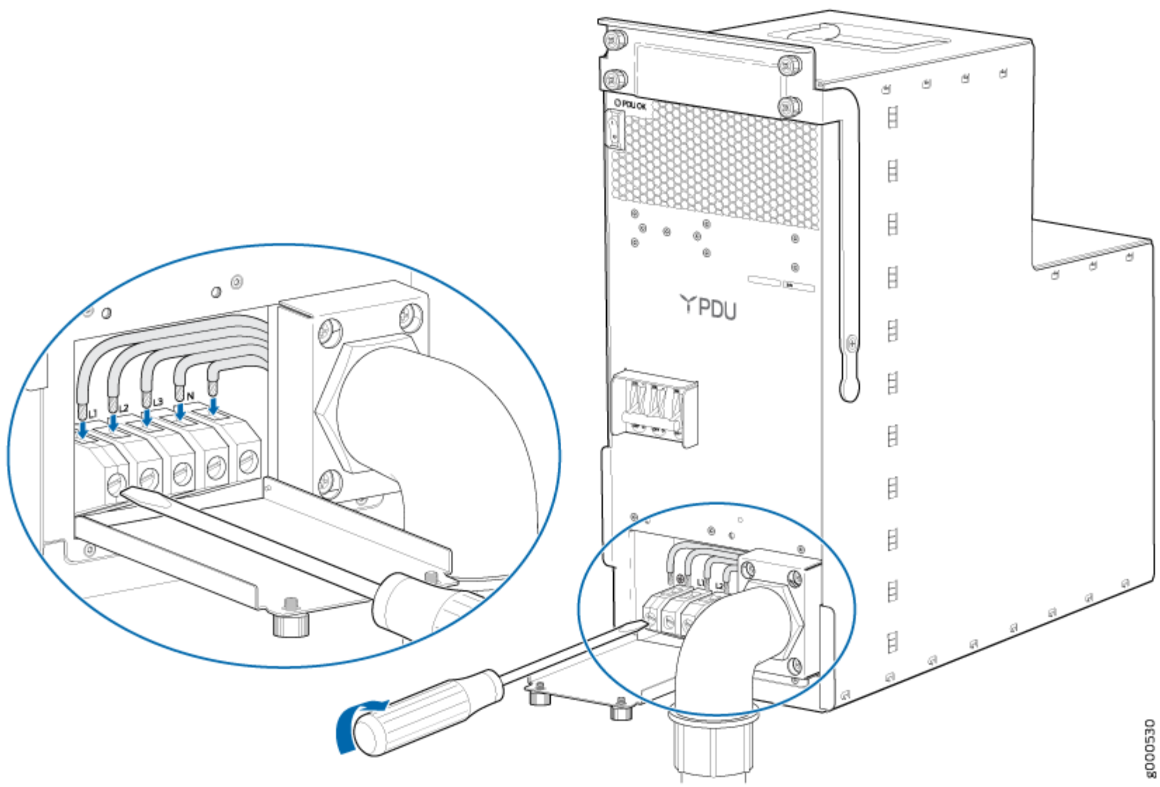
    b. Insert the wire labeled **L1** into the **L1** input terminal.

    c. Insert the wire labeled **L2** into the **L2** input terminal.

    d. Insert the wire labeled **L3** into the **L3** input terminal.

    e. Insert the wire labeled **N** into the **N** input terminal.

Figure 213: Connecting Grounding and AC Power Wires to a High Capacity Wye AC PDU



11. Verify that the AC power and grounding wire connections are correct.
12. Using a number 2 Phillips (+) screwdriver, tighten the two captive screws on the metal AC wiring compartment.
13. Verify that the AC power cord is does not touch or block access to chassis components, and that it does not drape where people could trip on it.
14. Reconnect the AC power cord to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

15. Switch on the customer-site circuit breaker to the PDU.
16. Verify that the AC input (~) LED on the PDU faceplate is lit steadily, indicating that the PDU is receiving voltage.
17. Reinstall the PSMs into the PDU.
    a. Loosen the captive screws on the door covering the PSMs and open the door.
    b. Place one hand underneath the PSM to support it and slide it into the PSM slot.
    c. Push the ejector handle toward the PSM, and tighten the captive screw on the ejector handle to secure it to the PSM.

d. Repeat these steps for all the other PSMs in the PDU.

18. Move the circuit breaker on the PDU to the on (|) position.
19. Verify that the **CB OK** LED on the PDU faceplate is lit steadily.
20. Move the power switch on the PDU to the on (|) position.
21. Verify that the input **OK** LED on the faceplate of each PSM in the PDU is lit steadily, which indicates that each PSM is receiving power. Verify that the fault
(
⚠
) LED is off.
22. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Replacing a PTX5000 High Capacity Single-Phase AC PDU

IN THIS SECTION

Removing a PTX5000 Single-Phase AC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The Single-Phase AC PDU weighs 60.5 lb (27.4 kg).

To remove a Single-Phase AC PDU:

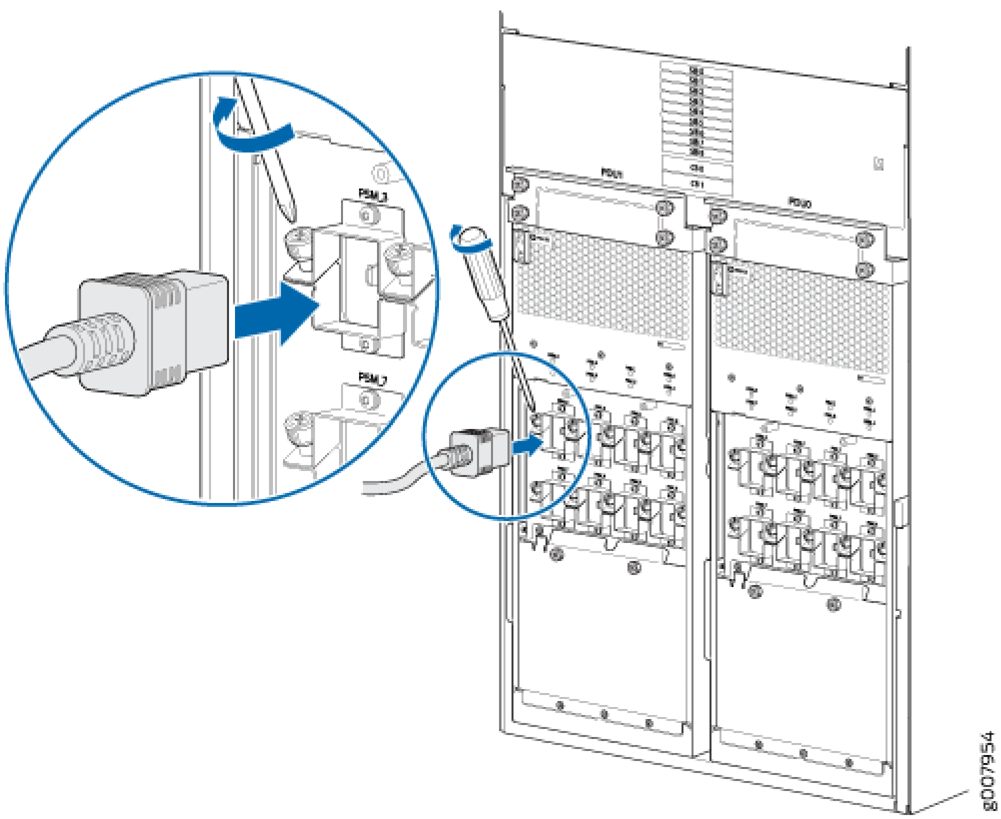
1. Switch off the customer-site circuit breakers to the PDU that is being removed.
2. Move the power switch located on the faceplate of the PDU to the standby
(
⏻
) position.
3. Disconnect the AC power cords from the power source.

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

4. Make sure that the voltage across the AC power cord is 0 V and that there is no chance that the AC power cord might become active during the removal process.
5. If 20-A input cord is used, then use a number 2 Phillips (+) screwdriver to loosen the screw on the 20-A input terminal and plug in the connector (see Figure 46). Tighten the screw after plugging in the connector.

> **NOTE**: The 30-A connector does not have a clamp, it has its own integral clip for locking the connector.

Figure 214: Disconnecting 20-A inputs to High Capacity Single-Phase AC PDU

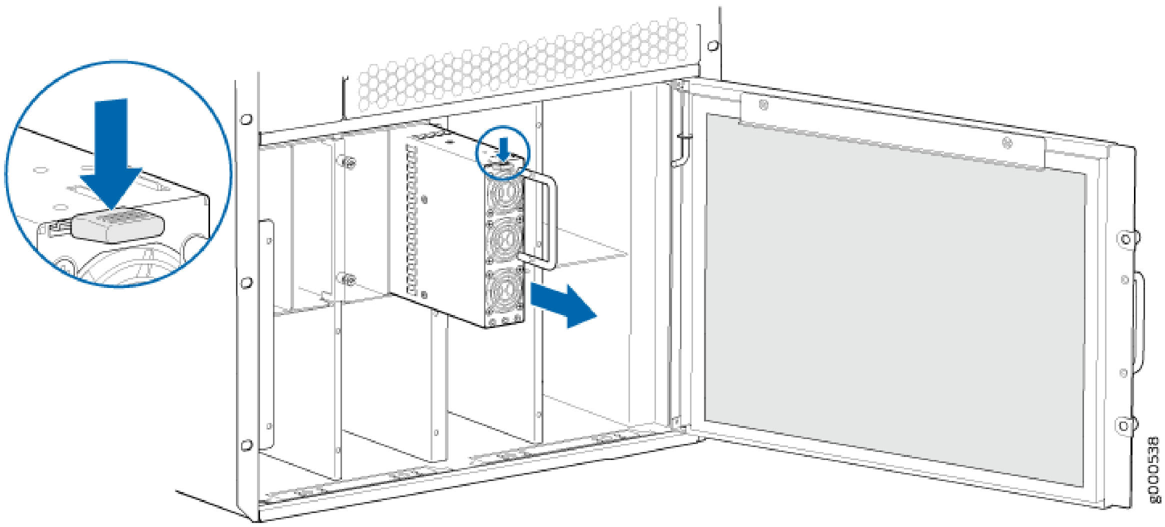


6. Remove the power supply modules (PSMs) in the front of the chassis from the PDU to be removed (see Figure 47).
   a. Loosen the captive screws on the door covering the PSMs and open the door.
   b. Press down the locking tab and then pull out the PSM by using the ejector handle.
   c. Grasp the ejector handle and pull to eject the PSM. Slide the PSM halfway out of the chassis.

d. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

e. Repeat these steps for the remaining PSMs in the PDU.

Figure 215: Removing the High Capacity AC Power Supply Modules



> **WARNING**: Each High Capacity AC PSM weighs approximately 14.3 lb (6.5 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

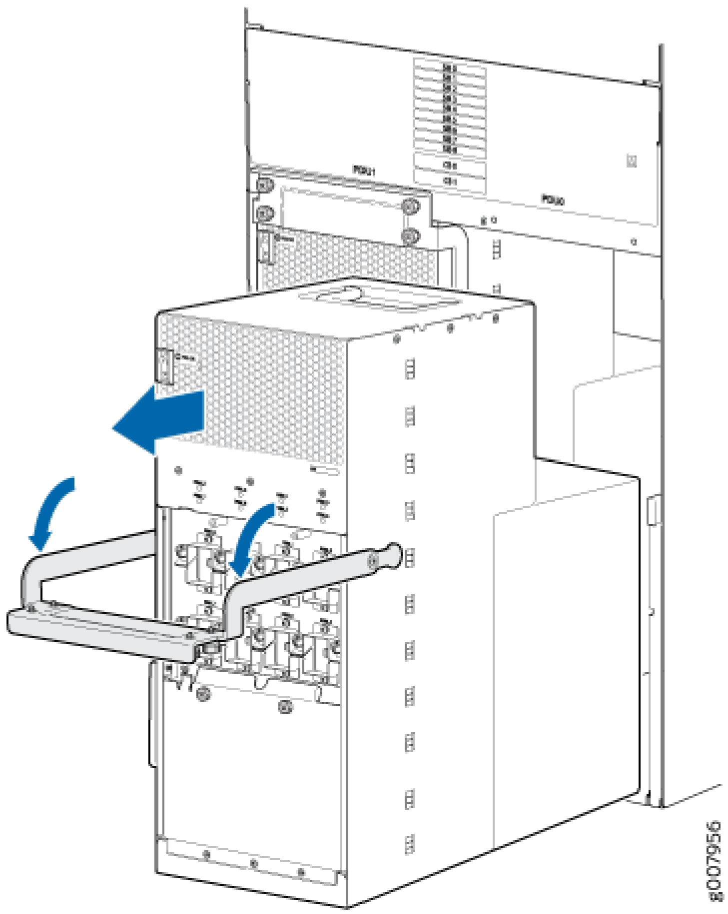
7. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
8. Loosen the four captive screws attaching the front PDU handle to the PDU and chassis.
9. Grasp the front installation handle on the PDU faceplate and pull the handle firmly down toward you. Slide the PDU halfway out of the chassis until you can reach the top installation handle. (See Figure 48.)
10. Use the top and front installation handle to slide the PDU completely out of the chassis.

> **CAUTION**: Each PDU weighs approximately 60.5 lb (27.4 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

> **WARNING**: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

CAUTION: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

Figure 216: Removing a High Capacity Single-Phase AC PDU



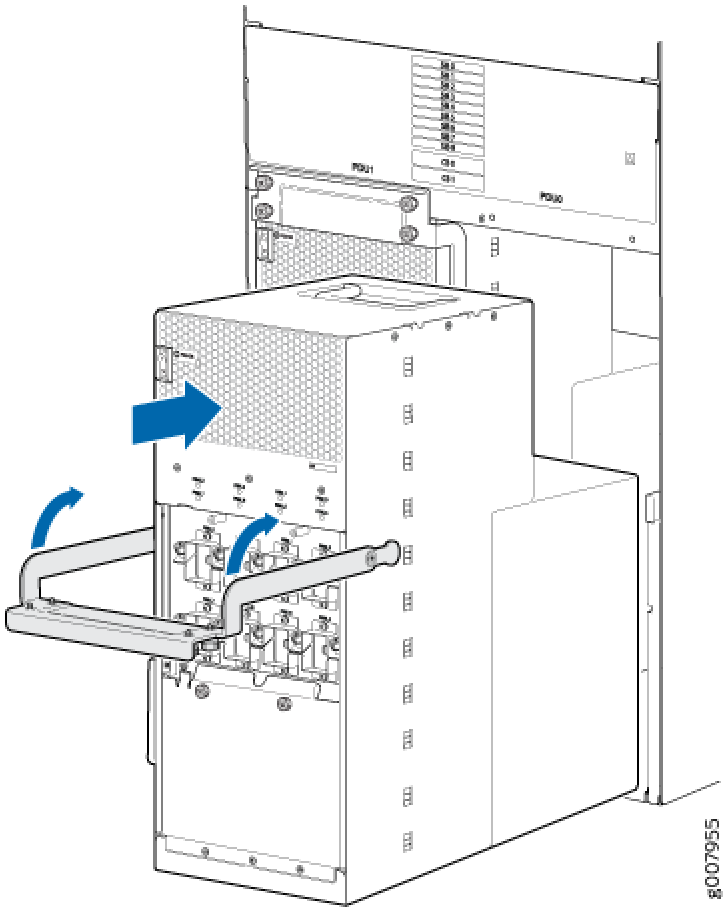
Installing a PTX5000 High Capacity Single-Phase AC PDU

To install a Single-Phase AC PDU:

1. Ensure that the voltage across the AC power source is 0 V and that there is no chance that the voltage might become active during installation.
2. Move the power switch located on the faceplate of the PDU to the standby
   (
   ⏻
) position.

3. Grasping both the front and top installation handles, insert the replacement PDU into the PDU slot. See Figure 217 on page 390.

Figure 217: Installing a Single-Phase AC PDU



4. Using both hands, slide the PDU into the chassis until you feel resistance.
5. Push the front installation handle up toward the PDU. Using a number 2 Phillips (+) screwdriver, tighten the captive screws on the handle.
6. Reinstall the PSMs into the PDU.

   a. Loosen the captive screws on the door covering the PSMs and open the door.

   b. Place one hand underneath the PSM to support it and slide it into the PSM slot.

   c. Push the ejector handle toward the PSM, and tighten the captive screw on the ejector handle to secure it to the PSM.

   d. Repeat these steps for all the other PSMs in the PDU.

7. Using a number 2 Phillips (+) screwdriver, loosen the two screws from the metal door of the metal AC wiring compartment located in the middle of the PDU for 20-A inputs and lower part of the PDU for the 30-A inputs.
8. Using a number 2 Phillips (+) screwdriver, loosen the screw on the 20-A input terminal and plug in the connector.(see Figure 219 on page 392). Tighten the screw after plugging in the connector.

> **NOTE**: The 30 A connector does not have a clamp, it has its own integral clip for locking the connector.

Figure 218: 20-A Plug Type (North America)

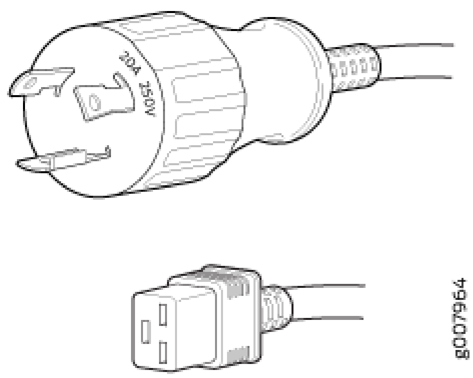
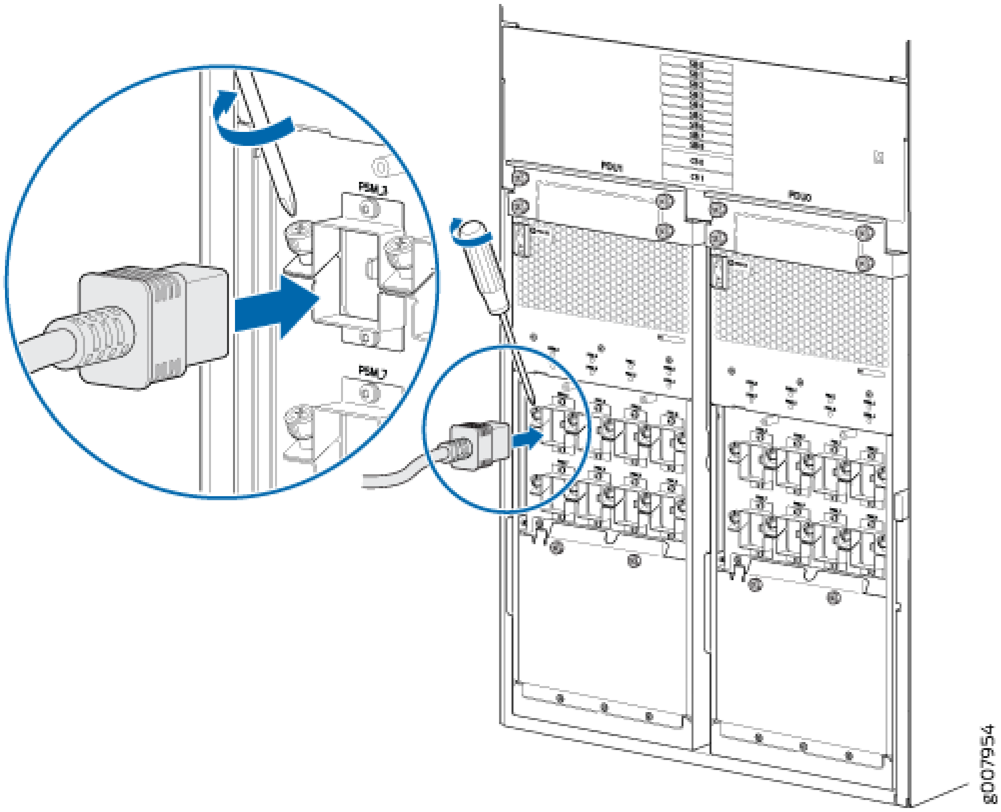


Figure 219: Connecting 20-A Inputs to High Capacity Single-Phase AC PDU



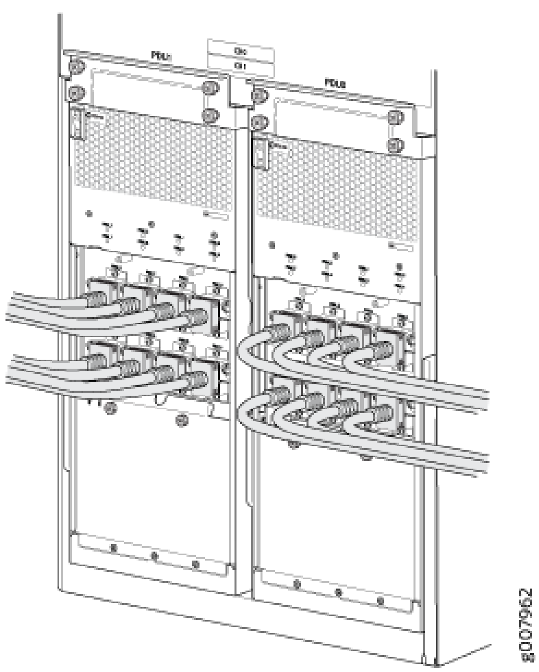
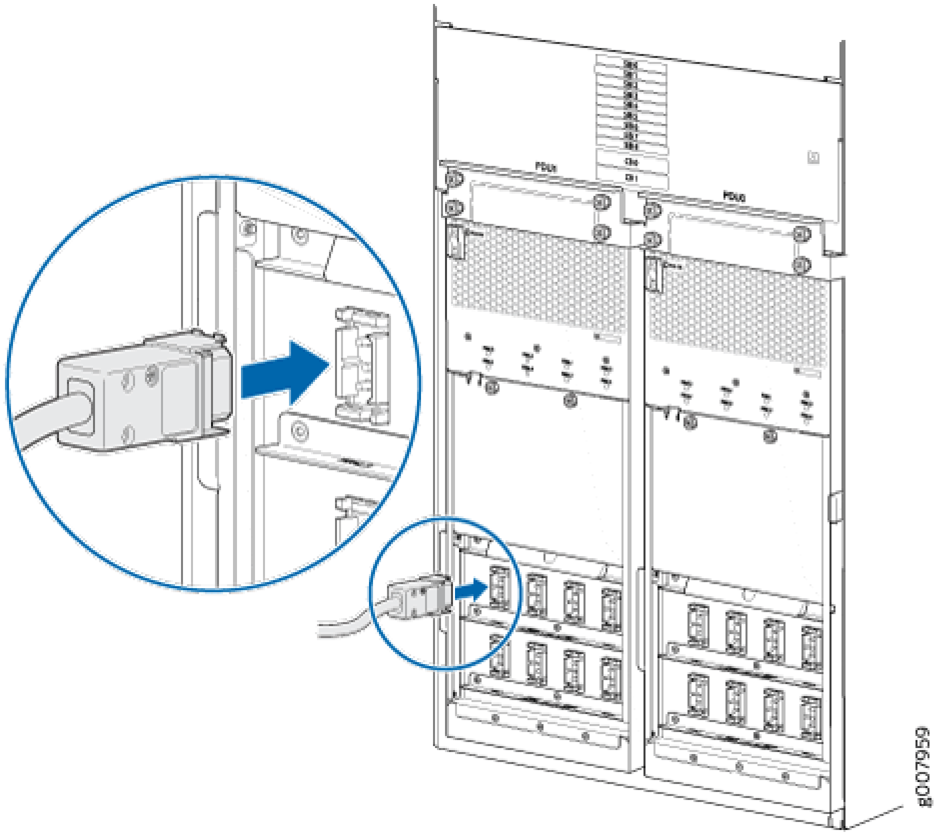


Figure 220: Connecting 30 A inputs to High Capacity Single-Phase AC PDU



9. Connect up to eight inputs (20-A or 30-A) to the PDU. See Figure 221 on page 393.

Figure 221: 30-A Plug Types (North America)

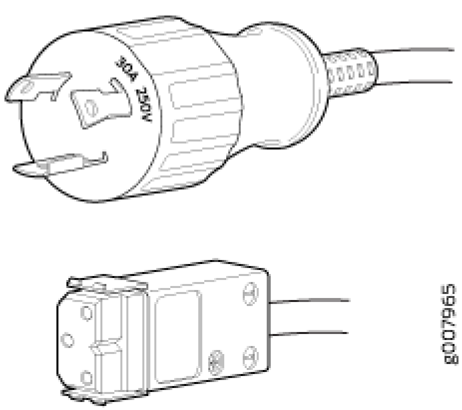
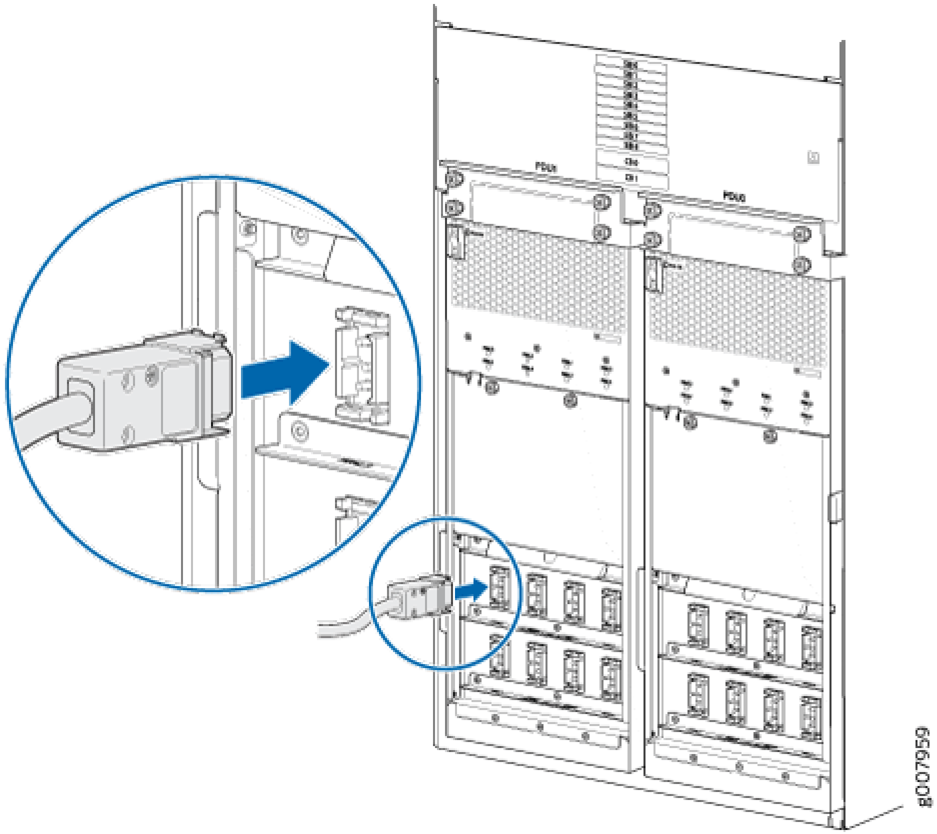
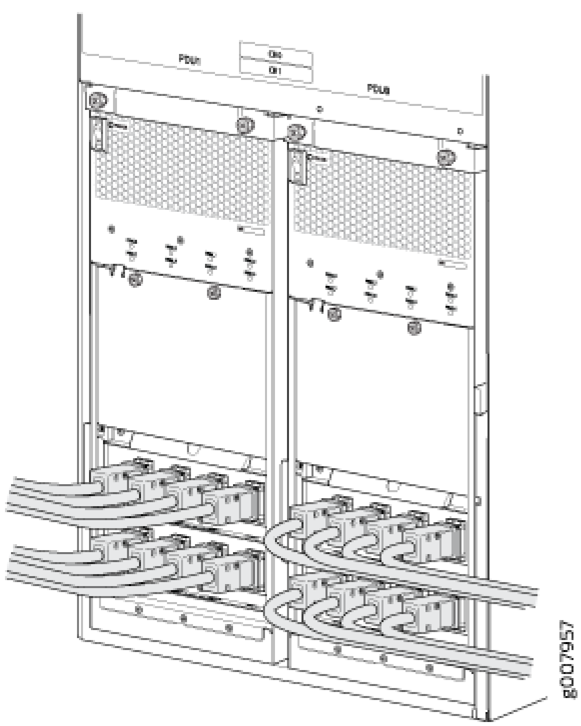


Figure 222: Connecting 30 A Inputs to High Capacity Single-Phase AC PDU





10. Verify that the AC power wiring connections are correct.

11. Verify that the AC power cord does not touch or block access to PTX5000 components, and that it does not drape where people could trip on it.
12. Repeat the procedure for the other single-phase AC PDU.
13. Verify that the AC power cord does not touch or block access to chassis components, and that it does not drape where people could trip on it.
14. Reconnect the all the AC power cords to the power source.

> **NOTE**: After powering on a PDU, you must wait at least 60 seconds before turning it off.

15. Switch on the customer-site circuit breakers to the PDU.
16. Move the power switch on the PDU to the on (|) position.
17. Verify that the input PSM LEDs on the faceplate of the PDU is lit steadily, which indicates that each PSM is receiving power.
18. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is functioning normally.

Replacing a PTX5000 High Capacity AC PSM

IN THIS SECTION

Removing a PTX5000 High Capacity AC PSM

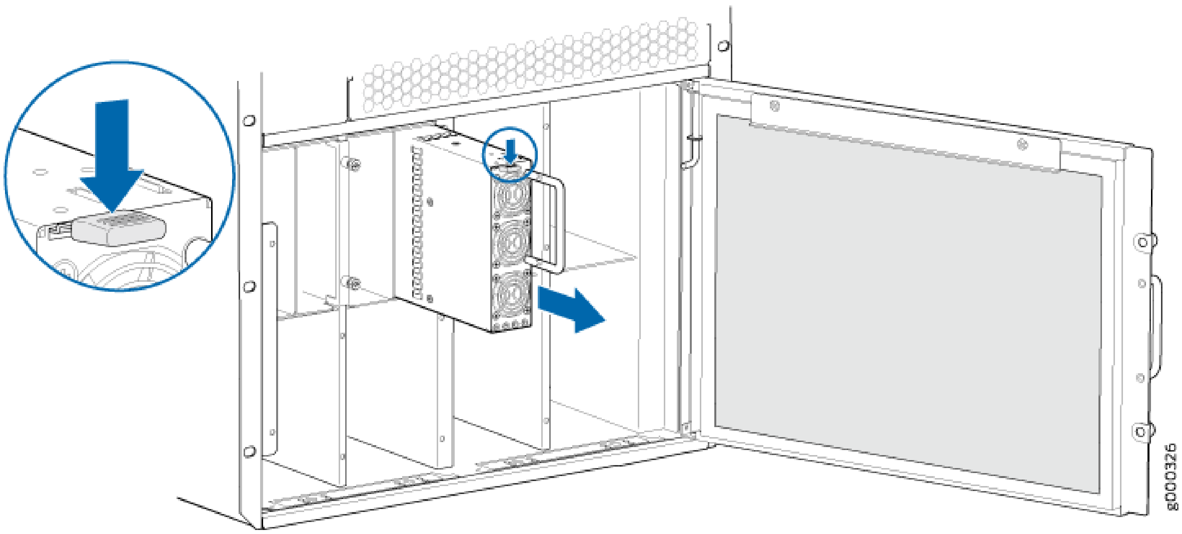
To remove a High Capacity AC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the door covering the PSMs and open the door.
3. Press down the locking tab and then pull out the PSM by using the ejector handle.

> ⚠ **CAUTION**: Each High Capacity AC PSM weighs approximately 9.8 lb (4.5 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

4. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

Figure 223: Removing a High Capacity AC PSM



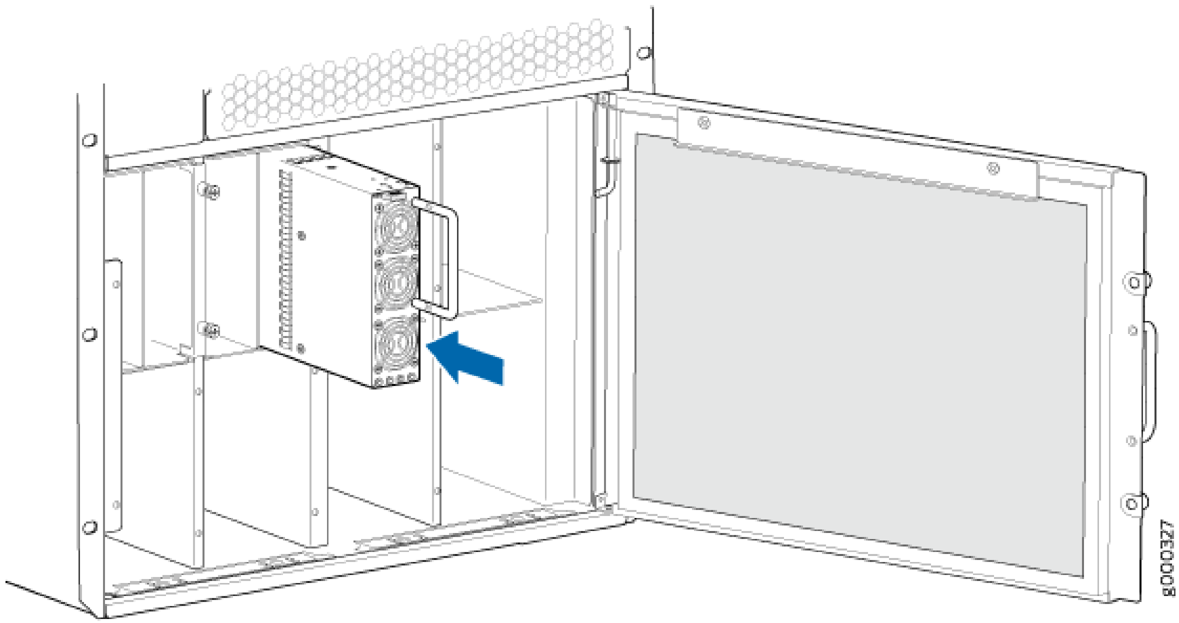
Installing a PTX5000 High Capacity AC PSM

The High Capacity DC PSMs are smaller in dimensions compared to the first-generation PSMs. So, you must install the PSM sleeves to install the High Capacity DC PSMs in the chassis. See "Installing the High Capacity PSM Sleeves" on page 437 for details. Each High Capacity AC PSM weighs approximately 9.8 lb (4.5 kg).

To install a High Capacity AC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Using both hands, slide the PSM into the chassis until the locking tab is engaged.

Figure 224: Installing a High Capacity AC PSM



3. Close the ejector handle so that it is flush with the PSM faceplate.
4. Verify that the AC input **OK** LED on the PSM faceplate is lit steadily, indicating that the PSM is receiving voltage.
5. Verify that the AC output **OK** LED on the PSM faceplate is lit steadily, indicating the output is functioning normally, and the input voltage is within the supported range.

RELATED DOCUMENTATION

PTX5000 AC Power System Description | 37

Understanding Normal-Capacity Power System Power Zones | 172

PTX5000 AC Power Distribution Unit LEDs | 54

PTX5000 AC Power Supply Module LEDs | 62

Installing the High Capacity PSM Sleeves | 437

Maintaining the PTX5000 DC Power System

IN THIS SECTION

Maintaining the PTX5000 DC Power System

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the power distribution units (PDUs), power supply modules (PSMs), DC power cables, and grounding cables.

Action

On a regular basis:

- Periodically inspect the site to ensure that the grounding and DC power cables connected to the PTX5000 are securely in place and that no moisture is accumulating near the PTX5000. To review grounding and site wiring requirements for the PTX5000, see "PTX5000 Chassis Grounding Cable and Lug Specifications" on page 154 and *Site Electrical Wiring Guidelines*.

- Check the status of the PDUs by issuing the `show chassis environment pdu` command.
- Make sure that the DC power cables are arranged so that they do not obstruct access to other router components.
- Routinely check the status LEDs on the PDU and PSM faceplates and the craft interface to verify that the power system is functioning normally.

  During normal operation of the 60-A and 120-A DC PDU and PSM:

  - The green **PDU OK** LEDs light to indicate that the PDUs are functioning normally.
  - Each green **DC IN** LED on a 60-A DC PDU lights when the input is receiving source DC power.
  - Each green **–48 V 120 A** LED on a 120-A DC PDU lights when the input is receiving source DC power.
  - Each **SW ON** LED on a 60-A DC PDU lights when the input power switch is on.
  - Each **CB ON** LED on a 120-A DC PDU lights when the circuit breaker is on.
  - The green **INPUT OK** LED on a power supply module lights when the PSM is receiving voltage.
  - The green **OUTPUT OK** LED on a power supply module lights when the circuit breaker on the PDU is on.

  During normal operation of the High Capacity DC PDU and PSM:

  - The green **PDU OK** LEDs light to indicate that the PDUs are functioning normally.
  - Each green PSM LED, **PSM_0** through **PSM_7** on a PDU, lights when the input is receiving appropriate source DC power.
  - The green **INPUT1 OK** LED on a power supply module lights when the input 1 of the PSM is receiving voltage.
  - The green **INPUT2 OK** LED on a power supply module lights when the input 2 of the PSM is receiving voltage.
  - The green **OUTPUT OK** LED on a power supply module lights when power supply output is functioning normally.

  For more information about the PDU and PSM LEDs, see "PTX5000 DC Power Distribution Unit LEDs" on page 91 and "PTX5000 DC Power Supply Module LEDs" on page 97.

- Check the red and yellow alarm LEDs and the LCD display on the craft interface. PDU and PSM failure or removal triggers an alarm that causes one or both of the LEDs to light and an error message to appear on the LCD display. You can display the associated error messages by issuing the following CLI command:

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

  For a list of possible alarm messages, see "Troubleshooting the PTX5000 Power System" on page 568.

- The power system requires an unobstructed airflow at both the front and rear of the chassis. Periodically check the site to ensure that both the air intake at the bottom front of the chassis and the exhaust from the PSM faceplates are unobstructed.

- To check the power usage in watts for all PDUs and PSMs, issue the `show chassis power` command .

```
Chassis Power        Input(V)     Used(W)

Total Power                        3810

  PDU 0                            3810
    PSM 0
      Input 1            54         331
    PSM 1
      Input 1            54         661
    PSM 2
      Input 1            54        1432
    PSM 3
      Input 1            54        1386
```

  Issue the `show chassis power detail` command to check the power usage in watts for hardware components such as FPCs, fan trays, Routing Engine and Control Board, and SIB, CCG, and craft interface.

```
user@host> show chassis power detail
Chassis Power        Used(W)

Total Power            4890

  PDU 0                2447
```

```
    PSM 0              1292
    PSM 1               702
    PSM 2               210
    PSM 3               243

  PDU 1                2443
    PSM 0              1291
    PSM 1               685
    PSM 2               196
    PSM 3               271

Item                 Used(W)
  Fan Tray 0            194
  Fan Tray 1            482
  Fan Tray 2            488
  RE0/CB0               107
  RE1/CB1               108
  SIB/CCG/FPD            63
  FPC 0                   0
  FPC 1                   0
  FPC 2                   0
  FPC 3                   0
  FPC 4                   0
  FPC 5                   0
  FPC 6                   8
  FPC 7                   0
```

Replacing a PTX5000 60-A DC PDU

IN THIS SECTION

Removing a PTX5000 60-A DC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The PDU weighs 60 lb (27.2 kg). Each input power tray weighs 1.6 lb (0.7 kg).

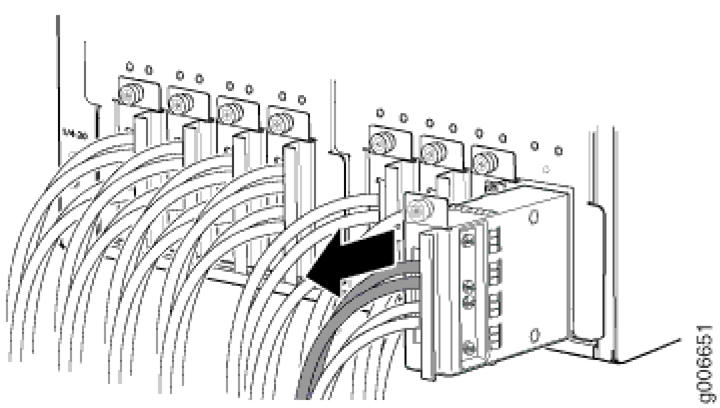
To remove a 60-A DC PDU:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Move the **OUTPUT**power switch on the PDU to the off (**O**) position.
3. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are off.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the front of the chassis.
5. Remove the PSMs in the front of the chassis from the PDU being removed
6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
7. Switch all input power switches on the PDU faceplate to the off (**O**) position.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

8. Loosen the captive screws that secure the input power trays to the PDU.
9. Remove each input power tray from the PDU.

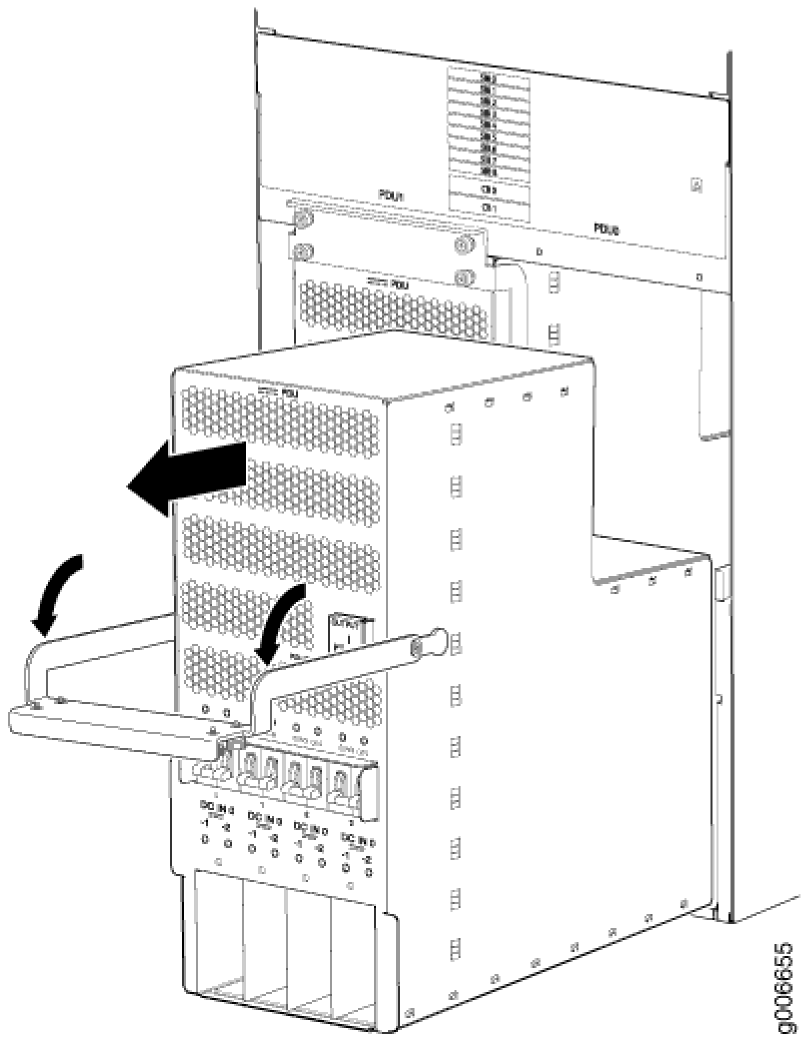
Figure 225: Removing the 60-A Input Power Tray



NOTE: It is not necessary to remove the power cables from the input power trays when you are replacing the PDU.

10. Loosen the four captive screws attaching the PDU handle to the PDU and chassis.
11. Grasp the handle on the PDU faceplate and pull firmly down toward you. Slide the PDU halfway out of the chassis (see Figure 2).

Figure 226: Removing a 60-A DC PDU



12. Place one hand underneath the PDU to support it and slide it partly out of the chassis until you can reach the two handles located on each side of the PDU.
13. Use the two handles on each side of the PDU to support it and slide the PDU completely out of the chassis.

WARNING: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

CAUTION: Each PDU weighs approximately 60 lb (27.2 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

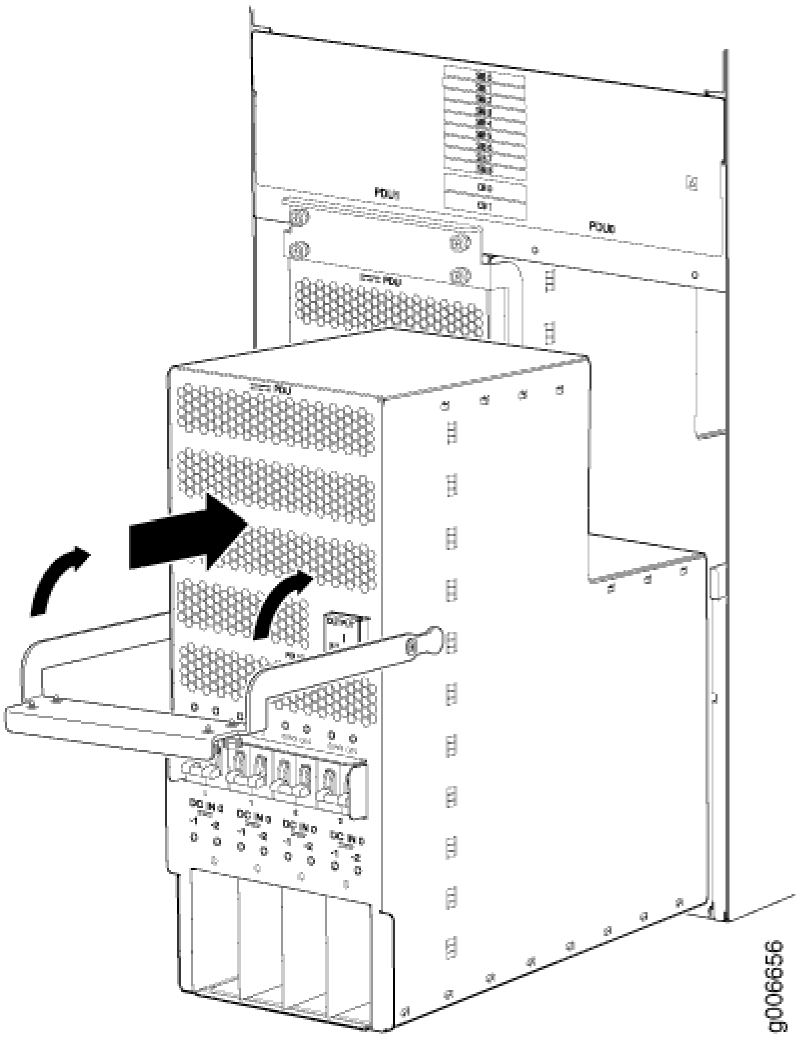
CAUTION: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

Installing a PTX5000 60-A DC PDU

Each PDU weighs approximately 60 lb (27.2 kg). The input power tray weighs 1.6 lb (0.7 kg). To install a PDU:

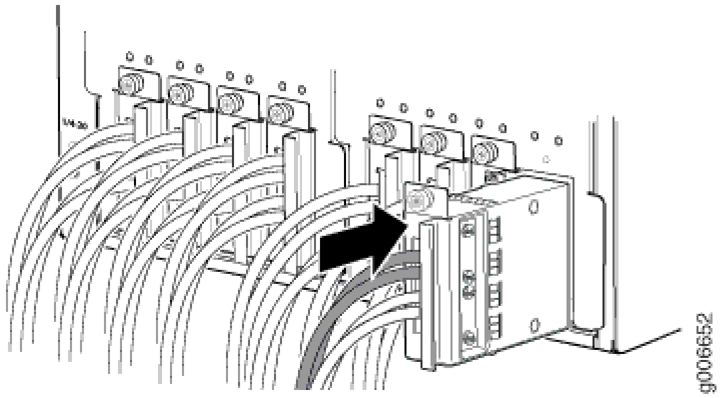
1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during installation.
2. Verify that the input power switches on the PDU faceplate of the replacement PDU are in the **OFF** position (**O**).
3. Verify that the **DC IN** LEDs on the PDU faceplate are off.
4. Remove the input power trays from the replacement PDU. Store the input power trays.
5. Using both hands, slide the PDU into the chassis until you feel resistance (see Figure 227 on page 405).

Figure 227: Installing a 60-A DC PDU



6. Push the metal handle up toward the PDU.
7. Tighten the captive screws on the metal handle. Use a Phillips (+) screwdriver.
8. Slide the input power trays into the new PDU (Figure 228 on page 406).

Figure 228: Installing a 60-A Input Power Tray



9. Tighten the captive screws on the input power tray. Use a Phillips (+) screwdriver.
10. Reinstall the PSMs at the front of the chassis.
11. Switch on the customer-site circuit breakers.
12. Verify that the **DC IN** LEDs on the PDU faceplate are lit steadily, indicating that the inputs are receiving power.
13. Move the input power switch on the PDU to the on (|) position.
14. Verify that the **SW ON** LEDs are lit steadily, indicating that the input power switch for each input power tray is on.
15. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is correctly installed and is functioning properly.

Replacing a PTX5000 60-A DC PDU Power Cable

IN THIS SECTION

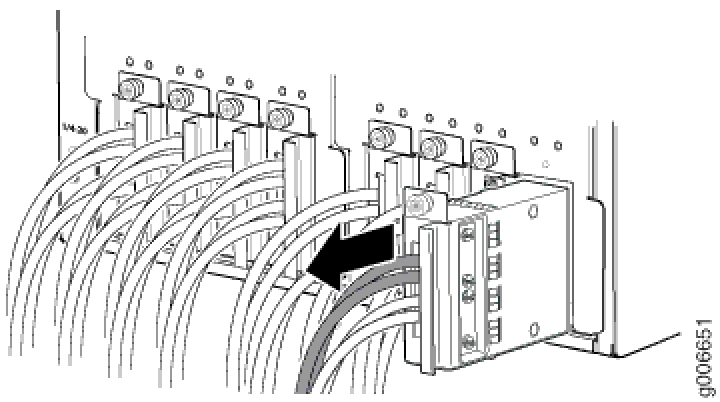
Removing a PTX5000 60-A DC PDU Power Cable

Each 60-A DC PDU has eight input power trays. Each input power tray is hot-insertable and hot-removable, and weighs 1.6 lb (0.7 kg).

To remove a 60-A DC power cable (see Figure 6):

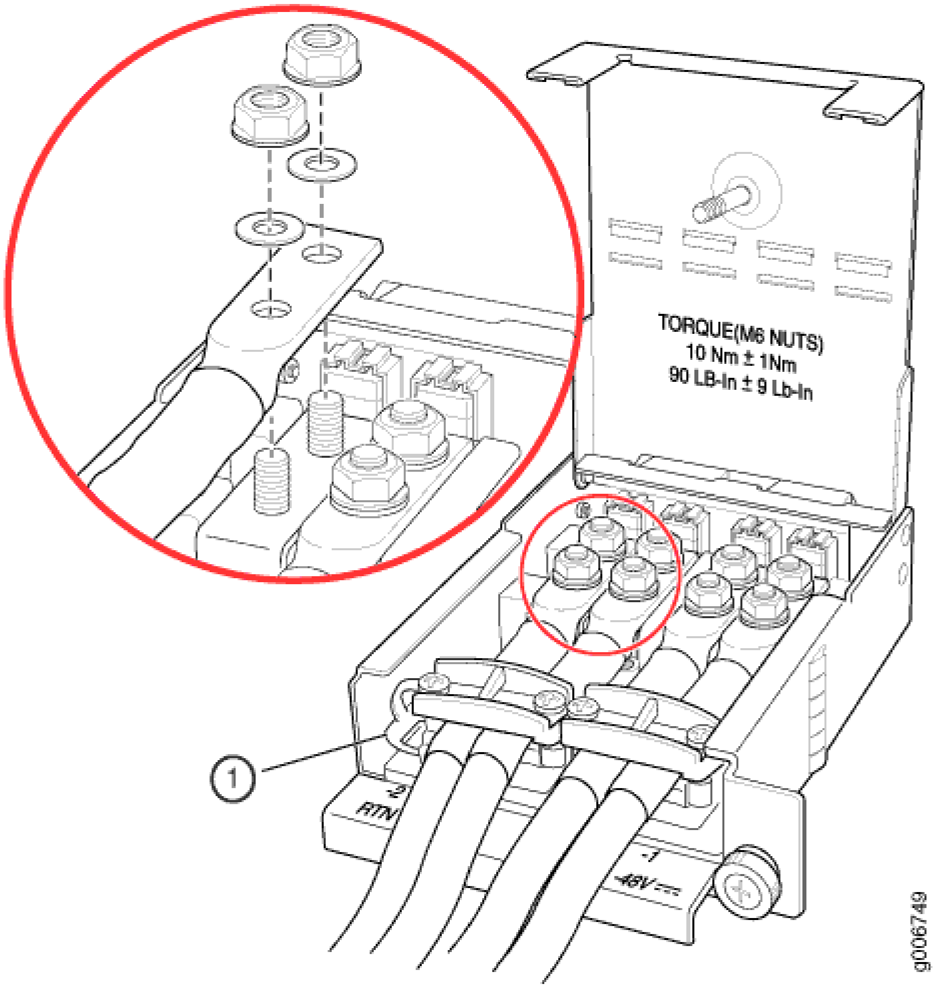
1. Switch off the customer-site circuit breakers to the input power tray that contains the DC power cable being removed.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process. On the PDU faceplate, verify that the **DC IN** LEDs are off for both inputs in the input power tray being removed
3. On the PDU faceplate, switch the input power switch for the input power tray to the off (**O**) position.
4. Loosen the captive screws that secure the input power tray to the PDU.
5. Remove the input power tray from the PDU.

Figure 229: Removing the Input Power Tray



6. Use a Phillips (+) screwdriver to loosen the screw on the metal input power tray cover.
7. Open the metal input power tray cover.
8. Loosen the cable restraints.
9. Use a 7/16-in. (11-mm) nut driver to loosen the nuts, and remove the nuts from the DC power terminal stud.
10. Remove the DC source power cable lug from the DC power terminal stud.

Figure 230: Disconnecting the 60-ADC Source Power Cable Lugs from an Input Power Tray



Installing a PTX5000 60-A DC PDU Power Cable

To install a 60-A DC power cable:

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active. Verify that the **DC IN** LEDs on the PDU faceplate are off.
2. On the PDU faceplate, switch the input power switch for the input power tray to the off (**O**) position.
3. Route the DC source power cable lug through the cable restraint.
4. Secure the DC source power cable lug to the terminal with a nut (see Figure 232 on page 410 and Figure 233 on page 411).

   Use a 7/16-in. (11-mm) nut driver to tighten the nut.
5. Tighten the cable restraint over the DC power cables.

6. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V**).
7. Close the input power tray cover, and secure it with the screw.
8. Insert the input power tray into the PDU.

Figure 231: Installing a 60-A Input Power Tray

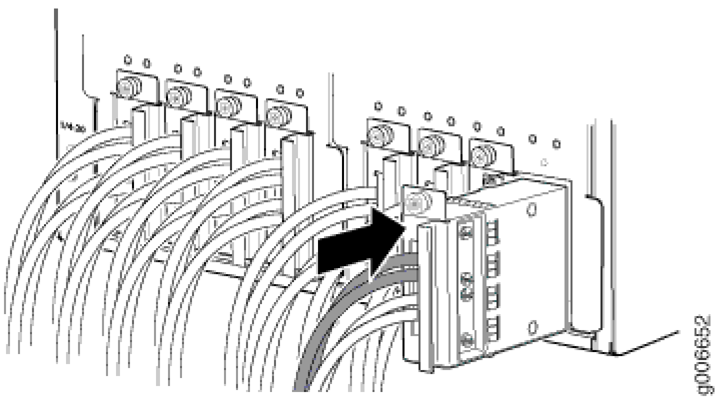


Figure 232: 60-A DC Input Power Terminals

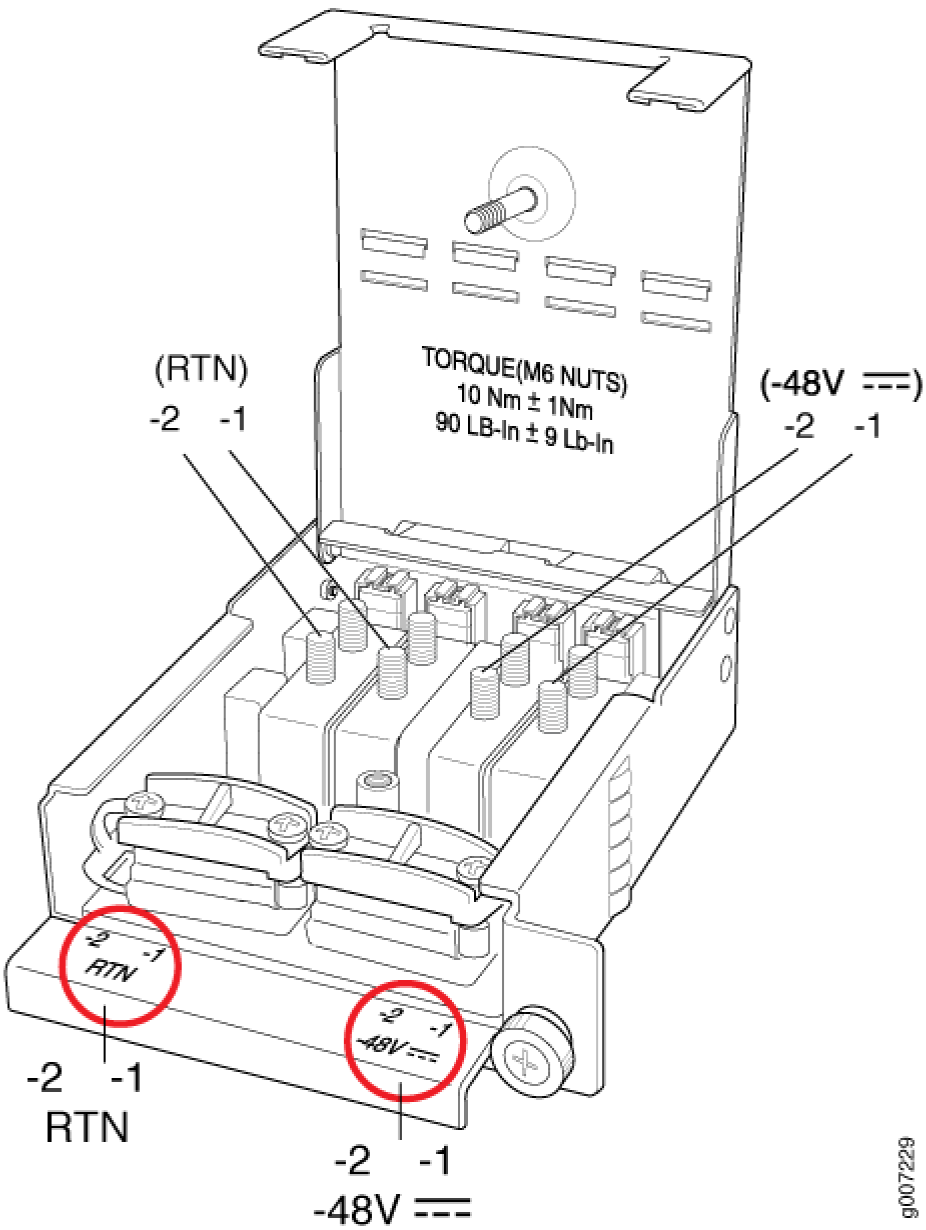
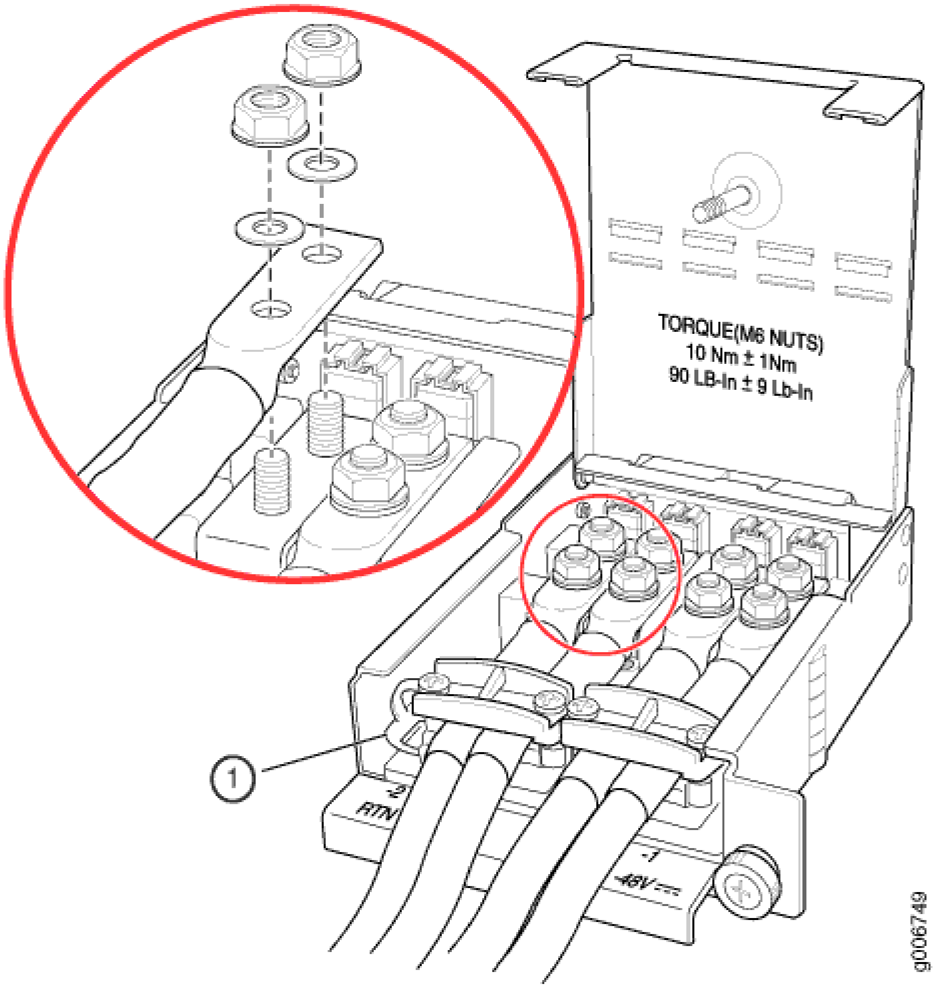


Figure 233: Connecting the 60-A DC Source Power Cable Lugs to an Input Power Tray



Replacing a PTX5000 120-A DC PDU

IN THIS SECTION

Removing a PTX5000 120-A DC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The PDU weighs 60 lb (27.2 kg). Each input power tray weighs 1.6 lb (0.7 kg).

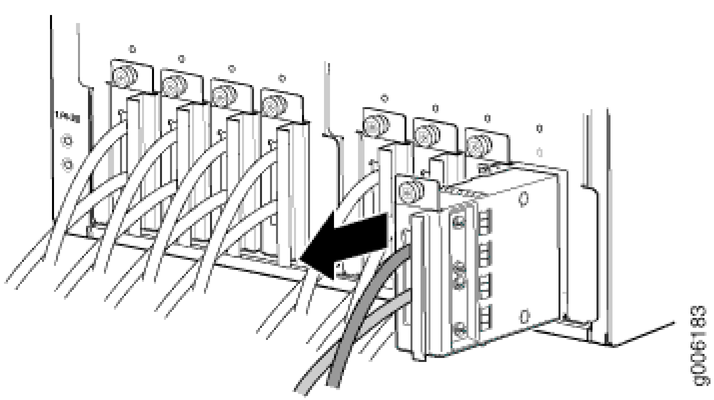
To remove a PDU:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Move the power switch on the PDU to the off (**O**) position.
3. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are off.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the front of the chassis.
5. Remove the PSMs in the front of the chassis from the PDU being removed
6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis at the back of the PTX5000.
7. Switch the circuit breakers on the PDU faceplate to the off (**O**) position.

   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

8. Loosen the captive screws that secure the input power trays to the PDU.
9. Remove each input power tray from the PDU.

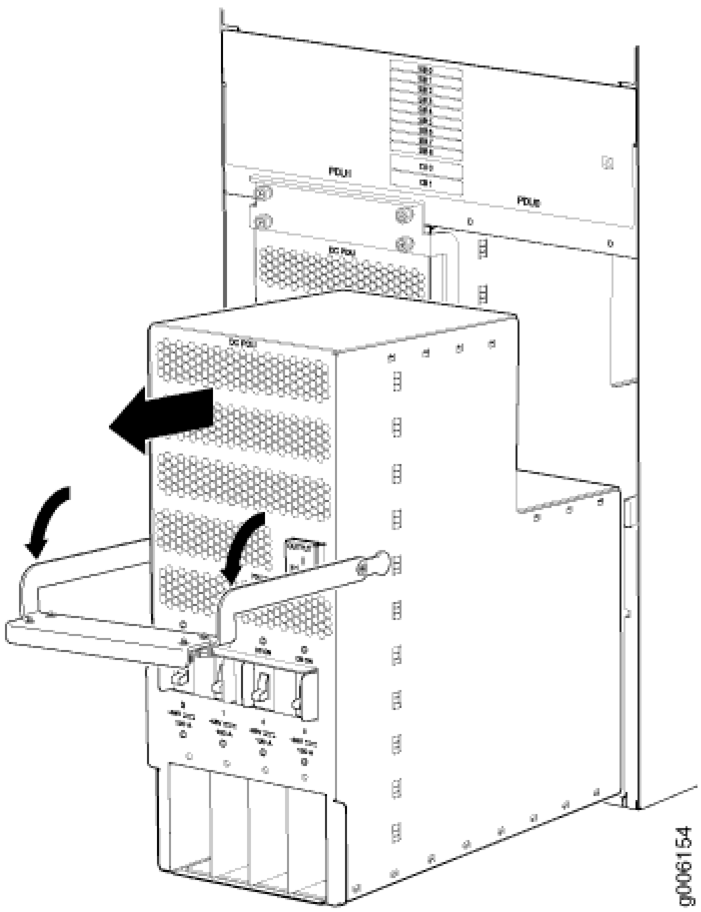
Figure 234: Removing a 120-A Input Power Tray



NOTE: It is not necessary to remove the power cables from the input power trays when you are replacing the PDU.

10. Loosen the four captive screws attaching the PDU handle to the PDU and chassis.
11. Grasp the handle on the PDU faceplate and pull firmly down toward you. Slide the PDU halfway out of the chassis (see Figure 11).

Figure 235: Removing a 120-A DC PDU



12. Place one hand underneath the PDU to support it and slide it partly out of the chassis until you can reach the two handles located on each side of the PDU.
13. Use the two handles on each side of the PDU to support it and slide the PDU completely out of the chassis.

WARNING: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

CAUTION: Each PDU weighs approximately 60 lb (27.2 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

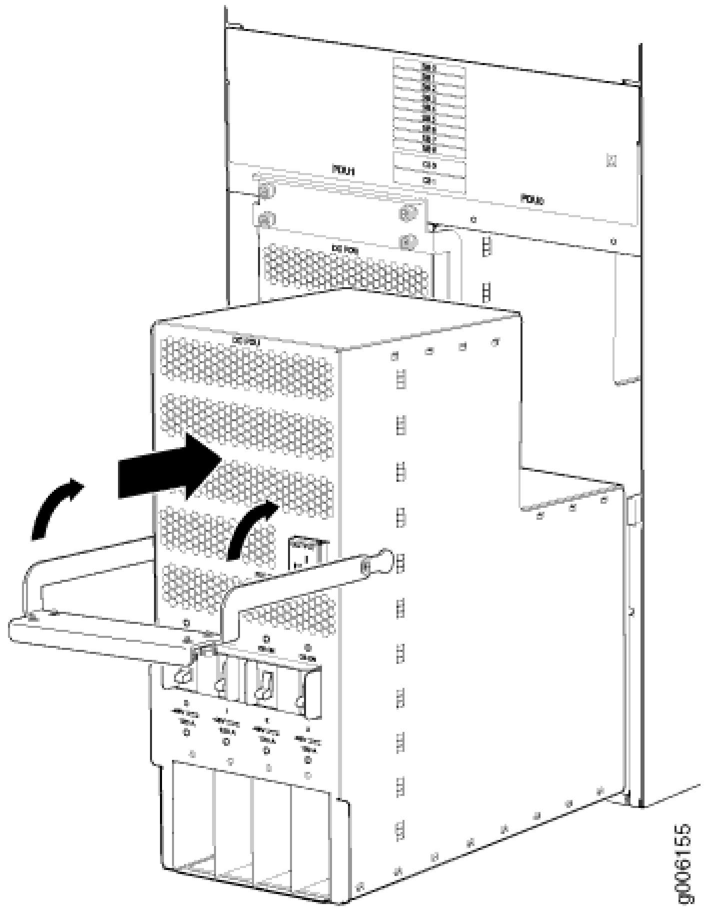
CAUTION: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

Installing a PTX5000 120-A DC PDU

Each PDU weighs approximately 60 lb (27.2 kg). The input power tray weighs 1.6 lb (0.7 kg). To install a PDU:

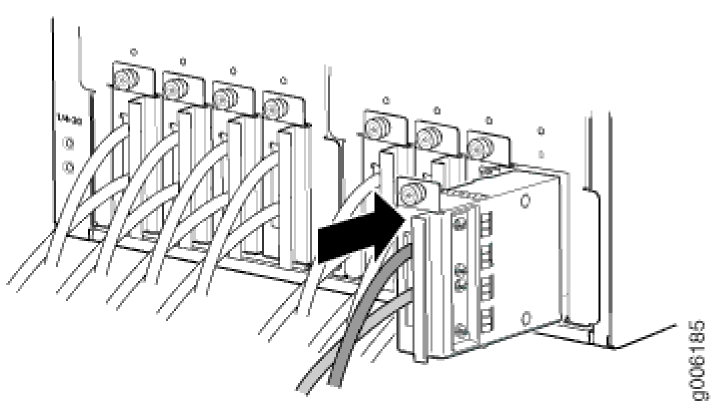
1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during installation.
2. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are off.
3. Switch the circuit breakers on the PDU faceplate to the **OFF** position (**O**).
4. Remove the input power trays from the replacement PDU. Store the input power trays.
5. Using both hands, slide the PDU into the chassis until you feel resistance (see Figure 236 on page 415).

Figure 236: Installing a 120-A DC PDU



6. Push the metal handle up toward the PDU.
7. Tighten the captive screws on the metal handle. Use a Phillips (+) screwdriver.
8. Slide the input power trays into the new PDU (Figure 237 on page 415).

Figure 237: Installing a 120-A Input Power Tray



9. Tighten the captive screws on the input power tray. Use a Phillips (+) screwdriver.
10. Reinstall the PSMs at the front of the chassis.
11. Switch on the customer-site circuit breakers.
12. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are lit steadily, indicating that the inputs are receiving power.
13. Switch the circuit breakers on the PDU to the on (|) position.
14. Verify that the **CB ON** LEDs are lit steadily, indicating that the circuit breaker for each input power tray is on.
15. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is correctly installed and is functioning properly.

Replacing a PTX5000 120-A DC PDU Power Cable

IN THIS SECTION

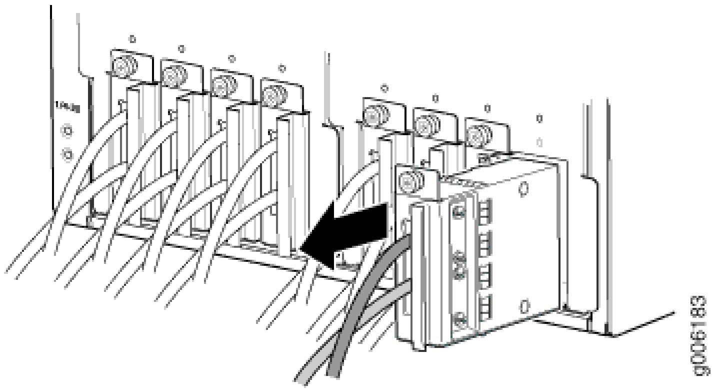
Removing a PTX5000 120-A DC PDU DC Power Cable

Each PDU has eight input power trays. Each input power tray is hot-insertable and hot-removable, and weighs 1.6 lb (0.7 kg).

To remove a DC power cable:

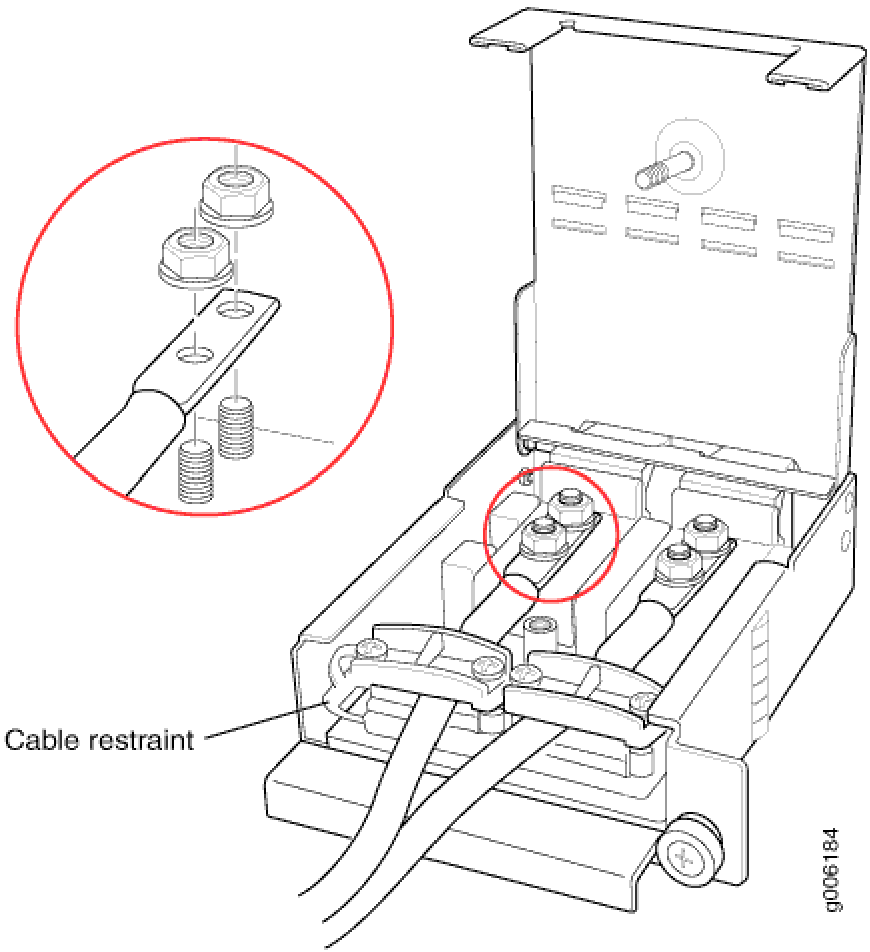
1. Switch off the customer-site circuit breakers to the input power tray that contains the DC power cable being removed.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are off.
3. Switch the circuit breaker for the input power tray on the PDU faceplate to the off (**O**) position.
4. Loosen the captive screws that secure the input power tray to the PDU.
5. Remove the input power tray from the PDU.

Figure 238: Removing the Input Power Tray



6. Use a Phillips (+) screwdriver to loosen the screw on the metal input power tray cover.
7. Open the metal input power tray cover.
8. Loosen the cable restraints.
9. Use a 7/16-in. (11-mm) nut driver to loosen the nuts, and remove the nuts from the DC power terminal stud.
10. Remove the DC source power cable lug from the DC power terminal stud.

Figure 239: Disconnecting the DC Source Power Cable Lugs to an Input Power Tray



Installing a PTX5000 120-A DC PDU Power Cable

To install a DC power cable:

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active. Verify that the **–48 V 120 A** LEDs on the PDU faceplate are off.
2. Switch the circuit breaker for the input power tray on the PDU faceplate to the off (**O**) position.
3. Route the positive (+) DC source power cable lug through the left cable restraint.
4. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal, located on the left, with a nut.

   Use a 7/16-in. (11-mm) nut driver to tighten the nut.
5. Route the negative (–) DC source power cable lug through the right cable restraint.
6. Attach the negative (–) DC source power cable lug to the **–48V** (input) terminal, located on the right.

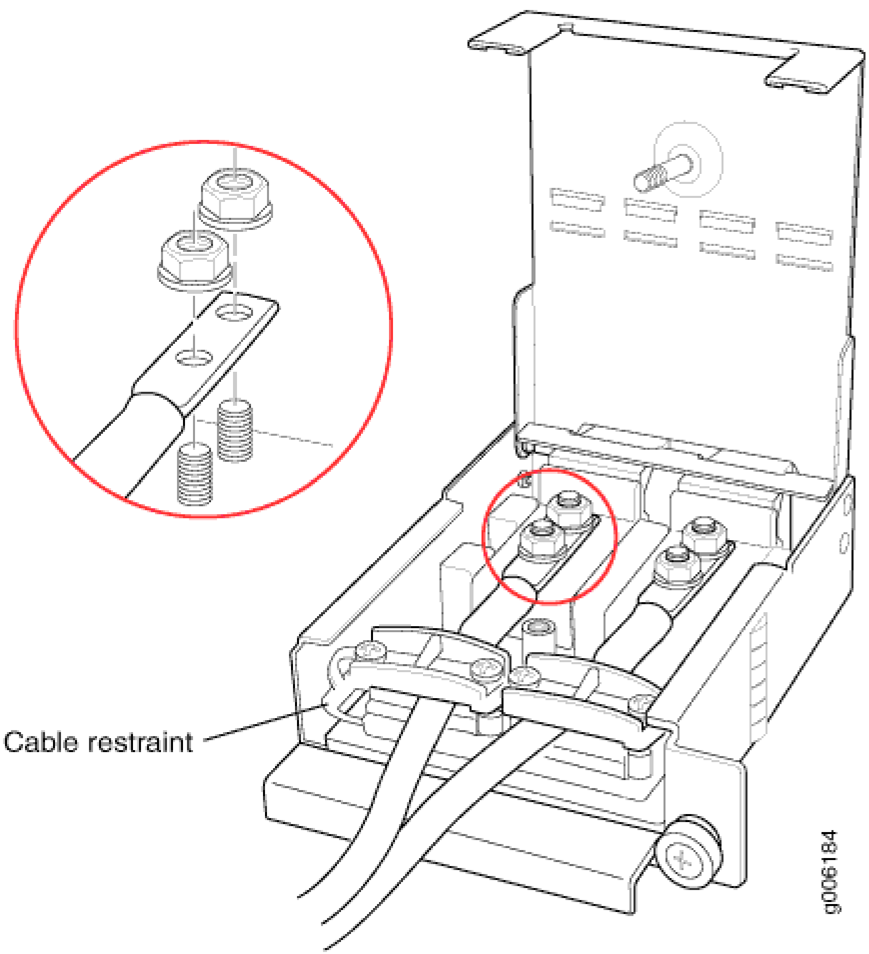
Use a 7/16-in. (11-mm) nut driver to tighten the nut.

CAUTION: You must use an appropriate torque-controlled tool to tighten the nuts. Applying excessive torque damages the terminal studs and power supply. The maximum torque that may be applied to this nut is 99 lb-in. (11 Nm).

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

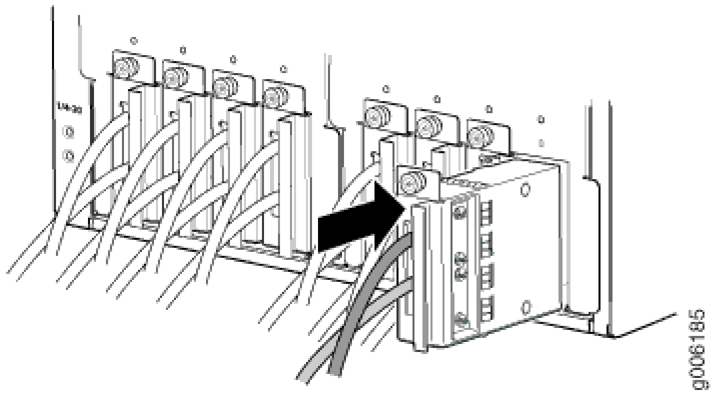
CAUTION: All inputs on the DC PDU in slot **PDU0** must be powered by dedicated power feeds derived from feed A, and all inputs on the DC PDU in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

Figure 240: Connecting the DC Source Power Cable Lugs to a 120-A Input Power Tray



7. Tighten the cable restraint over the DC power cables.
8. Verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled **RTN**) and the negative (–) source cable to the input terminal (labeled **–48V**).
9. Close the input power tray cover, and secure it with the screw..
10. Insert the input power tray into the PDU.

Figure 241: Installing a 120-A Input Power Tray



Replacing a PTX5000 60-A or 120-A DC PSM

IN THIS SECTION

Removing a PTX5000 60-A or 120-A DC PSM

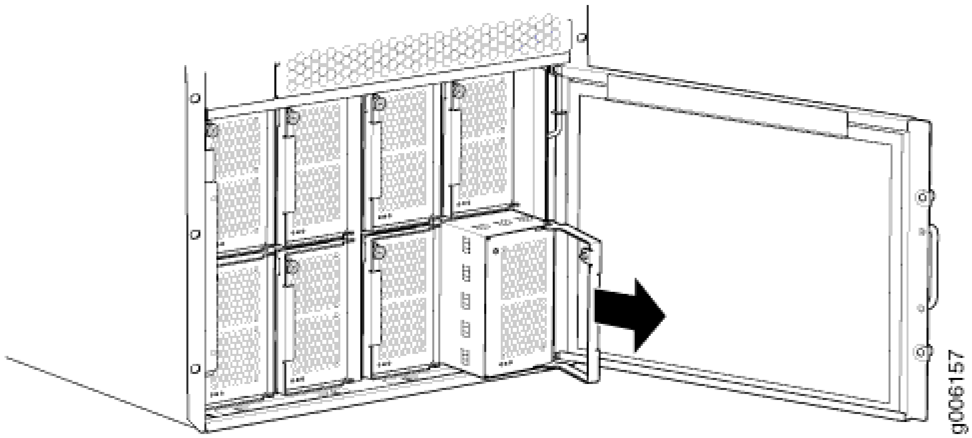
To remove a 60-A or 120-A DC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the door covering the PSM and open the door.
3. Loosen the captive screw on the PSM ejector handle.
4. Grasp the ejector handle and pull to eject the PSM. Slide it halfway out of the chassis (see Figure 18).

> **CAUTION**: Each DC PSM weighs approximately 10.6 lb (4.8 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

5. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

Figure 242: Removing a PSM



Installing a PTX5000 60-A or 120-A DC PSM

Each DC PSM weighs approximately 10.6 lb (4.8 kg). To install a 60-A or 120-A DC PSM:

1. Using both hands, slide the PSM into the chassis until you feel resistance .
2. Actuate the ejector handle to insert the PSM into the chassis.
3. Tighten the captive screw on the PSM.
4. Verify that the **INPUT OK** LED on the PSM faceplate is lit steadily, indicating that the PSM is receiving power.
5. Verify that the **OUTPUT OK** LED on the PSM faceplate is lit steadily.

Replacing a PTX5000 High Capacity DC PDU

IN THIS SECTION

Removing a PTX5000 High Capacity DC PDU

The PTX5000 has two redundant, load-sharing PDUs. Each PDU is hot-insertable and hot-removable. The High Capacity DC PDU weighs 64.5 lb (29.3 kg) without PSMs.

To remove a High Capacity DC PDU:

1. Switch off the customer-site circuit breakers to the PDU being removed.
2. Move the power switch to the standby
   (
   ⏻
) position.

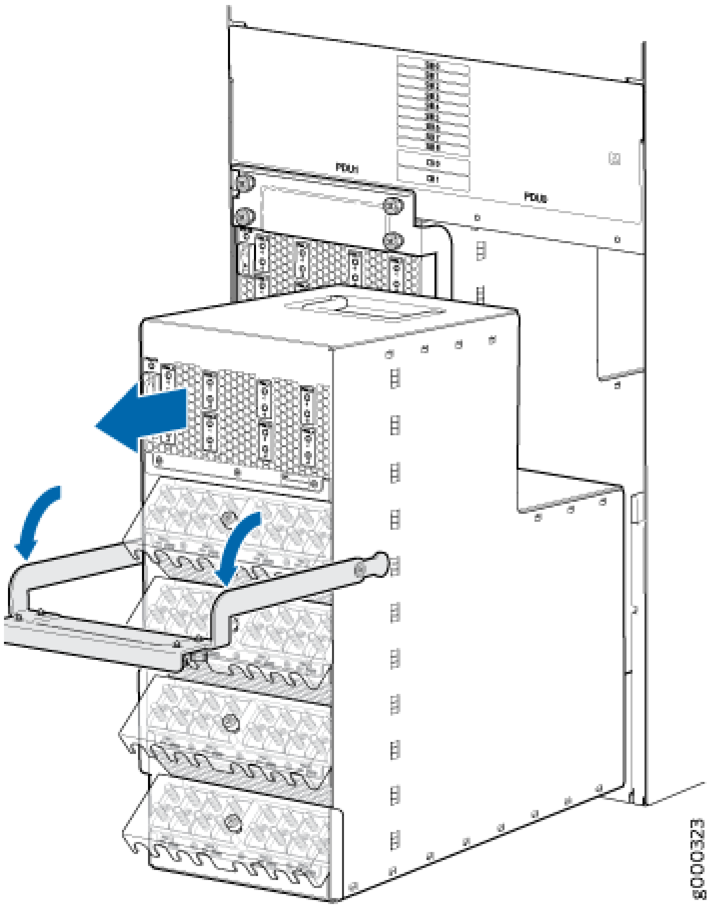
   NOTE: After powering off a PDU, you must wait at least 60 seconds before turning it back on.

3. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
4. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
5. In the front of the chassis, remove the PSMs that are installed in he PDU you plan to replace. See "Replacing a PTX5000 High Capacity DC PSM" on page 426 for details.
6. Remove the power cables from the power terminal block.

   CAUTION: Before removing the power input cables, verify that power is turned off. You can take the help of a licensed electrician to remove the cable lugs and the DC power input cables connected to the PDU.

7. Loosen the four captive screws attaching the PDU handle to the PDU and chassis.
8. Grasp the handle on the PDU faceplate and pull firmly down toward you. Slide the PDU halfway out of the chassis (see Figure 19).

Figure 243: Removing a High Capacity DC PDU



9. Place one hand underneath the PDU to support it and slide it partly out of the chassis until you can reach the two handles located on each side of the PDU.
10. Use the two handles on each side of the PDU to support it and slide the PDU completely out of the chassis.

> **WARNING**: Do not touch the power connectors on the rear of the PDU. They can contain dangerous voltages.

> **CAUTION**: Each PDU weighs approximately 64.5 lb (29.3 kg). Be prepared to support the full weight of the PDU as you remove it from the PTX5000.

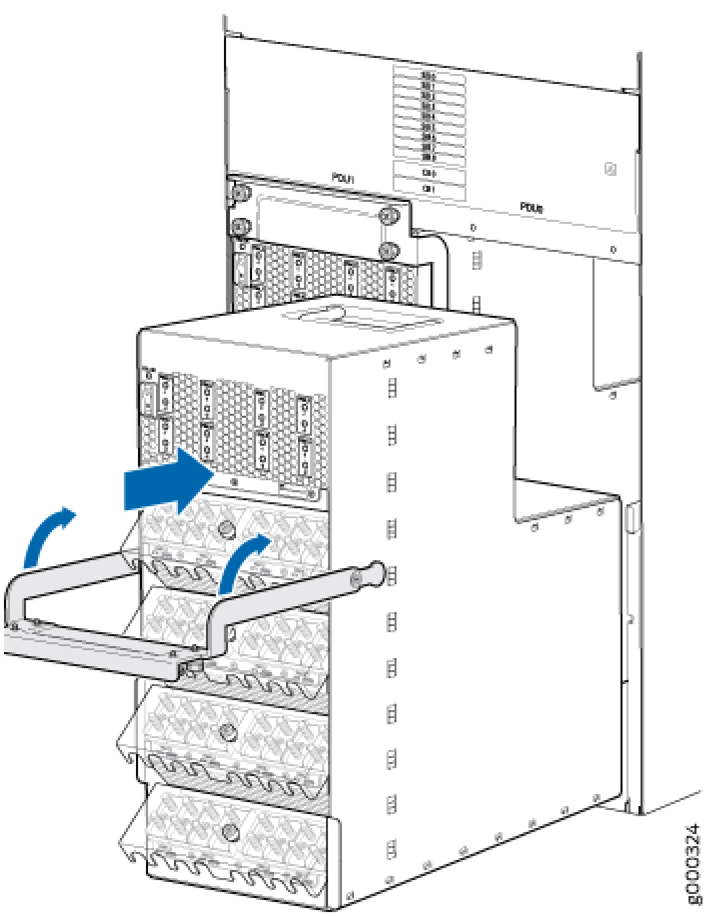
> **CAUTION**: Do not leave a PDU slot empty for more than a short time while the PTX5000 is operational. For proper airflow, the PDU must remain in the chassis or a blank panel must be used in an empty slot.

Installing a PTX5000 High Capacity DC PDU

Each High Capacity DC PDU without the PSMs weighs approximately 64.5 lb (29.3 kg). To install a PDU:

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during installation.
2. Verify that power switch on the PDU is in the standby
(
⏻
) position.
3. Verify that the DC power input cables are disconnected.
4. Using both hands, slide the PDU into the chassis until you feel resistance (see Figure 244 on page 425).

Figure 244: Installing a High Capacity DC PDU



5. Push the metal handle up toward the PDU.
6. Tighten the captive screws on the metal handle. Use a number 2 Phillips (+) screwdriver.

7. Connect the DC input power cables to the DC power terminal blocks. See "Connecting Power to the PTX5000 High Capacity DC PDUs" on page 260 for details.
8. Install the PSMs at the front of the chassis. See "Replacing a PTX5000 High Capacity DC PSM" on page 426 for details.
9. Switch on the customer-site circuit breakers.
10. Move the input power switch on the PDU to the on (|) position.
11. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily, indicating that the PDU is correctly installed and is functioning properly.

Replacing a PTX5000 High Capacity DC PSM

IN THIS SECTION

Removing a PTX5000 High Capacity DC PSM

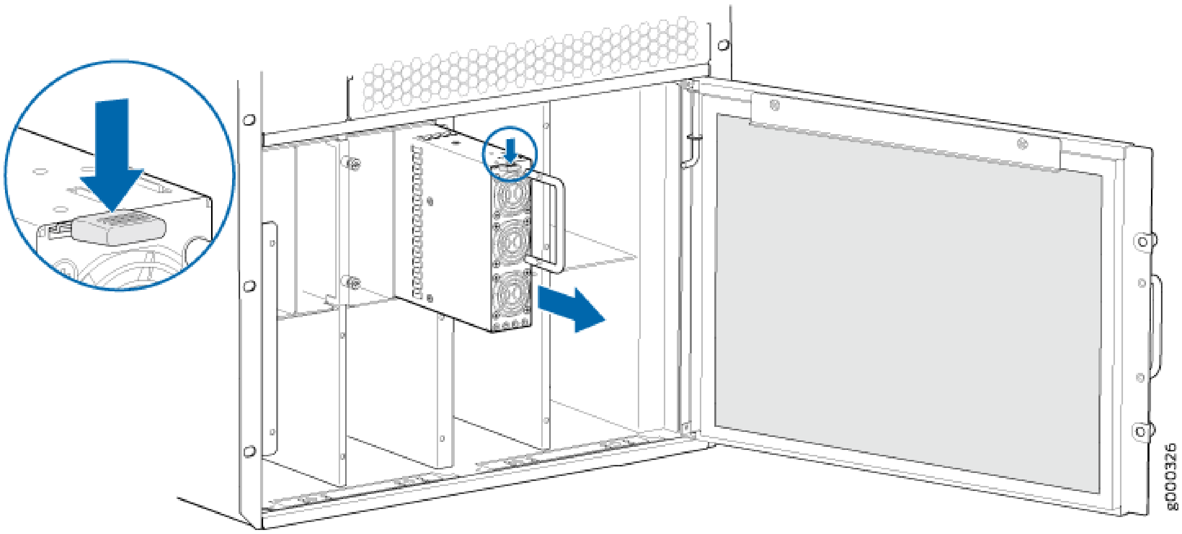
To remove a High Capacity DC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screws on the door covering the PSMs and open the door.
3. Press down the locking tab and then pull out the PSM by using the ejector handle.

> **CAUTION**: Each High Capacity DC PSM weighs approximately 10.1 lb (4.6 kg). Be prepared to support the full weight of the PSM as you remove it from the PTX5000.

4. Place one hand underneath the PSM to support it and slide it completely out of the chassis.

Figure 245: Removing a High Capacity DC PSM



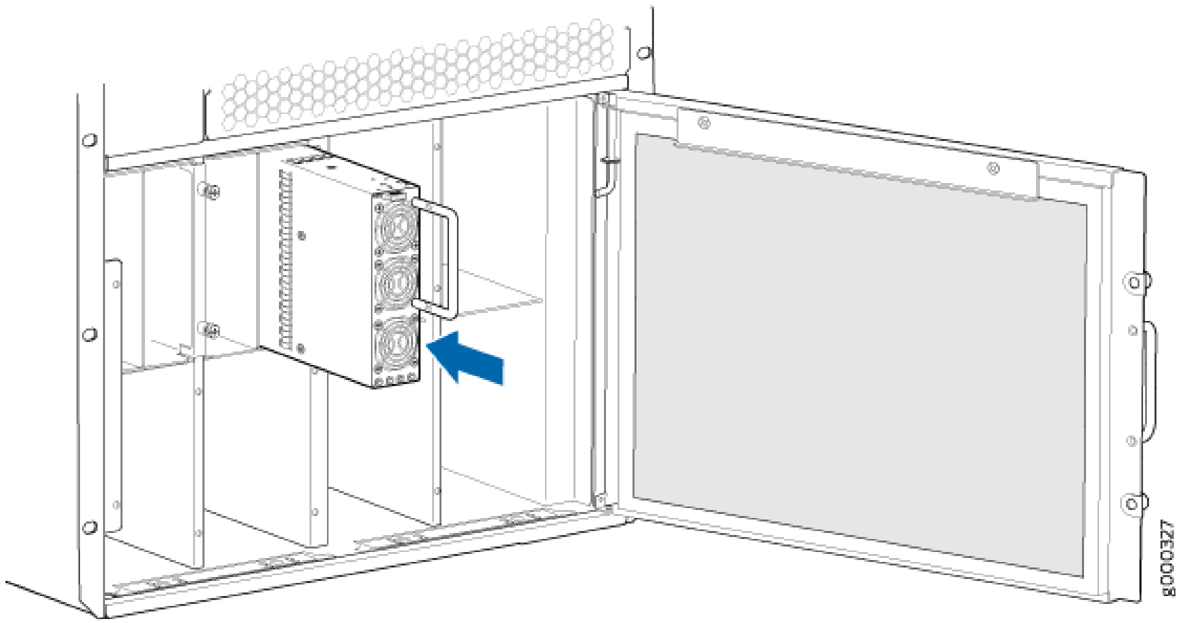
Installing a PTX5000 High Capacity DC PSM

The High Capacity DC PSMs are smaller in dimensions compared to the first-generation PSMs. So, you must install the PSM sleeves to install the High Capacity DC PSMs in the chassis. See "Installing the High Capacity PSM Sleeves" on page 437 for details. Each High Capacity DC PSM weighs approximately 10.1 lb (4.6 kg).

To install a High Capacity DC PSM:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Using both hands, slide the PSM into the chassis until you feel resistance.

Figure 246: Installing a High Capacity DC PSM



3. Press the ejector handle to insert the PSM into the chassis until is it fully seated.
4. Verify that the **Input 1 OK** LED on the PSM faceplate is lit steadily, indicating that the PSM is receiving power.
5. Verify that the **Input 2 OK** LED on the PSM faceplate is lit steadily, indicating that the power output is steady.

RELATED DOCUMENTATION

PTX5000 DC Power Distribution Unit LEDs | 91

Understanding Normal-Capacity Power System Power Zones | 172

Installing the High Capacity PSM Sleeves | 437

Upgrading the PTX5000 to a High Capacity Power System

IN THIS SECTION

Upgrading to the High Capacity AC Power System

Before you upgrade a PTX5000 to the High Capacity AC power system from a normal-capacity power system:

- Ensure that the `No Redundant Power for System` alarm is not displayed when you run the `show chassis alarms` operational-mode CLI command.

  If the `No Redundant Power for System` alarm is displayed, see "Understanding Normal-Capacity Power System Power Zones" on page 172 for more information about PTX5000 redundancy and power zones for normal-capacity PSMs. Modify your hardware configuration so that the PTX5000 power system is redundant. Once redundant power is configured and the alarm is no longer displayed, you can begin the upgrade procedure.

- Ensure that the PTX5000 is running Junos OS release 14.1R2 or a later 14.1 release, or Junos OS release 14.2 or later.

NOTE: If you are upgrading from normal-capacity Delta or Wye AC PDUs, you must begin this procedure with the left PDU when viewed from the rear of the chassis (labeled **PDU1** on the chassis).

NOTE: You cannot do a smooth upgrade from normal-capacity Delta or Wye AC PDUs to High Capacity Single-Phase AC PDU.

To upgrade to the High Capacity AC power system:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the existing power supply modules (PSMs) from one of the power distribution units (PDUs). See "Replacing a PTX5000 60-A or 120-A DC PSM" on page 421 or "Replacing a PTX5000 Normal-Capacity AC PSM" on page 367 for details, depending on your existing configuration.

   Removing the PSMs raises the following alarms:

   - `No Redundant Power for FPC 0-7`
   - `No Redundant Power for Rear Chassis`
   - `No Redundant Power for Fan 0-2`
3. Remove the PDU from which PSMs have been removed. See one of the following topics for details, depending on your existing configuration:
   - "Replacing a PTX5000 60-A DC PDU" on page 401
   - "Replacing a PTX5000 120-A DC PDU" on page 411
   - "Replacing a PTX5000 Three-Phase Delta AC PDU" on page 335
   - "Replacing a PTX5000 Three-Phase Wye AC PDU" on page 351
   - "Replacing a PTX5000 High Capacity Single-Phase AC PDU" on page 386
4. Install a High Capacity AC PDU. See "Replacing a PTX5000 High Capacity Delta AC PDU" on page 369 or "Replacing a PTX5000 High Capacity Wye AC PDU" on page 377 or "Replacing a PTX5000 High Capacity Single-Phase AC PDU" on page 386 for details, depending on the type of High Capacity PDUs you are installing.
5. Install the High Capacity PSM sleeve into the PTX5000. See "Installing the High Capacity PSM Sleeves" on page 437 for details.
6. Install the PSMs in the new PDU and power on the PDU. See "Replacing a PTX5000 High Capacity AC PSM" on page 395 for details.

   Now there are two different types of PDUs in the chassis, resulting in the `Mix of PDUs` alarm being raised. And there are two different types of PSMs in the chassis, resulting in the `Power Manager Non Operational` alarm being raised. However, as long as the PDU is operational, one PDU and associated PSMs can fulfill the power requirements of the PTX5000. In this configuration, the `No Redundant Power for System` alarm is not displayed when you run the `show chassis alarms` command.

   > **CAUTION**: Do not replace other FRUs or perform online operations during the PDU upgrade procedure to ensure a smooth upgrade of the power system.

7. Repeat Step 2 through Step 6 to replace the second PDU with a High Capacity AC PDU.
8. Run the `show chassis alarms` command to verify that the `Mix of PDUs`, `Power Manager Non Operational`, and `No Redundant Power for System` alarms are not active.
9. Run the `show chassis hardware` command to verify that the PDUs and PSMs are connected.

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number    Description
Chassis                                JN120A713AJA     PTX5000
Midplane         REV 16   750-035893   ACAW7978         Midplane-8S
FPM              REV 12   760-030647   BBBD5622         Front Panel Display
PDU 0            Rev 04   740-048337   1GB74260015      High Capacity AC DELTA PDU
  PSM 0          Rev 03   740-048334   1GB44260078      High Capacity AC PSM
  PSM 1          Rev 03   740-048334   1GB44260052      High Capacity AC PSM
  PSM 2          Rev 03   740-048334   1GB44260018      High Capacity AC PSM
  PSM 3          Rev 03   740-048334   1GB44260046      High Capacity AC PSM
  PSM 4          Rev 03   740-048334   1GB44260049      High Capacity AC PSM
  PSM 5          Rev 03   740-048334   1GB44260041      High Capacity AC PSM
  PSM 6          Rev 03   740-048334   1GB44260098      High Capacity AC PSM
  PSM 7          Rev 03   740-048334   1GB44260039      High Capacity AC PSM
PDU 1            Rev 04   740-048337   1GB74260025      High Capacity AC DELTA PDU
  PSM 0          Rev 03   740-048334   1GB44260142      High Capacity AC PSM
  PSM 1          Rev 03   740-048334   1GB44260174      High Capacity AC PSM
  PSM 2          Rev 03   740-048334   1GB44260033      High Capacity AC PSM
  PSM 3          Rev 03   740-048334   1GB44260007      High Capacity AC PSM
  PSM 4          Rev 03   740-048334   1GB44260016      High Capacity AC PSM
  PSM 5          Rev 03   740-048334   1GB44260040      High Capacity AC PSM
  PSM 6          Rev 03   740-048334   1GB44260045      High Capacity AC PSM
  PSM 7          Rev 03   740-048334   1GB44260029      High Capacity AC PSM
```

10. Run the `show chassis environment pdu` *`slot-number`* command to check the state of the upgraded PDUs and PSMs.

```
user@host> show chassis environment pdu 0
```

The following example shows output for High Capacity PDU 0.

```
user@host> show chassis environment pdu 0
PDU 0 status:
  State                          Online
```

```
  BoostConv                 OK
  Hours Used                260
  Firmware Version (MCU1)   03.04
  Firmware Version (MCU2)   03.02
  Firmware Version (MCU3)   03.02
  Firmware Version (MCU4)   03.02
  Firmware Version (MCU5)   03.02
  Firmware Version (MCU6)   03.02
  Firmware Version (MCU7)   03.02
  Firmware Version (MCU8)   03.02
PDU 0 PSM 0 status:
  State                     Online
  Temperature               OK   30 degrees C / 86 degrees F
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                260
  Firmware Version          01.01
PDU 0 PSM 1 status:
  State                     Online
  Temperature               OK   29 degrees C / 84 degrees F
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                259
  Firmware Version          01.01
PDU 0 PSM 2 status:
  State                     Online
  Temperature               OK   28 degrees C / 82 degrees F
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                260
  Firmware Version          01.01
PDU 0 PSM 3 status:
  State                     Online
  Temperature               OK   28 degrees C / 82 degrees F
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                259
  Firmware Version          01.01
PDU 0 PSM 4 status:
```

```
  State                       Online
  Temperature                 OK    28 degrees C / 82 degrees F
  Fans                        OK
  AC Input                    OK
  DC Output                   OK
  Hours Used                  259
  Firmware Version            01.01
PDU 0 PSM 5 status:
  State                       Online
  Temperature                 OK    28 degrees C / 82 degrees F
  Fans                        OK
  AC Input                    OK
  DC Output                   OK
  Hours Used                  259
  Firmware Version            01.01
PDU 0 PSM 6 status:
  State                       Online
  Temperature                 OK    28 degrees C / 82 degrees F
  Fans                        OK
  AC Input                    OK
  DC Output                   OK
  Hours Used                  258
  Firmware Version            01.01
PDU 0 PSM 7 status:
  State                       Online
  Temperature                 OK    28 degrees C / 82 degrees F
  Fans                        OK
  AC Input                    OK
  DC Output                   OK
  Hours Used                  259
  Firmware Version            01.01
```

SEE ALSO

PTX5000 AC Power System Description | 37

Upgrading to the High Capacity DC Power System

Before you upgrade a PTX5000 to the High Capacity DC power system from a normal-capacity power system:

- Ensure that the `No Redundant Power for System` alarm is not displayed when you run the `show chassis alarms` operational-mode CLI command.

  If the `No Redundant Power for System` alarm is displayed, see "Understanding Normal-Capacity Power System Power Zones" on page 172 for more information about PTX5000 redundancy and power zones for normal-capacity PSMs. Modify your hardware configuration so that the PTX5000 power system is redundant. Once redundant power is configured and the alarm is no longer displayed, you can begin the upgrade procedure.

- Ensure that the PTX5000 is running Junos OS release 14.1 or later.

To upgrade to the High Capacity DC power system:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the existing power supply modules (PSMs) from one of the power distribution units (PDUs). See "Replacing a PTX5000 60-A or 120-A DC PSM" on page 421 for details.

   Removing the PSMs raises the following alarms:

   - `No Redundant Power for FPC 0-7`
   - `No Redundant Power for Rear Chassis`
   - `No Redundant Power for Fan 0-2`
3. Remove the PDU from which PSMs have been removed and install a High Capacity DC PDU. See "Replacing a PTX5000 High Capacity DC PDU" on page 422 for details.
4. Install the High Capacity PSM sleeve into the PTX5000. See "Installing the High Capacity PSM Sleeves" on page 437 for details.
5. Install the PSMs in the new PDU and power on the PDU. See "Replacing a PTX5000 High Capacity DC PSM" on page 426 for details.

   Now there are two different types of PDUs in the chassis, resulting in the `Mix of PDUs` alarm being raised. And there are two different types of PSMs in the chassis, resulting in the `Power Manager Non Operational` alarm being raised. However, as long as the PDU is operational, one PDU and associated PSMs can fulfill the power requirements of the PTX5000. In this configuration, the `No Redundant Power for System` alarm is not displayed when you run the `show chassis alarms` command.

CAUTION: Do not replace other FRUs or perform online operations during the PDU upgrade procedure to ensure a smooth upgrade of the power system.

6. Repeat Step 2 through Step 5 to replace the second PDU with a High Capacity DC PDU.
7. Run the `show chassis alarms` command to verify that the `Mix of PDUs`, `Power Manager Non Operational`, and `No Redundant Power for System` alarms are not active.
8. Run the `show chassis hardware` command to verify that the PDUs and PSMs are connected.

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                JN120A713AJA      PTX5000
Midplane         REV 16   750-035893   ACAW7978          Midplane-8S
FPM              REV 12   760-030647   BBBD5622          Front Panel Display
PDU 0            Rev 02   740-036336   1GB93330016       Gen2 DC PDU
  PSM 0          Rev 02   740-046988   1GB63360009       Gen2 DC PSM
  PSM 1          Rev 02   740-046988   1GB63360002       Gen2 DC PSM
  PSM 2          Rev 02   740-046988   1GB63360017       Gen2 DC PSM
  PSM 3          Rev 02   740-046988   1GB63360005       Gen2 DC PSM
PDU 1            Rev 02   740-036336   1GB93330009       Gen2 DC PDU
  PSM 0          Rev 02   740-046988   1GB63360023       Gen2 DC PSM
  PSM 1          Rev 02   740-046988   1GB63360027       Gen2 DC PSM
  PSM 2          Rev 02   740-046988   1GB63360030       Gen2 DC PSM
  PSM 3          Rev 02   740-046988   1GB63360021       Gen2 DC PSM
```

NOTE: The High Capacity DC PDU and PSM are displayed as Gen2 DC PDU and Gen2 DC PSM in the command output (which is truncated).

9. Run the `show chassis environment pdu` *`slot-number`* command to check the state of the upgraded PDUs and PSMs.

```
user@host> show chassis environment pdu0
```

The following example shows output for High Capacity PDU 0.

```
user@host> show chassis environment pdu 0
PDU 0 status:
```

```
  State                     Online
  BoostConv                 OK
  Hours Used                69
  Firmware Version (MCU1)   02.16
PDU 0 PSM 0 status:
  State                     Online
  Temperature               OK   38 degrees C / 100 degrees F
  Fans                      OK
  DC Input                  OK
  DC Output                 OK
  Hours Used                69
  Firmware Version          01.46
PDU 0 PSM 1 status:
  State                     Online
  Temperature               OK   36 degrees C / 96 degrees F
  Fans                      OK
  DC Input                  OK
  DC Output                 OK
  Hours Used                69
  Firmware Version          01.46
PDU 0 PSM 2 status:
  State                     Online
  Temperature               OK   38 degrees C / 100 degrees F
  Fans                      OK
  DC Input                  OK
  DC Output                 OK
  Hours Used                69
  Firmware Version          01.46
PDU 0 PSM 3 status:
  State                     Online
  Temperature               OK   37 degrees C / 98 degrees F
  Fans                      OK
  DC Input                  OK
  DC Output                 OK
  Hours Used                69
  Firmware Version          01.46
PDU 0 PSM 4 status:
  State                     Online
  Temperature               OK   38 degrees C / 100 degrees F
  Fans                      OK
  DC Input                  OK
  DC Output                 OK
  Hours Used                68
```

```
  Firmware Version           01.46
PDU 0 PSM 5 status:
  State                      Online
  Temperature                OK   37 degrees C / 98 degrees F
  Fans                       OK
  DC Input                   OK
  DC Output                  OK
  Hours Used                 69
  Firmware Version           01.46
PDU 0 PSM 6 status:
  State                      Online
  Temperature                OK   38 degrees C / 100 degrees F
  Fans                       OK
  DC Input                   OK
  DC Output                  OK
  Hours Used                 68
  Firmware Version           01.46
PDU 0 PSM 7 status:
  State                      Online
  Temperature                OK   36 degrees C / 96 degrees F
  Fans                       OK
  DC Input                   OK
  DC Output                  OK
  Hours Used                 69
  Firmware Version           01.46
```

SEE ALSO

PTX5000 DC Power System Description | 78

Installing the High Capacity PSM Sleeves

The High Capacity AC and DC PSMs are smaller than the AC PSMs and 60-A or 120-A DC PSMs. Eight High Capacity AC or DC PSMs can be installed in a PTX5000. You must insert the PSM metal sleeves, provided with the High Capacity power system upgrade kit, in front of the PTX5000 router chassis before installing the PSMs. To install the PSM sleeve, you require the following tools and parts:

- Electrostatic discharge (ESD) grounding wrist strap (not provided)
- Phillips (+) screwdriver, number 1 (not provided)

- PSM sleeve and bracket—eight for each chassis (provided)

> **NOTE**: Each PSM sleeve can house two PSMs.

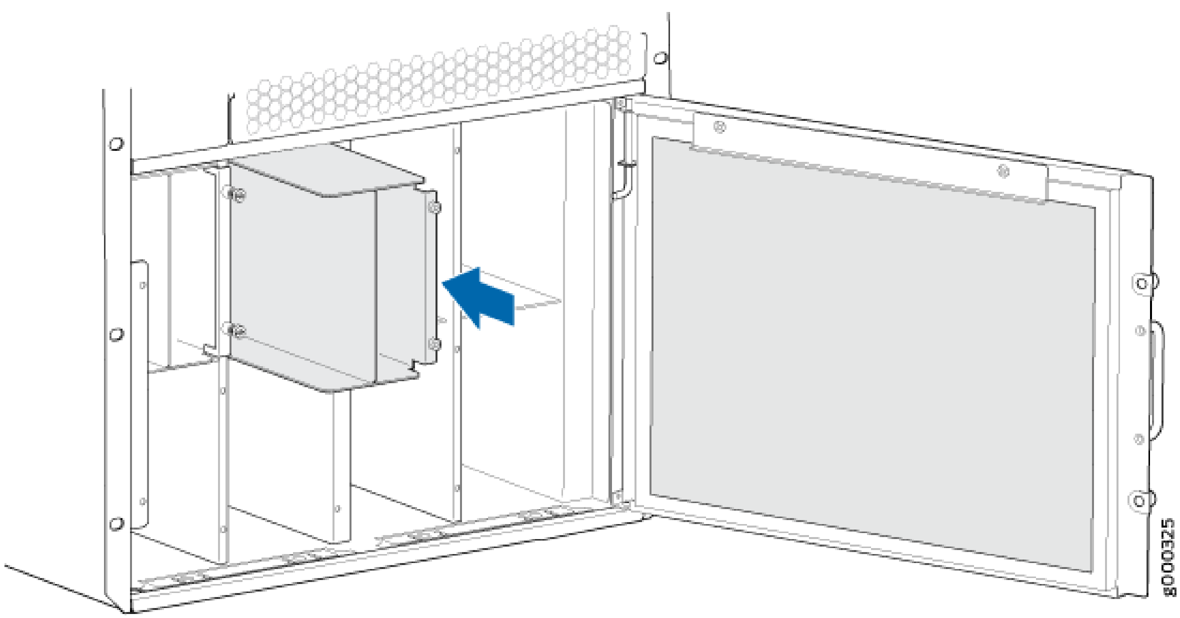
- PSM slot label—two for each chassis (provided)

Video: Installing the Metal Sleeves for High Capacity AC or DC PSMs

To install the High Capacity AC and DC PSM sleeve assembly:

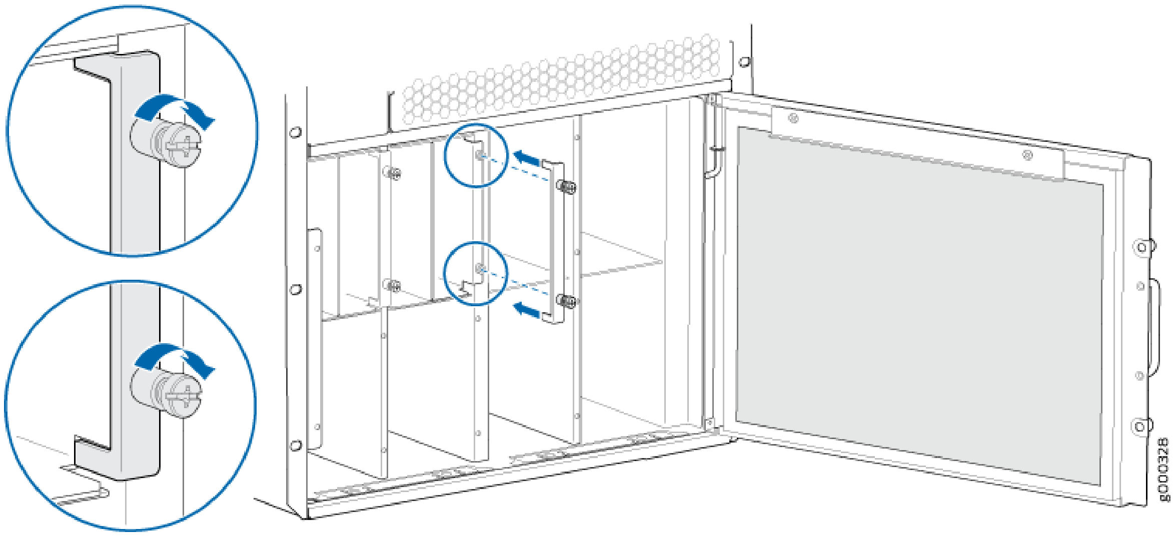
1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Remove the existing PSMs from the chassis. See "Replacing a PTX5000 60-A or 120-A DC PSM" on page 421 and "Replacing a PTX5000 Normal-Capacity AC PSM" on page 367 for details.
3. Take out the PSM sleeve assembly from the upgrade kit and remove the bracket by using a number 1 Phillips (+) screwdriver.
4. Insert the sleeve into one of the empty PSM slots and push the sleeve in until it is flush against the side of the chassis (see Figure 247 on page 438).

Figure 247: Inserting High Capacity PSM Sleeve



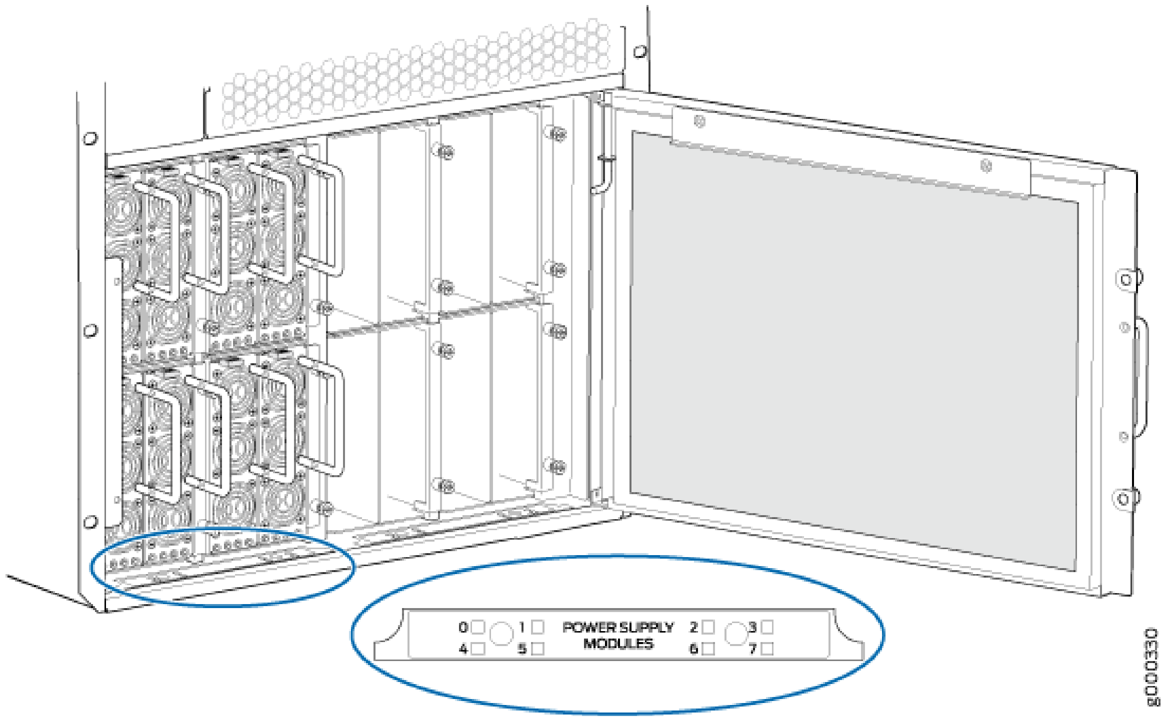
5. Align and fix the sleeve bracket tabs in to the slots at the top and bottom of the sleeve (see Figure 248 on page 439).

Figure 248: Fixing PSM Sleeve Bracket



6. Fasten the sleeve bracket screws into the chassis by using a number 1 Phillips (+) screwdriver.
7. Remove the old PSM slot label. You can lift a corner and peel off the label.
8. Remove the sticker liner from the new PSM slot label and apply it to the chassis, centered over the screws.

Figure 249: Applying New PSM Slot Label



9. Repeat these steps for the other sleeve assemblies.

SEE ALSO

Replacing a PTX5000 High Capacity DC PSM | 426

Maintaining the PTX5000 Host Subsystem

IN THIS SECTION

Maintaining the PTX5000 Host Subsystem

IN THIS SECTION

Purpose

For optimum PTX5000 performance, verify the condition of the host subsystem. Each host subsystem comprises a Routing Engine and an adjacent Control Board functioning together.

Action

On a regular basis:

- Check the host subsystem LEDs **OK** and **Fail** on the craft interface for (**HOST0** and **HOST1**. For more information about the LEDs on the craft interface, see "PTX5000 Craft Interface LEDs" on page 22.

  During normal operations:

  - The green host subsystem **OK** LED on the craft interface is lit.
  - The red host subsystem **FAIL** LED on the craft interface is not lit.

Understanding the Effect of Taking the PTX5000 Host Subsystem Offline

IN THIS SECTION

Taking a Nonredundant Host Subsystem Offline

Taking a nonredundant host subsystem offline shuts down the PTX5000.

Taking a Backup Host Subsystem Offline

Taking a backup host subsystem offline does not interrupt the functioning of the PTX5000. The backup host subsystem is hot-removable and hot-insertable.

Taking a Primary Host Subsystem Offline

Removal or failure of the primary Routing Engine affects forwarding and routing based on the high availability configuration.

NOTE: For information about configuring high availability features such as *graceful Routing Engine switchover* (GRES) and *nonstop active routing* (NSR), see the High Availability User Guide. Both Routing Engines should be running the same Junos OS release.

If the backup Routing Engine's configuration differs from the former primary's configuration, router performance might change. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to each Routing Engine.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the `re0` and `re1` statements at the `[edit groups]` hierarchy level and use the `apply-groups` statement. For instructions, see the Junos OS Administration Library.

When a primary host subsystem is taken offline or during a primary role switch, the backup host subsystem becomes the primary, and the backup Routing Engine assumes Routing Engine functions. The primary host subsystem is hot-pluggable. During the switchover to the backup Routing Engine:

- Dual Routing Engines without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. Packet forwarding halts while the standby Routing Engine becomes the primary and the Packet Forwarding Engine components reset and connect to the new primary Routing Engine. All kernel and forwarding processes are restarted. When the switchover to the new primary Routing Engine is complete, routing convergence takes place and traffic is resumed.

- GRES is supported on Junos OS Release 12.1X48 and later.

  GRES is enabled—Graceful Routing Engine switchover preserves interface and kernel information. Traffic is not interrupted. The backup Routing Engine immediately assumes Routing Engine functions and there is no interruption to packet forwarding. However, graceful Routing Engine switchover does not preserve the control plane. Neighboring routers detect that the PTX5000 has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful Routing Engine switchover must be combined with nonstop active routing.

- Nonstop active routing is supported on Junos OS Release 12.1X48R3 and later.

  Nonstop active routing is enabled (graceful Routing Engine switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports Routing Engine switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful Routing Engine switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both Routing Engines. In addition, nonstop active routing preserves TCP connections maintained in the kernel.

- Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop.

SEE ALSO

request system halt

request vmhost halt

Maintaining the PTX5000 Routing Engines

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the Routing Engines.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. During normal operations, the **OK** LED is lit green, and the **FAIL** LED is not lit. See "PTX5000 Craft Interface LEDs" on page 22.
- Check the LEDs on the Routing Engine. During normal operation, the **ONLINE** LED on each Routing Engine is lit green, indicating that the Routing Engine is functional. See "PTX5000 Routing Engine LEDs" on page 114.
- Look at the LCD display on the craft interface to view information about the status of the Routing Engines.
- Issue the `show chassis routing-engine` command to verify that the Routing Engines are operating properly.

Replacing a PTX5000 RE-DUO-C2600 Routing Engine

IN THIS SECTION

Taking the PTX5000 Host Subsystem Offline

Before you replace a Routing Engine, you must take the host subsystem offline. The host subsystem is taken offline and brought online as a unit. Be aware of the effect of taking a host subsystem offline on traffic, forwarding, and routing. See "Understanding the Effect of Taking the PTX5000 Host Subsystem Offline" on page 442.

To take a host subsystem offline:

1. Determine whether the Routing Engine to be replaced is currently functioning as the primary or as the backup, using one of the following methods:

   a. Check the **HOST 0** and **HOST 1** LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.

   b. Check the **MASTER** LED on the Control Board. If the blue **MASTER** LED is lit, the host subsystem is functioning as the primary.

   c. Issue the `show chassis routing-engine` command. The primary Routing Engine is designated `Master` in the `Current state` field.

   ```
   user@host> show chassis routing-engine

   user@host> show chassis routing-engine
   Routing Engine status:
     Slot 0:
       Current state                  Master
       Election priority              Master (default)
   ...
   ```

2. If the Routing Engine to be replaced is currently functioning as the primary, switch it to backup using the CLI command:

   ```
   user@host> request chassis routing-engine master switch
   warning: Traffic will be interrupted while the PFE is re-initialized
   Toggle mastership between Routing Engines ? [yes,no] (no) yes
   ```

```
Resolving mastership...
Complete. The other Routing Engine becomes the master.
```

3. Halt the host subsystem.

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

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

> **NOTE**: The `request system halt` command halts the Routing Engine on the control plane from which it was issued. The command shuts down the Routing Engine cleanly, so its state information is preserved. The SIBs might continue forwarding traffic for approximately 5 minutes after the `request system halt` command has been issued. To reboot a Routing Engine that has been halted, you must connect through the console.

4. On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host> request chassis cb offline slot n
```

n is 0 or 1 for the slot number of the host subsystem being taken offline.

5. Verify that the Control Board is offline:

```
user@host> show chassis environment cb
```

Removing a PTX5000 Routing Engine

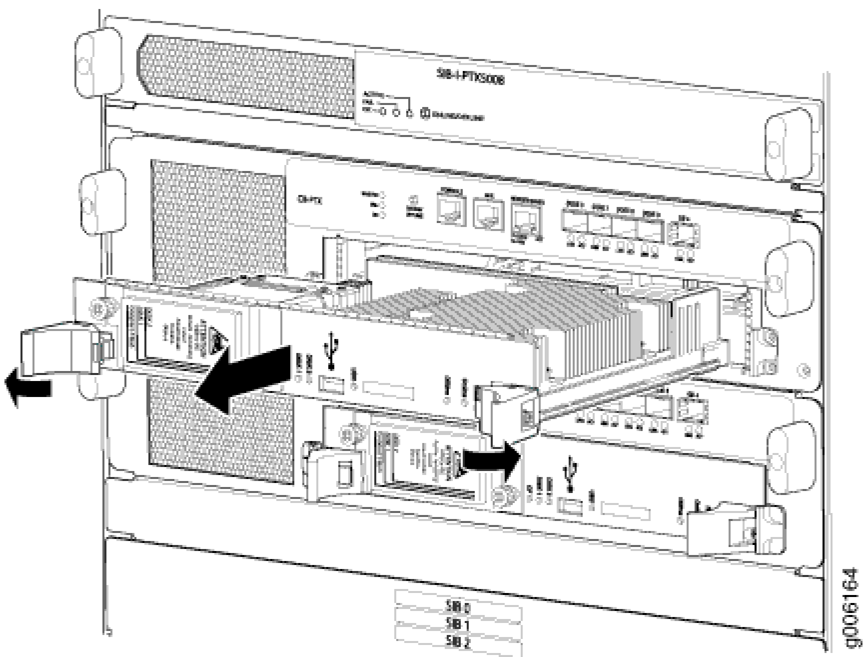
The PTX5000 can have one or two Routing Engines. They are located in a slot inside the Control Board below the SIBs in the rear of the chassis. Each Routing Engine can weigh up to 2.8 lb (1.3 kg).

To remove a Routing Engine (see Figure 250 on page 447):

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

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Take the host subsystem offline.
4. Press the red tabs on the ejector handles on both sides of the Routing Engine faceplate.
5. Flip the ejector handles outward to unseat the Routing Engine.
6. Grasp the Routing Engine by the ejector handles and slide it about halfway out of the chassis.
7. Place one of your hands underneath the Routing Engine to support it and slide it completely out of the chassis.
8. Place the Routing Engine on the antistatic mat.

Figure 250: Removing a Routing Engine



Installing a PTX5000 Routing Engine

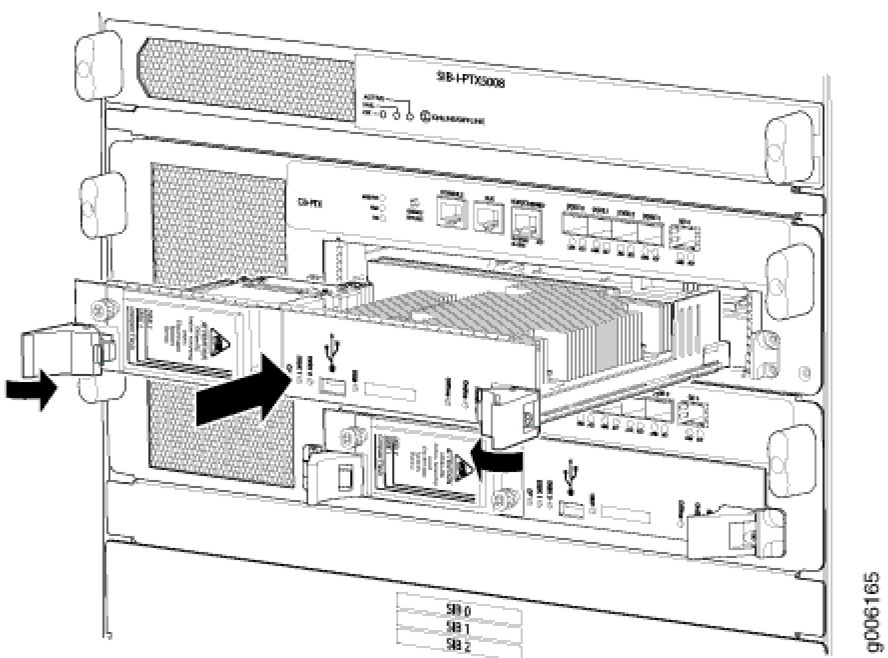
To install a Routing Engine (see Figure 251 on page 448):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.

4. Carefully align the sides of the Routing Engine with the guides inside the opening on the Control Board.
5. Slide the Routing Engine into the chassis until you feel resistance, then press the Routing Engine's faceplate until it engages the connectors.
6. Press both the ejector handles inward to seat the Routing Engine.

   The Routing Engine might require several minutes to boot. If the PTX5000 is powered on and the Routing Engine's corresponding Control Board is functioning normally, the Routing Engine comes online automatically.
7. Verify that the Routing Engine is installed correctly and functioning properly:
   - Verify that the green **ONLINE** LED lights steadily.
   - Verify the status of the Routing Engine using the **show chassis routing-engine** command.

Figure 251: Installing a Routing Engine



Replacing a CompactFlash Card in a PTX5000 Routing Engine

IN THIS SECTION

Removing a CompactFlash Card from a PTX5000 Routing Engine

The CompactFlash card is located in the slot labeled **CompactFlash** on the Routing Engine faceplate. To remove the CompactFlash card (see Figure 3):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Determine whether the host subsystem is functioning as the primary or as the backup, using one of these methods:
   - Check the **HOST 0** and **HOST 1** LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.
   - Check the **MASTER** LED on the Control Board. If the blue **MASTER** LED is lit, the host subsystem is functioning as the primary.
   - Issue the following CLI command. The primary Routing Engine is designated `Master` in the `Current state` field for the Routing Engine in `Slot 0`:

   ```
   user@host> show chassis routing-engine
   Routing Engine status:
     Slot 0:
       Current state                  Master
   ...
   ```

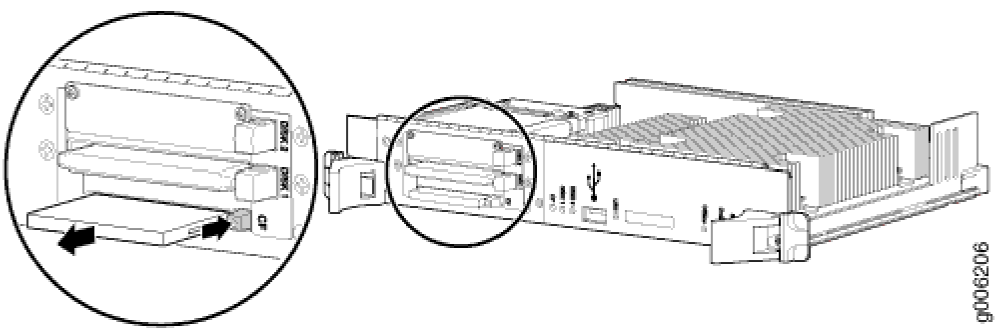
3. If the host subsystem is functioning as the primary, switch it to backup using the `request chassis routing-engine master switch` command.
4. From the primary Routing Engine, issue the `request system power-off other-routing-engine` to power down the backup Routing Engine.
5. Verify that the **Online**, **Disk1**, and **CF** LEDs on the backup Routing Engine faceplate are off.

6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
7. Remove the cover from the Routing Engine slots by loosening the captive screws on the corners of the cover (using a number 2 Phillips (+) screwdriver).

> **CAUTION**: Do not remove the cover if any of the LEDs are lit.

8. Press the eject button on the right side of the CompactFlash card slot to release the CompactFlash card.
9. The CompactFlash card pops partially out of the slot. Grasp the card and pull it completely out of the slot.
10. Place the CompactFlash card on the antistatic mat.

Figure 252: Removing a Routing Engine CompactFlash Card



Installing a CompactFlash Card in a PTX5000 Routing Engine

To install a CompactFlash card (see Figure 253 on page 451):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the cover from the Routing Engine slots by loosening the captive screws on the corners of the cover (using a number 2 Phillips (+) screwdriver).
3. Insert the CompactFlash card into the CompactFlash card slot on the Routing Engine, with the logo facing up.

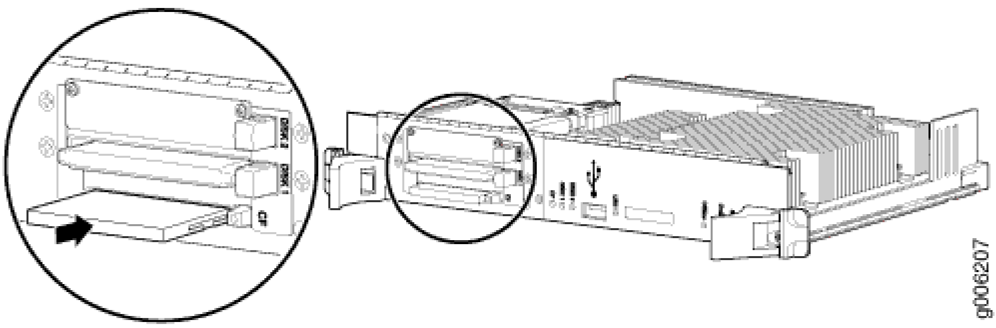
> **CAUTION**: Be sure to insert the CompactFlash card with the label facing up. Inserting the CompactFlash card incorrectly might damage the Routing Engine.

4. Press the card firmly all the way into the slot.

5. Reinstall the Routing Engine cover and tighten the screws on the corners of the cover to secure it to the Routing Engine (using a number 2 Phillips (+) screwdriver).
6. From the primary Routing Engine, issue the `request system power-on other-routing-engine` command to power on the Routing Engine.

> **NOTE**: You may get an error message and be prompted for a keystroke. After you press the keystroke, it might take up to 10 minutes for the Routing Engine to reset and for the router to boot from the solid-state disk.

Figure 253: Installing a Routing Engine CompactFlash Card



Copying the Junos OS to the CompactFlash Card in a PTX5000 Routing Engine

After installing the CompactFlash card for the first time, you must copy the software from the Routing Engine's solid-state disk (SSD) to the CompactFlash card.

To copy software to the CompactFlash card:

1. On the console or other management device connected to the Routing Engine, enter CLI operational mode, and copy the currently running and active file system partitions on the router to standby partitions on the CompactFlash card. Issue the `request system snapshot partition` command.
2. Wait until a message appears on the console confirming that the snapshot partition procedure is complete.
3. Issue the `request system reboot` command to reboot the router's software.
4. Issue the `show system boot-messages` command to verify that the CompactFlash card is listed as the primary boot device. The output lists the devices mounted. The CompactFlash card is located at `ad0`.

Replacing an SSD Drive on a RE-DUO-C2600-16G

IN THIS SECTION

Removing an SSD Drive From a RE-DUO-C2600-16G

The solid-state disk (SSD) drive is located in the slot labeled **Disk1** on the Routing Engine faceplate.

NOTE: The **Disk 2** slot is not currently supported.

To remove an SSD drive from a Routing Engine (see Figure 5):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Determine whether the host subsystem is functioning as the primary or as the backup, using one of these methods:
   - Check the **HOST 0** and **HOST 1** LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.
   - Check the **MASTER** LED on the Control Board. If the blue **MASTER** LED is lit, the host subsystem is functioning as the primary.
   - Issue the following CLI command. The primary Routing Engine is designated `Master` in the `Current state` field:

```
user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
...
```

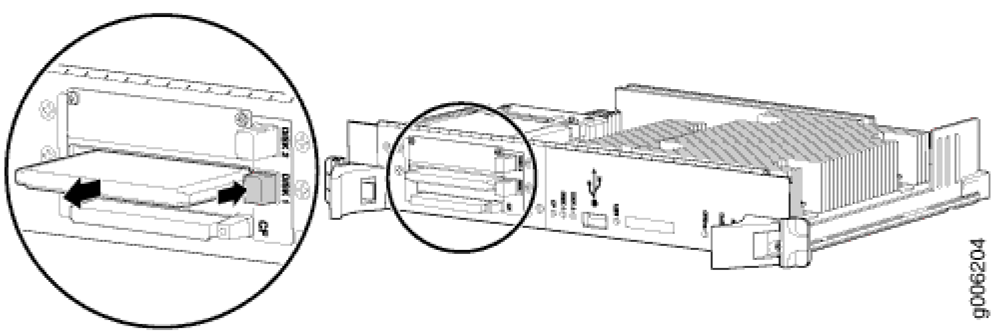
3. If the host subsystem is functioning as the primary, switch it to backup using the `request chassis routing-engine master switch` command.

4. From the primary Routing Engine, issue the `request system power-off other-routing-engine` to power down the backup Routing Engine.
5. Verify that the **Online**, **Disk1** , and **CF** LEDs on the backup Routing Engine faceplate are off.
6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
7. Remove the cover from the Routing Engine slots by loosening the captive screws on the corners of the cover (using a number 2 Phillips (+) screwdriver).

> **CAUTION**: Do not remove the cover if any of the LEDs on the Routing Engine faceplate are lit.

8. Press the eject button on the right side of the **Disk1** slot to release the SSD drive.
9. The SSD drive pops partially out of the slot. Grasp the SSD drive and carefully slide it completely out of the slot.
10. Place the SSD drive on the antistatic mat.

Figure 254: Removing an SSD Drive From a RE-DUO-C2600-16G



Installing an SSD Drive in a RE-DUO-C2600-16G

To install an SSD drive in a Routing Engine (see Figure 255 on page 454):

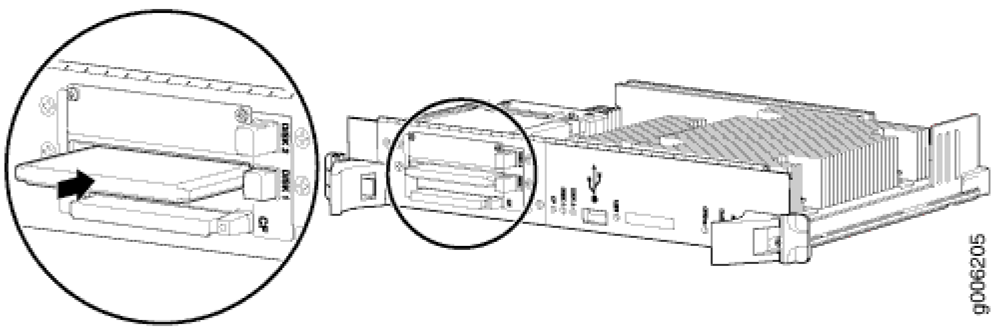
1. Insert the SSD drive into the **Disk1** slot on the Routing Engine, with the logo facing down.

> **CAUTION**: Be sure to insert the SSD drive with the label facing down. Inserting the SSD drive incorrectly might damage the Routing Engine.

Slide the SSD drive into the slot until you feel resistance, carefully ensuring that it is correctly aligned.

2. Reinstall the Routing Engine cover and tighten the screws on the corners of the cover to secure it to the Routing Engine (using a number 2 Phillips (+) screwdriver).
3. From the primary Routing Engine, issue the `request system power-on other-routing-engine` command to power on the Routing Engine.

Figure 255: Installing an SSD Drive in a RE-DUO-C2600-16G



Copying the Junos OS to the Solid-State Disk in a PTX5000 Routing Engine

After installing a solid-state disk (SSD) for the first time, you must copy the software from the Routing Engine's CompactFlash card to the SSD drive.

To copy software to the SSD drive:

1. On the console or other management device connected to the Routing Engine, enter CLI operational mode.
2. Partition the SSD drive. Issue the `request system partition hard-disk` command.
3. Wait until a message appears on the console confirming that the partition procedure is complete.
4. Reboot the router's software. Issue the `request system reboot` command.
5. Back up the currently running and active file system partitions on the router to standby partitions that are not running. Issue the `request system snapshot` command.issue the `request system snapshot` command.
6. Wait until a message appears on the console confirming that the snapshot procedure is complete.
7. Reboot the router's software again. Issue the `request system reboot` command.
8. Verify that the SSD drive is listed as the secondary boot device. The output lists the devices mounted. The SSD drive is located at `ad1`. issue the `show system boot-messages` command.

Replacing a PTX5000 RE-PTX-X8-64G Routing Engine

IN THIS SECTION

To replace the RE-PTX-X8-64G Routing Engine, perform the following procedures:

Taking the Host Subsystem Offline

Before you replace a Routing Engine, you must take the host subsystem offline. The host subsystem is taken offline and brought online as a unit. Be aware of the effect of taking a host subsystem offline on traffic, forwarding, and routing. See "Understanding the Effect of Taking the PTX5000 Host Subsystem Offline" on page 442.

To take a host subsystem offline:

1. Determine whether the Routing Engine to be replaced is currently functioning as the primary or as the backup, using one of the following methods:

   - Check the **HOST 0** and **HOST 1** LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.

   - Check the **MASTER** LED on the Control Board. If the blue **MASTER** LED is lit, the host subsystem is functioning as the primary.

   - Issue the `show chassis routing-engine` command. The primary Routing Engine is designated `Master` in the `Current state` field.

```
user@host> show chassis routing-engine

user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
...
```

2. If the Routing Engine to be replaced is currently functioning as the primary, switch it to backup by using the CLI command:

```
user@host> request chassis routing-engine master switch
warning: Traffic will be interrupted while the PFE is re-initialized
Toggle mastership between Routing Engines ? [yes,no] (no) yes

Resolving mastership...
Complete. The other Routing Engine becomes the master.
```

3. Halt the host subsystem.

```
user@host> request vmhost halt

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

> **NOTE**: The `request vmhost halt` command halts the Routing Engine on the control plane from which it was issued. The command shuts down the Routing Engine cleanly, so its state information is preserved. The SIBs might continue forwarding traffic for approximately 5 minutes after the `request vmhost halt` command has been issued. To reboot a Routing Engine that has been halted, you must connect through the console.

On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host> request chassis cb offline slot n
```

n is 0 or 1 for the slot number of the host subsystem being taken offline.

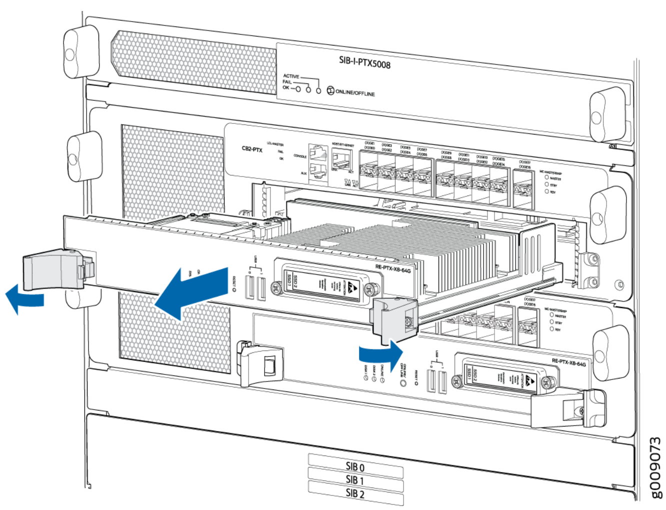
4. Verify that the Control Board is offline:

```
user@host> show chassis environment cb
```

Removing the Routing Engine

The PTX5000 can have one or two Routing Engines. They are located in a slot inside the Control Board below the SIBs in the rear of the chassis. Each Routing Engine can weigh up to 2.6 lb (1.2 kg).

Figure 256: Removing the RE-PTX-X8-64G Routing Engine

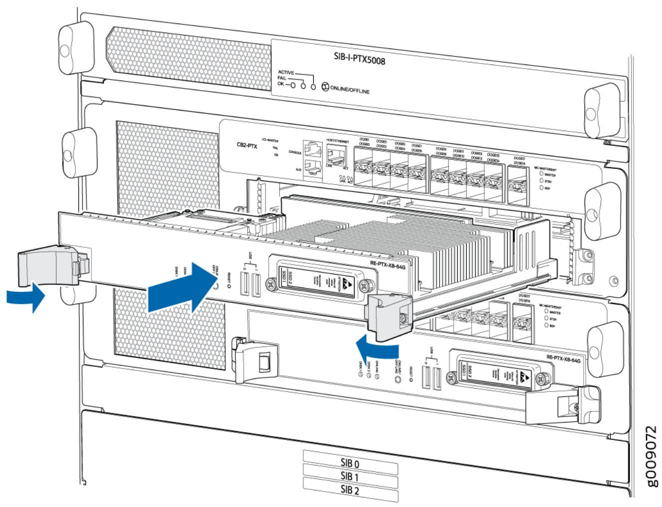


Remove the Routing Engine from the chassis:

1. Power off the Routing engine gracefully.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface. 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. Verify that the Routing Engine LEDs are off. Loosen the captive screws on the top and bottom of the Routing Engine.
4. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
5. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis. Place the Routing Engine on an antistatic mat.

Installing the Routing Engine RE-PTX-X8-64G

Figure 257: Installing the RE-PTX-X8-64G Routing Engine



NOTE: While installing, ensure that you install the Routing Engine RE-PTX-X8-64G into the Control Board CB2-PTX only.

To install a Routing Engine (see Figure 257 on page 458):

1. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.
4. Carefully align the sides of the Routing Engine with the guides inside the opening on the Control Board.
5. Slide the Routing Engine into the chassis until you feel resistance, and then press the Routing Engine's faceplate until it engages the connectors.
6. Press both the ejector handles inward to seat the Routing Engine.
7. Reconnect the cables and verify that the Routing Engine is installed correctly and functioning properly:

- Verify that the green **ONLINE** LED lights steadily.
- Verify the status of the Routing Engine using the `show chassis routing-engine` command.

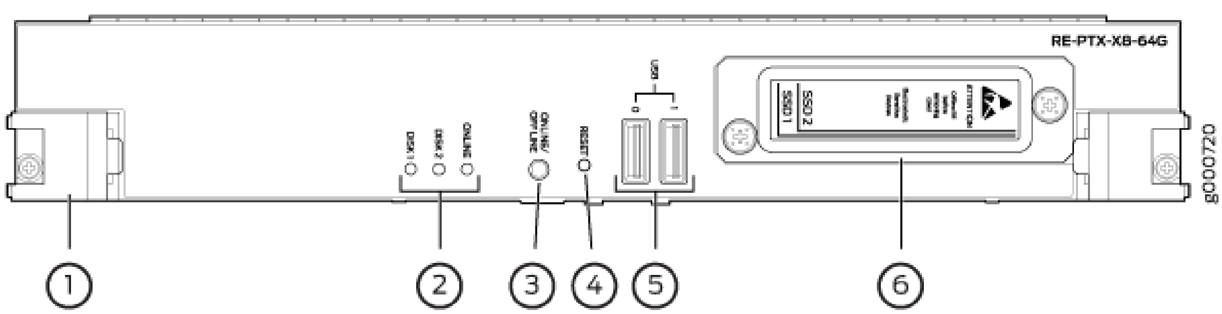
The Routing Engine might require several minutes to boot. If the PTX5000 is powered on and the Routing Engine's corresponding Control Board is functioning normally, the Routing Engine comes online automatically.

Replacing an SSD Drive on a RE-PTX-X8-64G

Each RE-PTX-X8-64G Routing Engine supports two solid-state disk (SSD) drives specified by Juniper Networks. The RE-PTX-X8-64G ships with two SSD drives installed in the slot labeled **DISK1** and **DISK2**. Figure 258 on page 459 shows the arrangement of storage drive slots on a RE-PTX-X8-64G Routing Engine.

64GB slim SATA SSD drive has been verified to work in the RE-PTX-X8-64G Routing Engine.

Figure 258: RE-PTX-X8-64G Storage Drive Slots



To replace a SSD drive:

1. Offline the Routing Engine by pressing the **ONLINE/OFFLINE** button.
2. Remove the SSD drive.

    a. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the appliance.

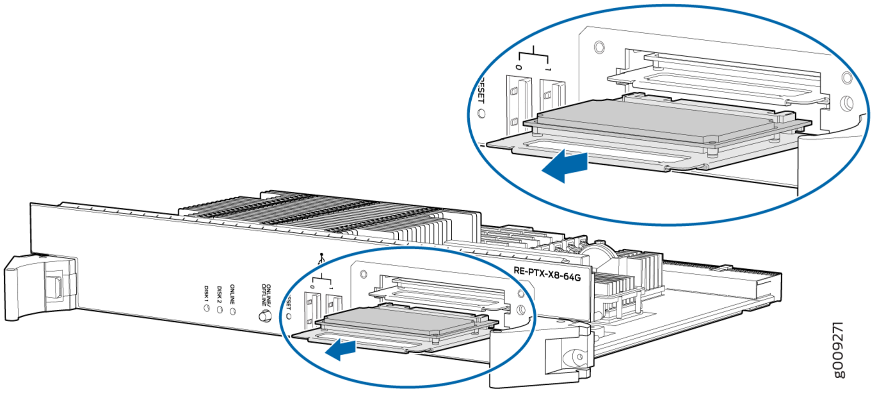
    For more information about ESD, see *Preventing Electrostatic Discharge Damage* in the hardware guide for your router.

    b. Unfasten the thumbscrew that secures the access door in front of the storage drive slots, and open the door.

    c. Slide the lock on the ejector to the unlocked position.

d. Carefully slide the drive out of the slot.

Figure 259: Removing the SSD Drive From a RE-PTX-X8-64G



3. Reinstall a storage drive.

   a. Carefully align the sides of the drive with the guides in the slot.

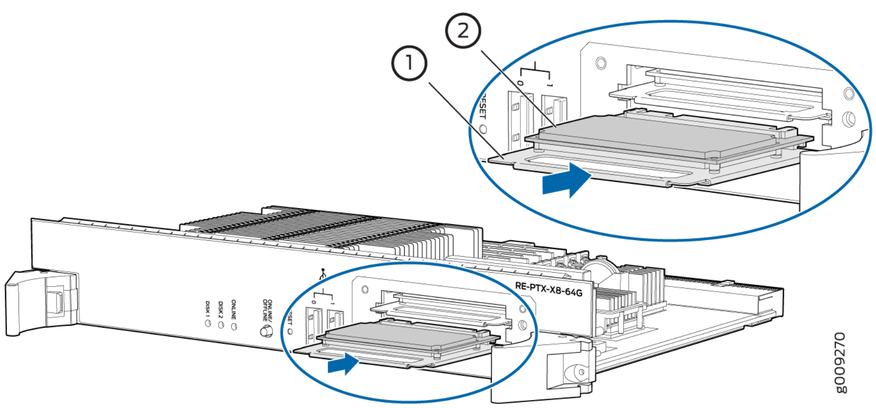
   b. Slide the drive into the slot until you feel resistance, carefully ensuring that it is correctly aligned.

   c. Close the access door and tighten the thumbscrew to secure the door.

4. Bring the Routing Engine online by pressing the **ONLINE/OFFLINE** button or from the CLI by using `request chassis cb0/1 online` command.

5. Verify that the SSD drive is recognized by using the `show vmhost hardward` command.

Figure 260: Installing an SSD Drive in a RE-PTX-X8-64G



1– Carrier	2– SSD drive

Maintaining the PTX5000 Control Boards

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the Control Boards.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. See "PTX5000 Craft Interface LEDs" on page 22.

  During normal operations:

  - The green host subsystem **OK** LED on the craft interface is lit.
  - The red host subsystem **FAIL** LED on the craft interface is not lit.

- Look at the LEDs on the Control Board faceplates to see information about the Control Boards.

  During normal operations:

  - The green **OK** LED on the Control Board faceplate is lit.
  - The yellow **FAIL** LED on the Control Board faceplate is not lit.

- Issue the `show chassis environment cb` command to verify that the Control Boards are operating properly.

Replacing a PTX5000 Control Board

IN THIS SECTION

Taking the PTX5000 Host Subsystem Offline

Before you replace a Control Board, you must take the host subsystem offline. The host subsystem is taken offline and brought online as a unit. Be aware of the effect of taking a host subsystem offline on traffic, forwarding, and routing. See "Understanding the Effect of Taking the PTX5000 Host Subsystem Offline" on page 442.

To take a host subsystem offline:

1. Determine whether the host subsystem is functioning as the primary or as the backup, using one of the two following methods:

   - If the green **MASTER** LED on the Routing Engine is lit, the corresponding host subsystem is functioning as the primary.

   - Issue the `show chassis routing-engine` command. The primary Routing Engine is designated `Master` in the `Current state` field.

   ```
   user@host> show chassis routing-engine
   user@host> show chassis routing-engine
   Routing Engine status:
     Slot 0:
       Current state                 Master
       Election priority             Master (default)
   ...
   ```

2. If the host subsystem is functioning as the primary, switch it to backup using the CLI command:

```
user@host> request chassis routing-engine master switch
warning: Traffic will be interrupted while the PFE is re-initialized
Toggle mastership between Routing Engines ? [yes,no] (no) yes
```

```
Resolving mastership...
Complete. The other Routing Engine becomes the master.
```

3. To halt the host subsystem:

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

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

> **NOTE**: To halt the host subsystem that comprises the Routing Engine RE-DUO-C2600-16G, use **request system halt**.
>
> Similarly, to halt the host subsystem that comprises the Routing Engine RE-PTX-X8-64G, use **request vmhost halt**.
>
> The `request system halt` command halts the Routing Engine on the control plane from which it was issued. The command shuts down the Routing Engine cleanly, so its state information is preserved. The SIBs might continue forwarding traffic for approximately 5 minutes after the `request system halt` command has been issued. To reboot a Routing Engine that has been halted, you must connect through the console.

4. On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host> request chassis cb offline slot n
```

n is 0 or 1 for the slot number of the host subsystem being taken offline.

5. Verify that the Control Board is offline:

```
user@host> show chassis environment cb
```

Removing a PTX5000 Control Board

To remove a Control Board (see Figure 262 on page 465):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label and disconnect the cables.
4. Remove the Routing Engine from the Control Board.
5. Rotate the ejector handles counterclockwise on both sides of the Control Board faceplate.
6. Grasp the ejector handles and slide the Control Board about halfway out of the chassis.
7. Place one hand underneath the Control Board to support it and slide it completely out of the chassis. Place it on the antistatic mat.

> **CAUTION**: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 261: Removing a Routing Engine from a Control Board

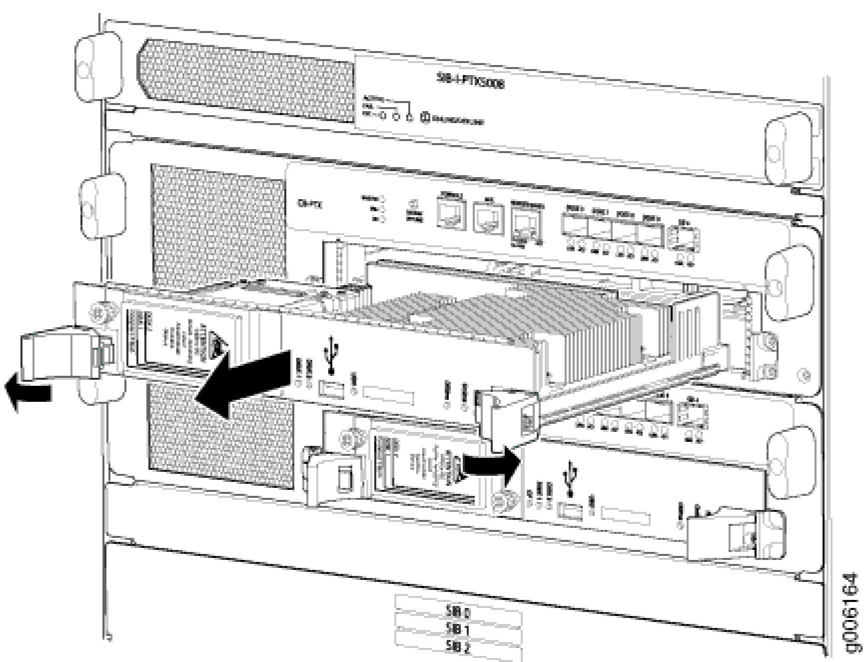
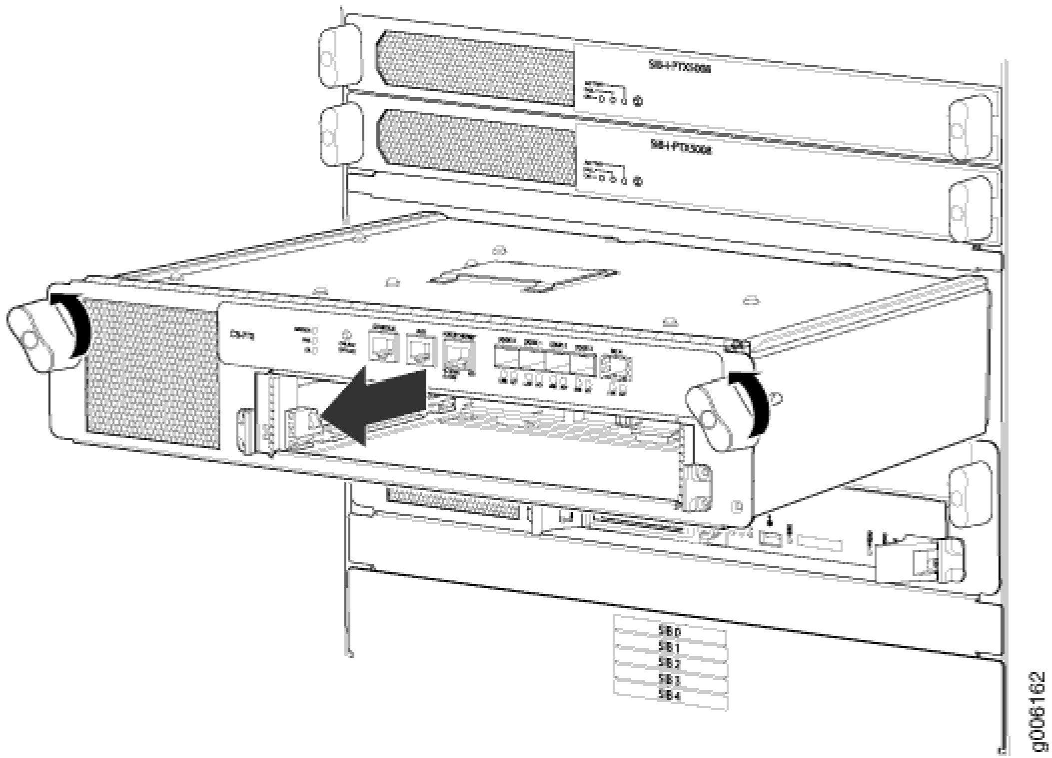


Figure 262: Removing a Control Board



Installing a PTX5000 Control Board

To install a Control Board (see Figure 263 on page 466):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
2. Carefully align the bottom and then the top edges of the Control Board with the guides inside the chassis.
3. Slide the Control Board into the chassis, carefully ensuring that it is correctly aligned.
4. Twist both ejector handles clockwise to seat the host subsystem until the ejectors latch into the faceplate.
5. Install the Routing Engine into the Control Board.

> **NOTE**: If power is applied to the Routing Engine and its corresponding Control Board is functioning normally, the Control Board comes online automatically.

6. Reconnect the cables.
7. To verify that the Control Board is installed correctly and functioning normally:

- Connect an Ethernet cable to the **HOST/ETHERNET** port on the Control Board. If the host subsystem is operational, the **ACT** port LED is lit to indicate Ethernet activity. If you can run the CLI from a management device attached to the Control Board, the Control Board is installed correctly.
- Verify that the green **OK** LED on the Control Board faceplate is lit steadily green. The green **OK** LED should light steadily a few minutes after the Control Board is installed.
- Verify that the **FAIL** on the Control Board faceplate is not lit. If the **FAIL** LED is lit steadily, remove and install the Control Board again. If the **FAIL** LED still lights steadily, the Control Board is not functioning properly. Contact your customer support representative.
- To verify that the Control Board is `Online`, use the `show chassis environment cb` command.

NOTE: Ensure that you Install the Routing Engine RE-DUO-C2600-16G into the Control Board CB-PTX and the Routing Engine RE-PTX-X8-64G into the Control Board CB2-PTX only.

Figure 263: Installing a Control Board

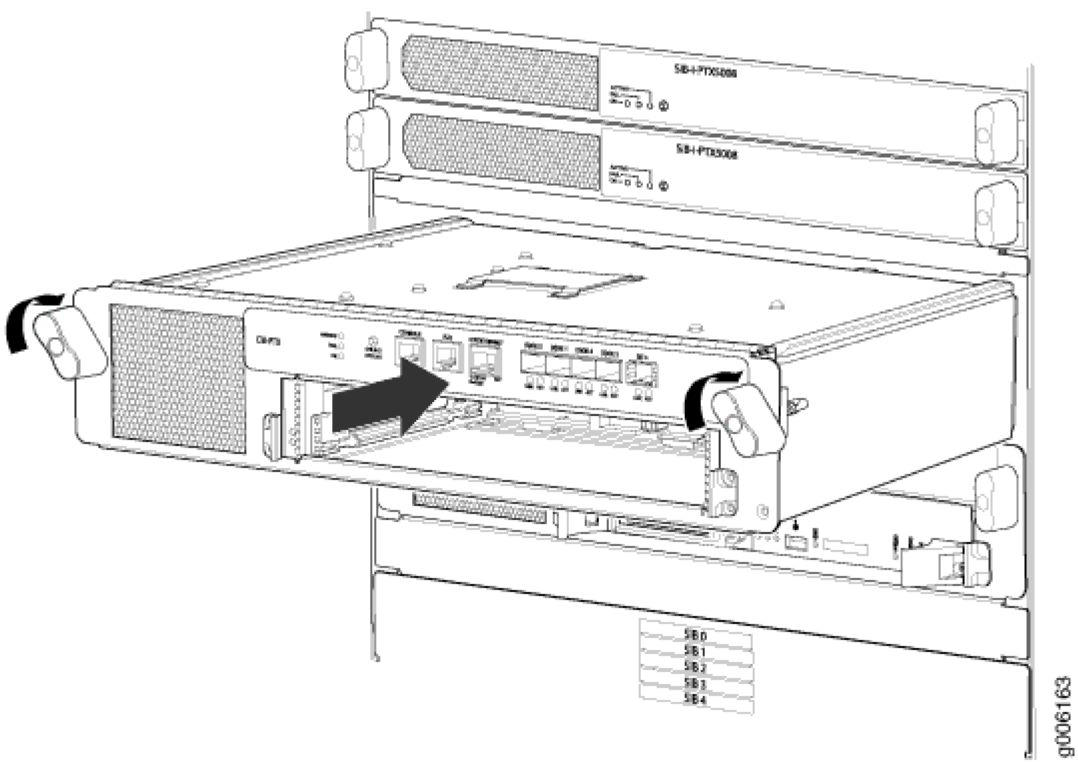
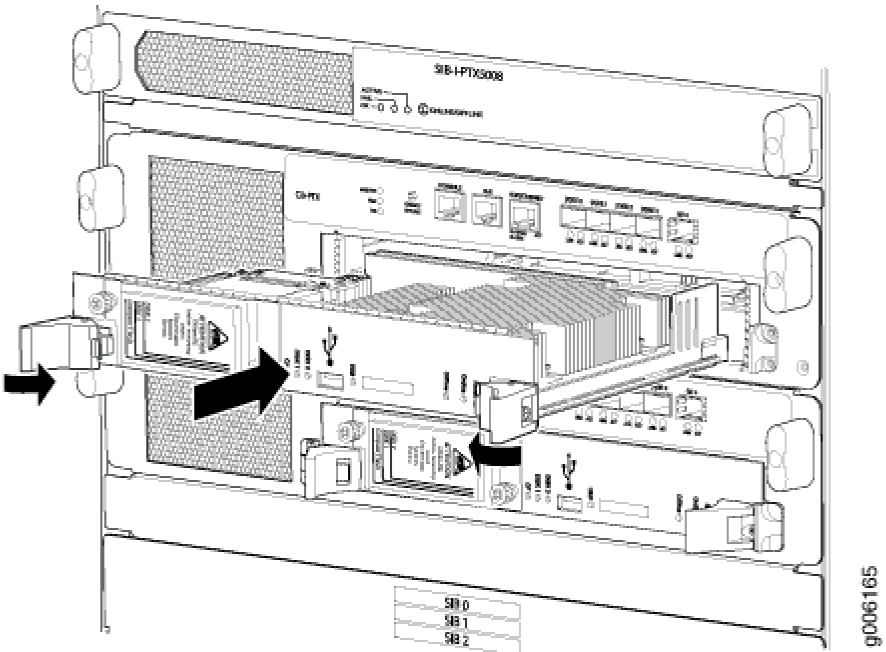


Figure 264: Installing a Routing Engine into a Control Board



Replacing a PTX5000 Management Console or Auxiliary Port Cable

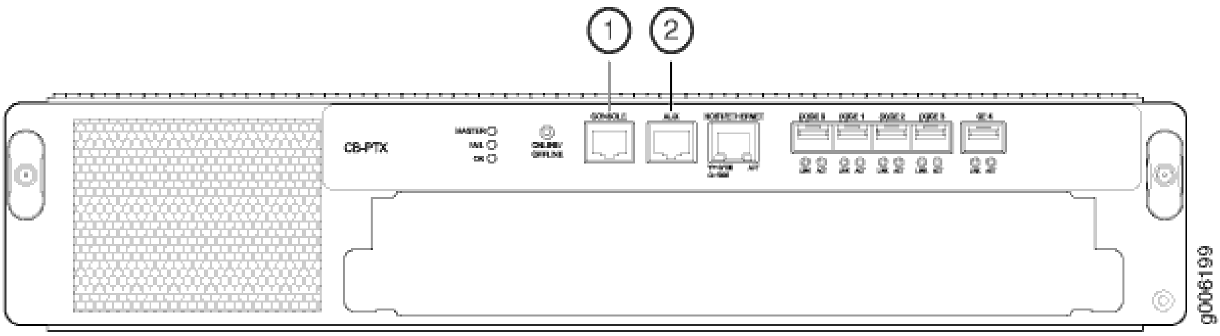
IN THIS SECTION

Removing a Management Console or Auxiliary Port Cable

To remove a cable from the console or auxiliary port (see Figure 16):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Turn off the power to the console or auxiliary device.
3. Pull the cable connector straight out of the port.
4. Disconnect the cable from the console or auxiliary device.

Figure 265: Installing the Console or Auxiliary Port Cable



1– Console port	2– Auxiliary port

Installing a Management Console or Auxiliary Port Cable

To install a management console or auxiliary device cable:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. If necessary, turn off the power to the console or auxiliary device.
3. Plug one end of a copper cable with RJ-45 connectors into the **CONSOLE** or **AUXILIARY** port on the Control Board in slot **CB0**. This port connects to the Routing Engine installed into the Control Board in slot **CB0**.
4. Attach the other end of the cable to the console or auxiliary device.
5. Plug one end of another copper cable with RJ-45 connectors into the **CONSOLE** or **AUXILIARY** port on **CB1**. This port connects to the Routing Engine installed into the control in slot **CB1**.
6. Attach the other end of the cable to the console or auxiliary device.

Replacing a PTX5000 Management Ethernet Cable

IN THIS SECTION

Removing a PTX5000 Management Ethernet Cable

To remove a management Ethernet cable:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Press the tab on the connector and pull the connector straight out of the **HOST/ETHERNET** port (see Figure 18). Figure 17 shows the connector.
3. Disconnect the cable from the network device.

Figure 266: Management Ethernet Cable Connector

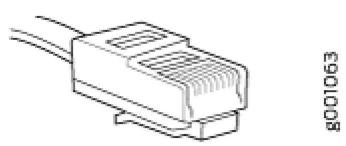
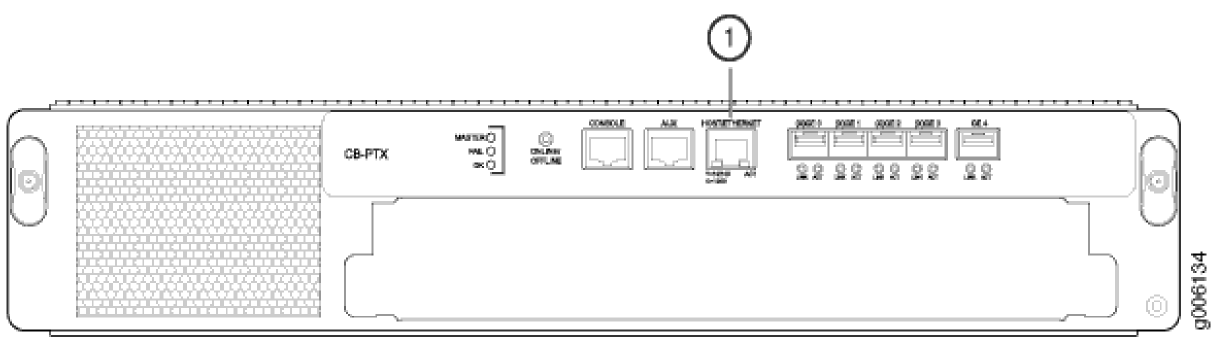


Figure 267: Host/Ethernet Port on the Control Board



1– Host/Ethernet port

Installing a PTX5000 Management Ethernet Cable

To install a Management Ethernet cable:

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

> **CAUTION**: During the initial installation before the chassis is grounded, you must connect to an approved site ESD point. See the instructions for your site.

2. Plug one end of a UTP Category 5 Ethernet cable into the **HOST/ETHERNET** port on the Control Board . This port connects to the Routing Engine installed into the Control Board.
3. Plug the other end of the cable into the network device.

RELATED DOCUMENTATION

PTX5000 Host Subsystem Description | 108
PTX5000 Routing Engine Description | 109
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PTX5000 Control Board Description | 122
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Routing Engines Supported on PTX Series Routers
Connecting the PTX5000 to a Management Ethernet Device | 266
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Troubleshooting the PTX5000 Host Subsystem | 582
Troubleshooting the PTX5000 Routing Engines | 584
Troubleshooting the PTX5000 Control Boards | 588
Prevention of Electrostatic Discharge Damage

Upgrading the PTX5000 Host Subsystem

IN THIS SECTION

Upgrading to the RE-PTX-X8-64G Routing Engine in a Redundant Host Subsystem

IN THIS SECTION

In a PTX5000 with a redundant host subsystem, Routing Engine RE0 is the primary Routing Engine and RE1 is the backup Routing Engine.

To upgrade the existing Routing Engine to the RE-PTX-X8-64G Routing Engine, perform the following procedures:

Taking the Host Subsystem Offline Before Upgrading the Routing Engine

Before you replace a Routing Engine, you must take the host subsystem offline. The host subsystem is taken offline and brought online as a unit. Be aware of the effect of taking a host subsystem offline on traffic, forwarding, and routing. See "Understanding the Effect of Taking the PTX5000 Host Subsystem Offline" on page 442.

To take a host subsystem offline:

1. Determine whether the Routing Engine to be replaced is currently functioning as the primary or as the backup, using one of the following methods:

   - Check the **HOST 0** and **HOST 1** LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.

   - Check the **MASTER** LED on the Control Board. If the blue **MASTER** LED is lit, the host subsystem is functioning as the primary.

- Issue the `show chassis routing-engine` command. The primary Routing Engine is designated `Master` in the `Current state` field.

```
user@host> show chassis routing-engine

user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
...
```

2. If the Routing Engine to be replaced is currently functioning as the primary, switch it to backup by using the CLI command:

```
user@host> request chassis routing-engine master switch
warning: Traffic will be interrupted while the PFE is re-initialized
Toggle mastership between Routing Engines ? [yes,no] (no) yes

Resolving mastership...
Complete. The other Routing Engine becomes the master.
```

3. Halt the host subsystem.

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

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

NOTE: The `request vmhost halt` command halts the Routing Engine on the control plane from which it was issued. The command shuts down the Routing Engine cleanly, so its state information is preserved. The SIBs might continue forwarding traffic for approximately 5 minutes after the `request vmhost halt` command has been issued. To reboot a Routing Engine that has been halted, you must connect through the console.

On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host> request chassis cb offline slot n
```

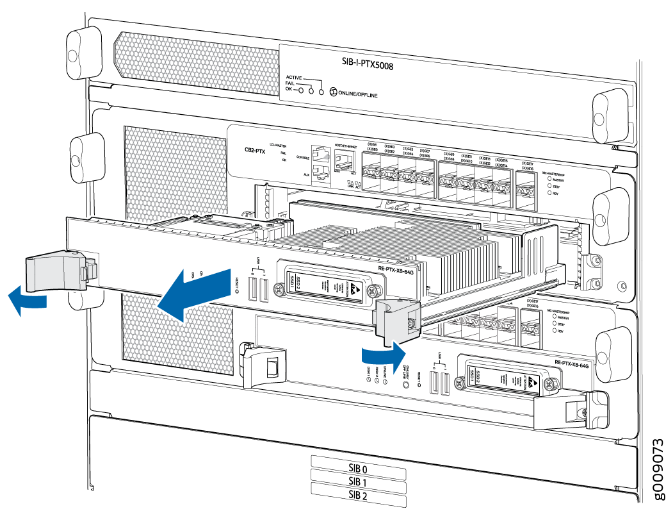
n is 0 or 1 for the slot number of the host subsystem being taken offline.

4. Verify that the Control Board is offline:

```
user@host> show chassis environment cb
```

Removing the Backup Routing Engine During Upgrade

Figure 268: Removing the RE-PTX-X8-64G Routing Engine



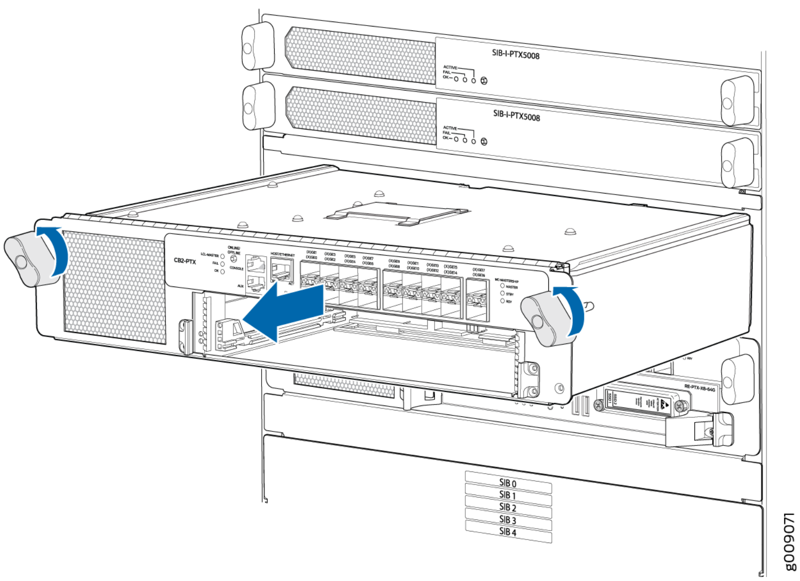
Remove the backup Routing Engine from the chassis:

1. Power off the backup Routing engine gracefully.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface. 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. Verify that the Routing Engine LEDs are off. Loosen the captive screws on the top and bottom of the Routing Engine.
4. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
5. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis. Place the Routing Engine on an antistatic mat.

Removing the Control Board During Upgrade

Figure 269: Removing a Control Board



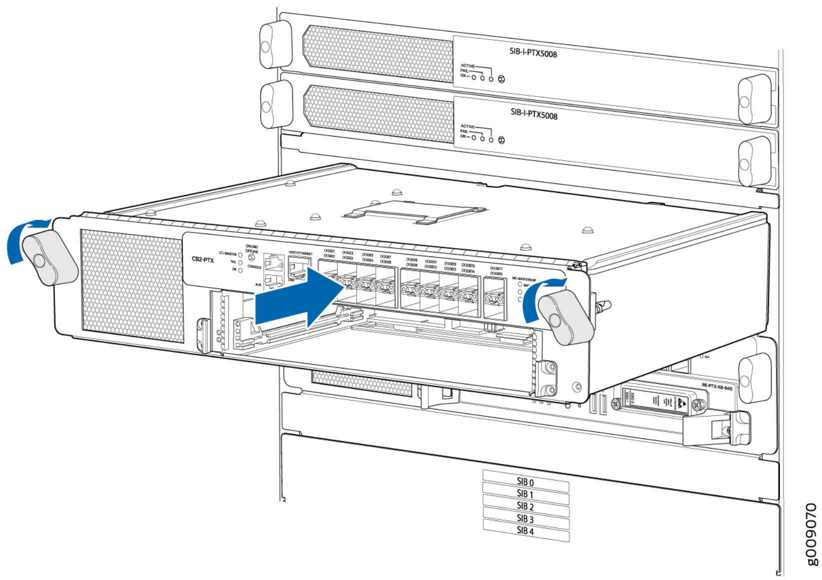
To remove a Control Board (see Figure 269 on page 474):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label and disconnect the cables.
4. Rotate the ejector handles counterclockwise on both sides of the Control Board faceplate.
5. Grasp the ejector handles and slide the Control Board about halfway out of the chassis.
6. Place one hand underneath the Control Board to support it and slide it completely out of the chassis. Place it on the antistatic mat.

CAUTION: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Installing the CB2-PTX Control Board During Upgrade

Figure 270: Installing the CB2-PTX Control Board



To install a Control Board (see Figure 270 on page 475):

1. Attach an ESD grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.
2. Carefully align the bottom and then the top edges of the Control Board with the guides inside the chassis.
3. Slide the Control Board into the chassis, carefully ensuring that it is correctly aligned.
4. Twist both ejector handles clockwise to seat the host subsystem until the ejectors latch into the faceplate.
5. To verify that the Control Board is installed correctly and functioning normally:

    a. Connect an Ethernet cable to the **HOST/ETHERNET** port on the Control Board. If the host subsystem is operational, the **ACT** port LED is lit to indicate Ethernet activity. If you can run the CLI from a management device attached to the Control Board, the Control Board is installed correctly.

b. Verify that the green **OK** LED on the Control Board faceplate is lit steadily green. The green **OK** LED should light steadily a few minutes after the Control Board is installed.

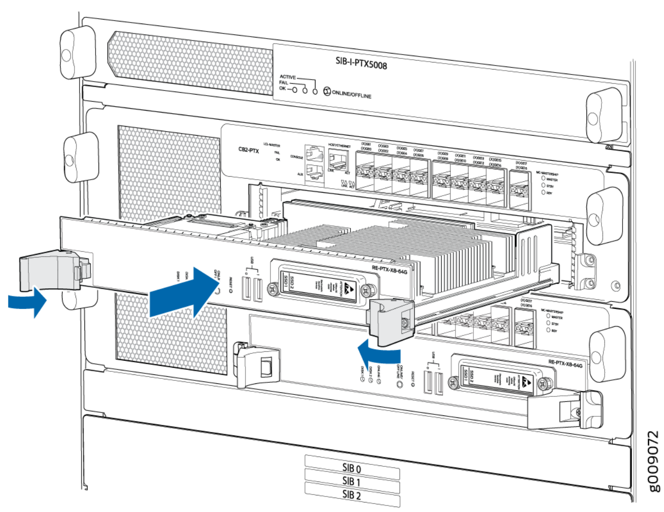
c. Verify that the **FAIL** on the Control Board faceplate is not lit. If the **FAIL** LED is lit steadily, remove and install the Control Board again. If the **FAIL** LED still lights steadily, the Control Board is not functioning properly. Contact your customer support representative.

d. To verify that the Control Board is `Online`, use the `show chassis environment cb` command.

> **NOTE**: While installing, ensure that you install the Control Board that is compatible with the Routing Engine. Install the Routing Engine RE-DUO-C2600-16G into the Control Board CB-PTX and Routing Engine RE-PTX-X8-64G into the Control Board CB2-PTX only.

Installing the Routing Engine RE-PTX-X8-64G During Upgrade

Figure 271: Installing the RE-PTX-X8-64G Routing Engine



To install a Routing Engine (see Figure 271 on page 476):

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

2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.

3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.

4. Carefully align the sides of the Routing Engine with the guides inside the opening on the Control Board.

5. Slide the Routing Engine into the chassis until you feel resistance, and then press the Routing Engine's faceplate until it engages the connectors.

6. Press both the ejector handles inward to seat the Routing Engine.

   The Routing Engine might require several minutes to boot. If the router is powered on and the Routing Engine's corresponding Control Board is functioning normally, the Routing Engine comes online automatically.

7. Reconnect the cables.

8. The Routing Engine RE1 comes up as the backup Routing Engine.

Verifying the Upgrade and Configuring the Upgraded Routing Engine

Configure the upgraded Routing Engine:

1. You then switch over this backup Routing Engine to make it the primary Routing Engine. Use the `request chassis routing-engine master (acquire | release | switch)` command to switchover the RE1-CB1 to become primary host subsystem. All FPCs reboot after this step.

2. Replace the Routing Engine RE0 with the RE-PTX-X8-64G Routing Engine.

3. Use the `request chassis routing-engine master (acquire | release | switch)` command to make the Routing Engine RE0 as the backup Routing Engine.

4. Configure the new backup Routing Engine RE0 by using the `commit synchronize` command to copy the configuration to the backup Routing Engine.

Upgrading to the RE-PTX-X8-64G Routing Engine in a Nonredundant Host Subsystem

IN THIS SECTION

In a nonredundant host subsystem, only one Routing Engine and one Control Board are present in the chassis.

To upgrade the existing Routing Engine to the RE-PTX-X8-64G Routing Engine, perform the following steps.

Taking the Host Subsystem Offline in a Nonredundant Host Subsystem

Before you replace a Routing Engine, you must take the host subsystem offline. The host subsystem is taken offline and brought online as a unit. Be aware of the effect of taking a host subsystem offline on traffic, forwarding, and routing. See "Understanding the Effect of Taking the PTX5000 Host Subsystem Offline" on page 442.

Halt the host subsystem.

1. To halt the host subsystem use the `request vmhost halt` command.

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

*** FINAL System shutdown message from user@host ***
System going down IMMEDIATELY
Terminated
...
syncing disks... 11 8 done
The operating system has halted.
Please press any key to reboot.
```

> **NOTE**: The `request vmhost halt` command halts the Routing Engine on the control plane from which it was issued. The command shuts down the Routing Engine cleanly, so its state information is preserved. The SIBs might continue forwarding traffic for approximately 5 minutes after the `request vmhost halt` command has been issued. To reboot a Routing Engine that has been halted, you must connect through the console.

2. On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

```
user@host> request chassis cb offline slot n
```

n is 0 or 1 for the slot number of the host subsystem being taken offline.

3. Verify that the Control Board is offline:

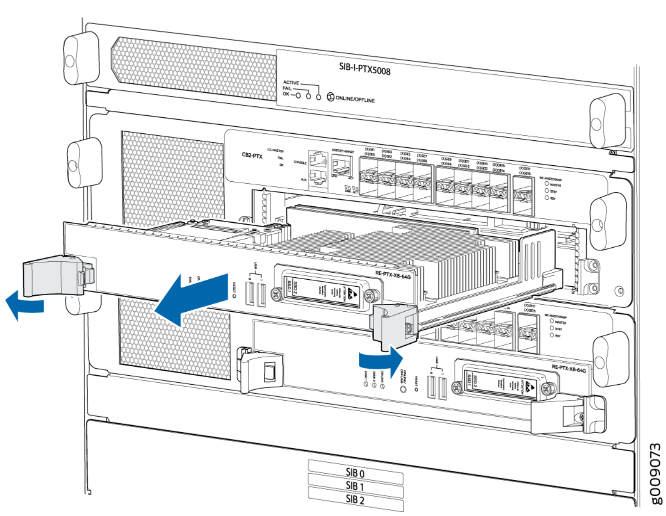
```
user@host> show chassis environment cb
```

Removing the Routing Engine From a Nonredundant Host Subsystem

To remove the Routing Engine from the chassis:

1. Power off the Routing Engine.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface. 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. Verify that the Routing Engine LEDs are off. Loosen the captive screws on the top and bottom of the Routing Engine.
4. Grasp the Routing Engine by the ejector handles, and slide it about halfway out of the chassis.
5. Place one hand underneath the Routing Engine to support it, and slide it completely out of the chassis. Place the Routing Engine on an antistatic mat.

Figure 272: Removing the RE-PTX-X8-64G Routing Engine



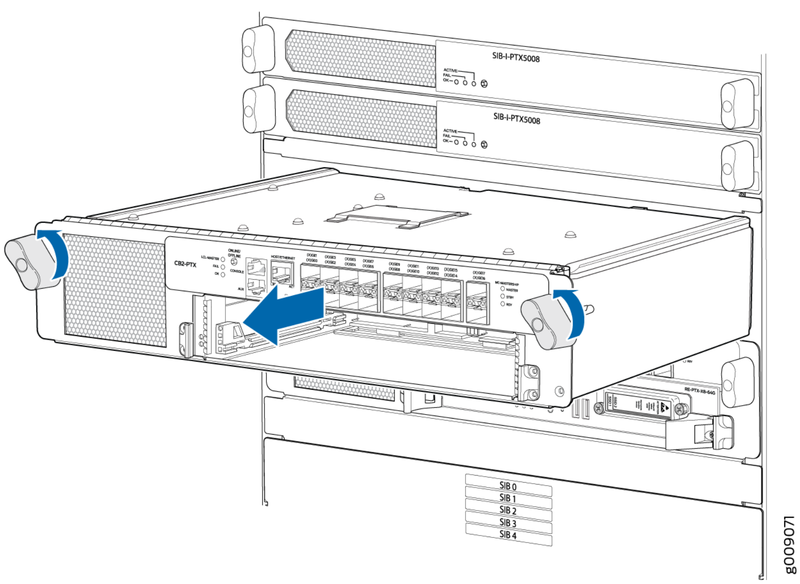
Removing the Control Board From a Nonredundant Host Subsystem

To remove a Control Board (see Figure 273 on page 480):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label and disconnect the cables.
4. Rotate the ejector handles counterclockwise on both sides of the Control Board faceplate.
5. Grasp the ejector handles and slide the Control Board about halfway out of the chassis.
6. Place one hand underneath the Control Board to support it and slide it completely out of the chassis. Place it on the antistatic mat.

> **CAUTION**: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 273: Removing a Control Board



Installing the CB2-PTX Control Board in a Nonredundant Host Subsystem

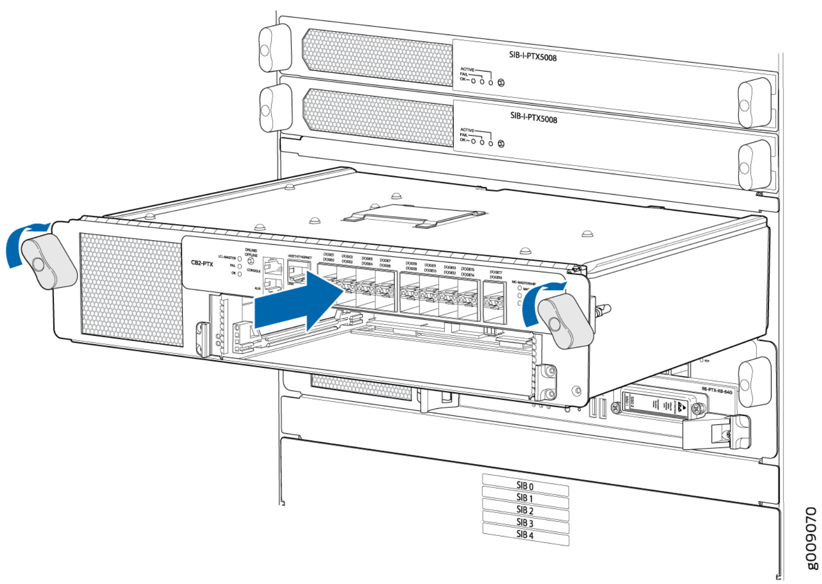
To install a Control Board (see Figure 274 on page 481):

1. Attach an ESD grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point.

2. Carefully align the bottom and then the top edges of the Control Board with the guides inside the chassis.
3. Slide the Control Board into the chassis, carefully ensuring that it is correctly aligned.
4. Twist both ejector handles clockwise to seat the host subsystem until the ejectors latch into the faceplate.

> **NOTE**: While installing, ensure that you install the Control Board that is compatible with the Routing Engine. Install the Routing Engine RE-DUO-C2600-16G into the Control Board CB-PTX and Routing Engine RE-PTX-X8-64G into the Control Board CB2-PTX only.

Figure 274: Installing the CB2-PTX Control Board



5. To verify that the Control Board is installed correctly and functioning normally:
   - Connect an Ethernet cable to the **HOST/ETHERNET** port on the Control Board. If the host subsystem is operational, the **ACT** port LED is lit to indicate Ethernet activity. If you can run the CLI from a management device attached to the Control Board, the Control Board is installed correctly.
   - Verify that the green **OK** LED on the Control Board faceplate is lit steadily green. The green **OK** LED should light steadily a few minutes after the Control Board is installed.
   - Verify that the **FAIL** LED on the Control Board faceplate is not lit. If the **FAIL** LED is lit steadily, remove and install the Control Board again. If the **FAIL** LED still lights steadily, the Control Board is not functioning properly. Contact your customer support representative.

- To verify that the Control Board is `Online`, use the `show chassis environment cb` command.

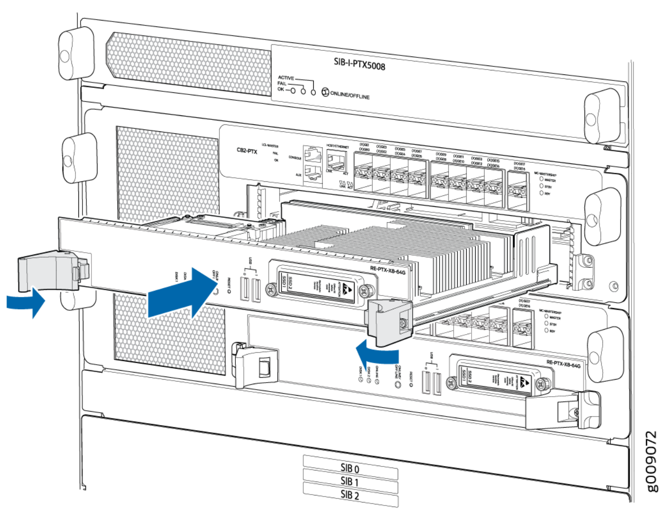
Installing the RE-PTX-X8-64G Routing Engine in a Nonredundant Host Subsystem

To install the Routing Engine (see Figure 275 on page 482):

1. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.
4. Carefully align the sides of the Routing Engine with the guides inside the opening on the Control Board.
5. Slide the Routing Engine into the chassis until you feel resistance, then press the Routing Engine's faceplate until it engages the connectors.
6. Press both the ejector handles inward to seat the Routing Engine.

The Routing Engine might require several minutes to boot. If the router is powered on and the Routing Engine's corresponding Control Board is functioning normally, the Routing Engine comes online automatically.

Figure 275: Installing the RE-PTX-X8-64G Routing Engine



Verifying the Upgrade and Configuring the Routing Engine in a Nonredundant Host Subsystem

Verify that the Routing Engine is installed correctly and functioning properly:

1. Verify that the green **ONLINE** LED lights steadily.
2. Verify the status of the Routing Engine by using the **show chassis routing-engine** command.

   The Routing Engine might require several minutes to boot. After the Routing Engine boots, verify that it is installed correctly by checking **FAIL**, **RE0**, and **RE1** LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green **ONLINE** LED lights steadily. If the red **FAIL** LED lights steadily instead, remove and reinstall the Routing Engine. If the red **FAIL** LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

   NOTE: To maintain proper airflow through the chassis, do not leave a CB installed in the chassis without a Routing Engine for extended periods of time. If a Routing Engine is removed, a replacement Routing Engine should be installed as soon as possible.

   NOTE: If power is applied to the Routing Engine and its corresponding Control Board is functioning normally, the Control Board comes online automatically.

3. Reconnect the cables to the Control Board. The Routing Engine comes up.

RELATED DOCUMENTATION

PTX5000 Routing Engine Description | 109

Maintaining the PTX5000 Switch Interface Boards

IN THIS SECTION

Maintaining the PTX5000 Switch Interface Boards

IN THIS SECTION

Purpose

For optimum performance, verify the status of the Switch Interface Boards (SIBs).

Action

On a regular basis:

- Check the LEDs on the SIB faceplate and craft interface.

  During normal operations:

  - The green **OK** LED on the SIB faceplate is lit.
  - The yellow **FAIL** LED on the SIB faceplate is not lit.
- Issue the `show chassis fabric topology` command. During normal operations, the output for the command shows that the state of the online SIBs and FPCs links are in the `OK` state.
- Issue the `show chassis environment sib` command.

Replacing a PTX5000 Switch Interface Board

IN THIS SECTION

Replace the PTX5000 Switch Interface Boards (SIBs) by following the procedures described in the following sections.

Removing a PTX5000 Switch Interface Board

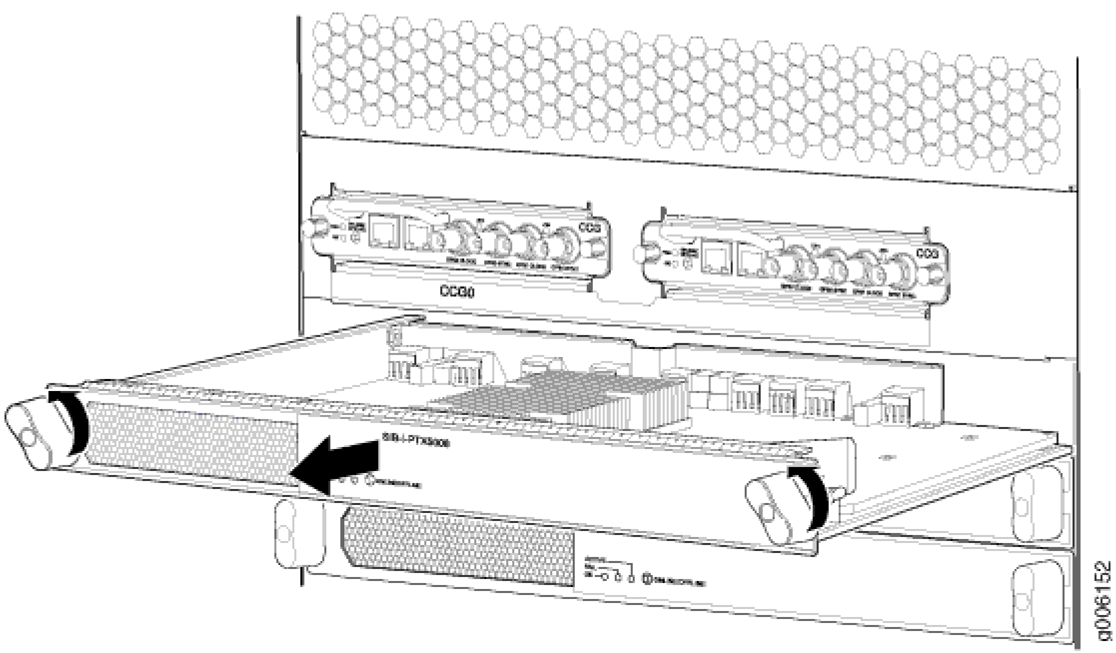
Nine SIBs are installed in the PTX5000. The SIBs are located in the rear of the chassis in the slots marked **SIB0** through **SIB8**. Each SIB can weigh up to 10.4 lb (4.7 kg).

To remove the SIBs (see Figure 1):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Twist the ejector handles counterclockwise to unseat the SIB.
4. Grasp both ejector handles, pull firmly, and slide the SIB about three-quarters of the way out of the chassis.
5. Place one hand underneath the SIB to support it and slide it completely out of the chassis. Place it on the antistatic mat.

> **CAUTION**: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 276: Removing a SIB



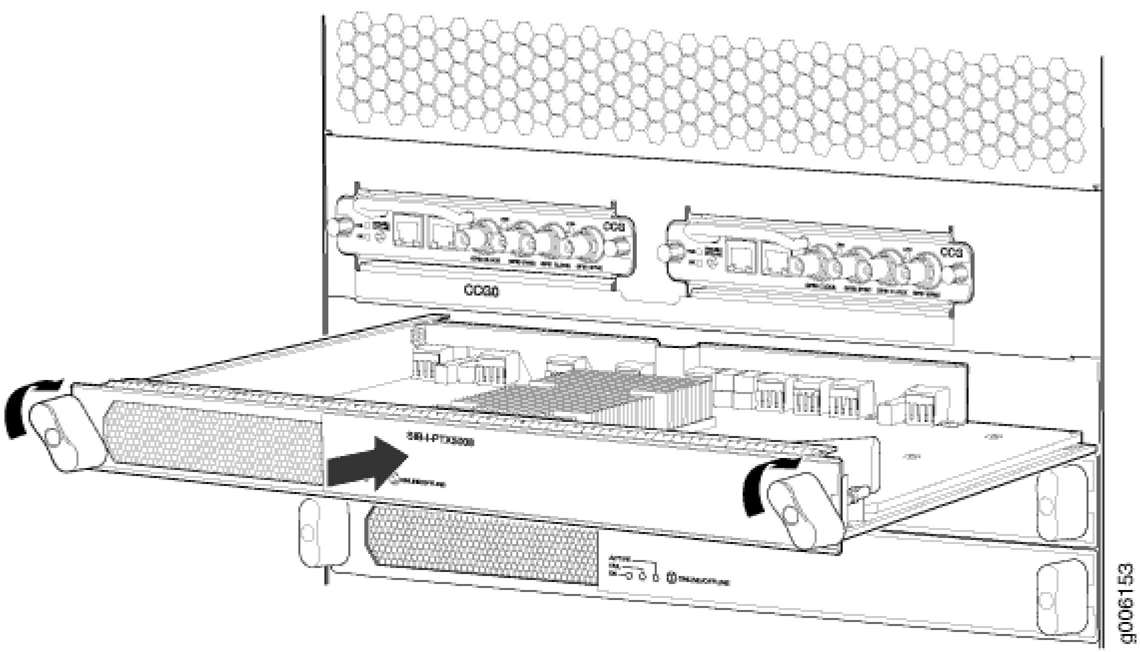
Installing a PTX5000 Switch Interface Board

Each SIB can weigh up to 10.4 lb (4.7 kg). To install a SIB (see Figure 277 on page 486):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place one hand underneath the SIB to support it. With the other hand, hold one of the ejector handles on the SIB faceplate.
3. Carefully align the sides of the SIB with the guides inside the chassis.
4. Slide the SIB into the chassis, carefully ensuring that it is correctly aligned.
5. Twist the ejector handles clockwise until they stop.
6. Bring the SIB online using one of the following methods:
   - Press and hold the **ONLINE/OFFLINE** button on the SIB faceplate. The green **OK** LED on the faceplate begins to blink. Hold the button down until the LED blinks.
   - Issue the following CLI command on the PTX5000:

```
user@host> request chassis sib online slot 0
```

Figure 277: Installing a SIB



RELATED DOCUMENTATION

PTX5000 Switch Interface Board Description | 131
PTX5000 Switch Interface Board LEDs | 133
Troubleshooting the PTX5000 Switch Interface Boards | 593
Prevention of Electrostatic Discharge Damage

Maintaining PTX5000 Interface Modules

IN THIS SECTION

Maintaining the PTX5000 FPCs

IN THIS SECTION

Purpose

For optimum PTX5000 performance, verify the condition of the FPCs.

Action

On a regular basis:

- Check the LEDs on the FPC. During normal operation:

  The green **OK** LED located the bottom of the FPC lights steadily when the FPC is online and functioning normally. The green **OK** LED blinks during startup.

- Issue the CLI `show chassis fpc` command to check the status of installed FPCs. The value `Online` in the column labeled `State` indicates that the FPC is functioning normally.

- Issue the CLI `show chassis environment fpc` command to check the temperature and power of installed FPCs. The temperature values should be below the preconfigured thresholds. The power values provide Information about the voltage supplied to the FPC. The left column displays the required power, in volts. The right column displays the measured power, in millivolts.

- Issue the `show chassis fabric topology` command. During normal operations, the output for the command shows that the state of the online SIBs and FPCs links are in the `OK` state.

Holding PTX5000 FPCs

IN THIS SECTION

Preventing Damage to FPCs

CAUTION: Many components on the FPC are fragile. Failure to handle FPCs as specified in this document can cause irreparable damage.

CAUTION: To prevent damage when handling or carrying FPCs:

- As you carry the FPC, do not bump it against anything. FPC components are fragile.
- Do not grasp the FPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet (see Figure 1).
- Do not carry the FPC by the faceplate with only one hand (see Figure 2).
- Do not rest any edge of an FPC directly against a hard surface (see Figure 3). If you must rest the FPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Figure 278: Do Not Grasp the Connector Edge

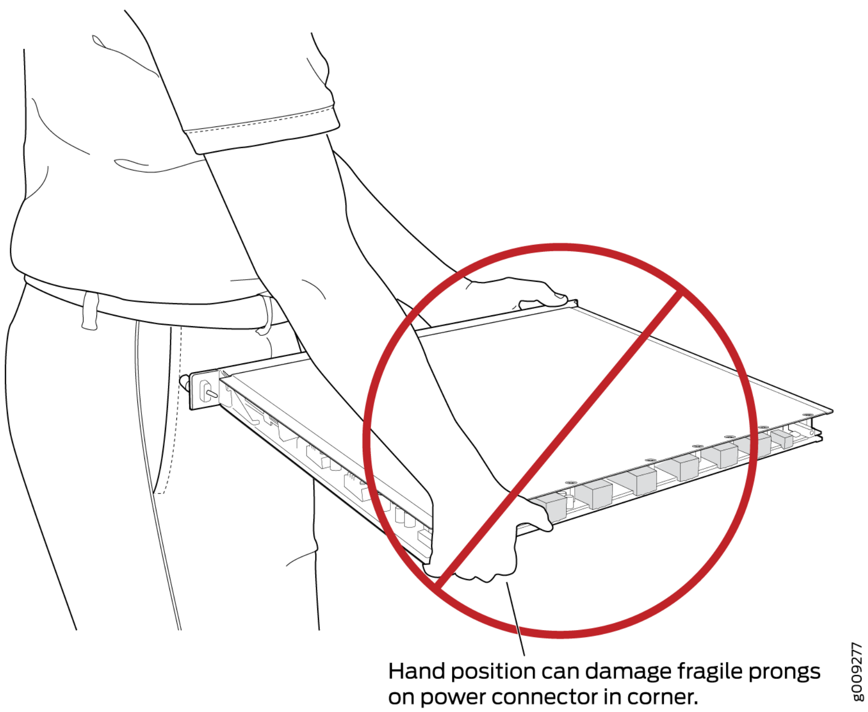


Figure 279: Do Not Carry an FPC with Only One Hand

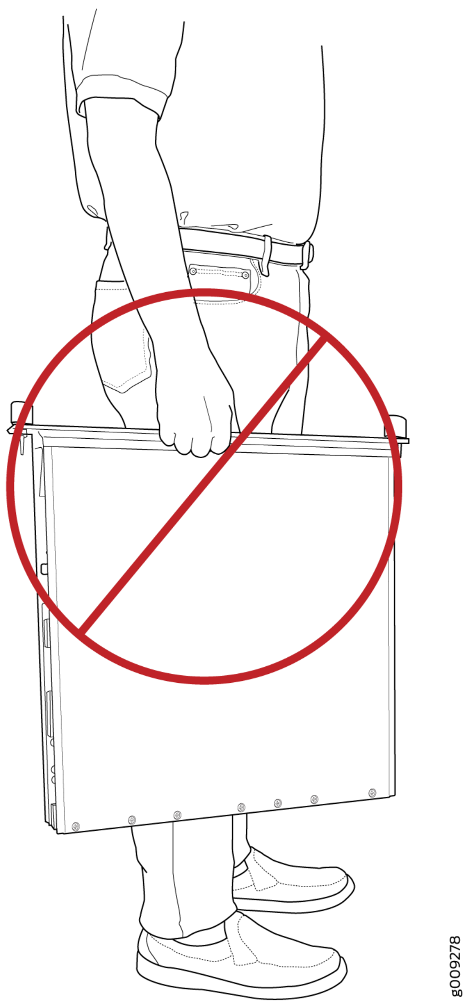
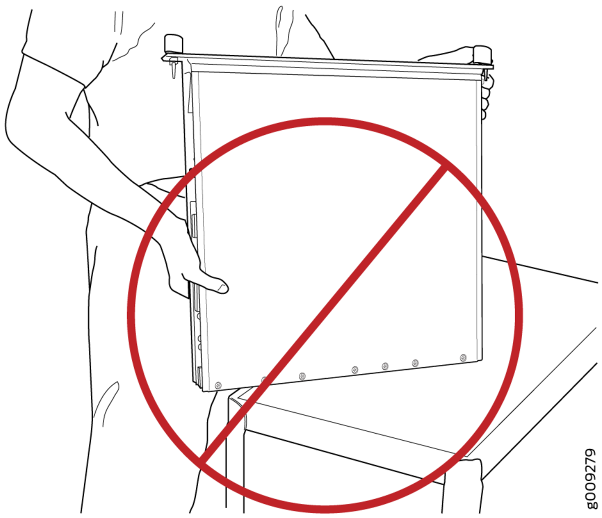


Figure 280: Do Not Rest the FPC on an Edge



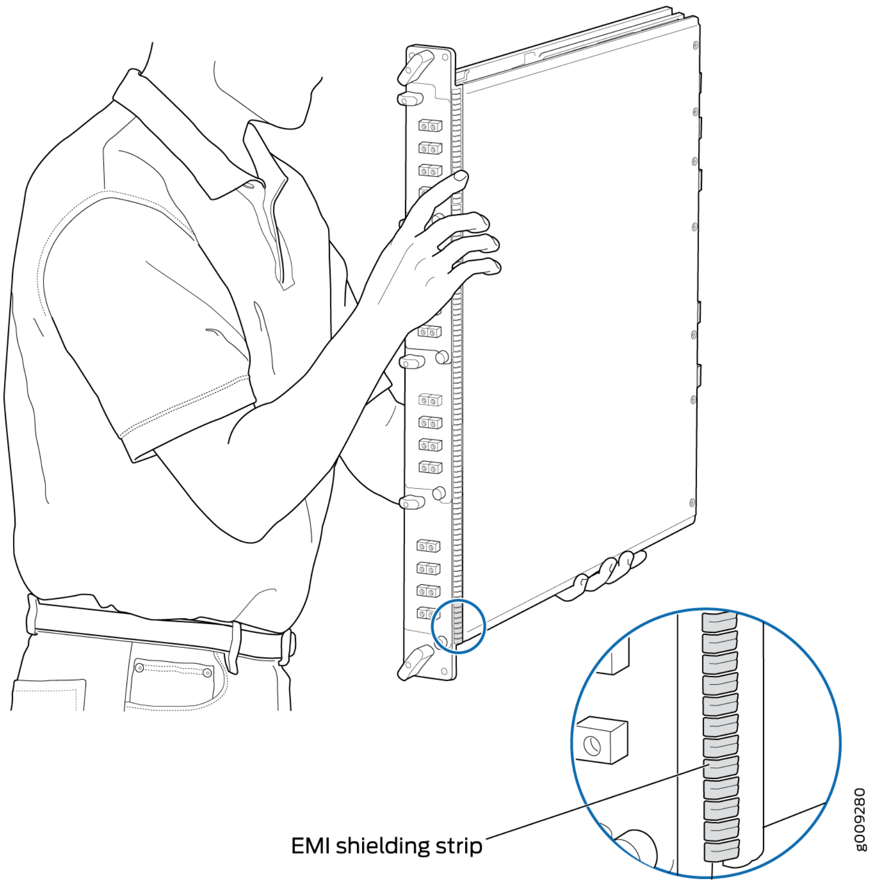
Holding PTX5000 FPCs Vertically

> **NOTE**: An FPC configured with PICs installed can weigh as much as 50 lb (22.7 kg). Be prepared to accept the full weight of the FPC as you lift it.

You hold an FPC vertically when installing it into the chassis. To hold an FPC vertically (see Figure 281 on page 492):

1. Orient the FPC so that the faceplate faces you.
2. Place one hand around the FPC faceplate about a quarter of the way down from the top edge. To avoid deforming the electromagnetic interference (EMI) shielding strip, do not press hard on it.
3. Place your other hand at the bottom edge of the FPC.

Figure 281: Holding an FPC Vertically



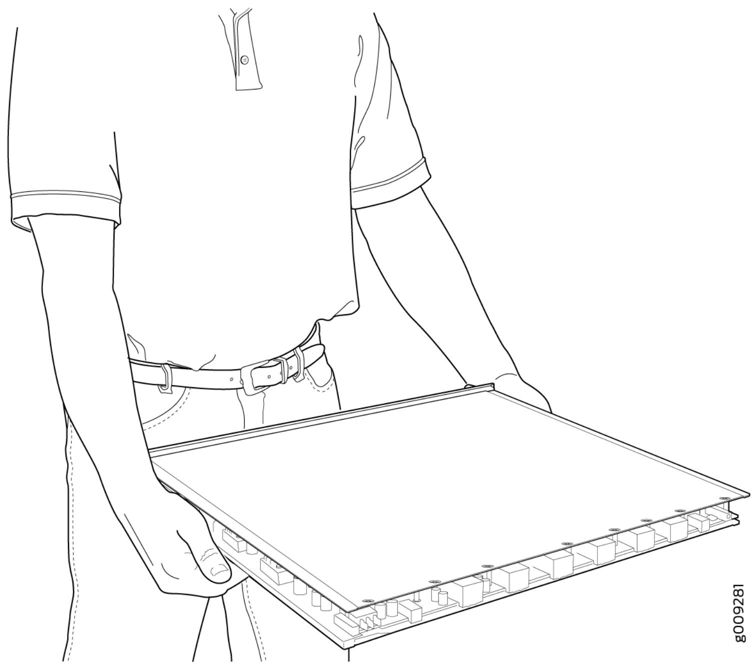
Holding PTX5000 FPCs Horizontally

To hold an FPC horizontally:

1. Orient the FPC so that the faceplate is facing you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

You can rest the faceplate of the FPC against your body as you carry it (see Figure 282 on page 493).

Figure 282: Holding an FPC Horizontally



Replacing a PTX5000 FPC

IN THIS SECTION

Removing a PTX5000 FPC

The PTX5000 holds up to eight FPCs, which are installed vertically in the front of the PTX5000. An empty FPC weighs between 24.5 lb (11.1 kg) and 38.5 lb (17.5 kg), and an FPC with PICs installed can weigh up to 50 lb (22.7 kg).

Each FPC slot not occupied by an FPC must be covered by an FPC blank panel. An FPC blank panel weighs 6.9 lb (3.1 kg).

To remove an FPC (see Figure 6):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Use one of the following methods to take the FPC offline:

   - Press and hold the FPC online/offline button. The green OK LED next to the button begins to blink. Hold the button down until the LED goes out.

   - Issue the following CLI command:

   ```
   user@host>request chassis fpc slot slot-number offline
   ```

4. Disconnect the cables from the PICs installed in the FPC. Immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system, to prevent the cables from developing stress points.

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

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

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

5. If necessary, remove each installed PIC from the FPC.
6. After you remove each PIC, immediately place it on an antistatic mat or in an electrostatic bag.
7. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
8. Grasp the handles and slide the FPC straight out of the card cage halfway.
9. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 50 lb (22.7 kg) with PICs installed—as you slide the FPC out of the chassis.

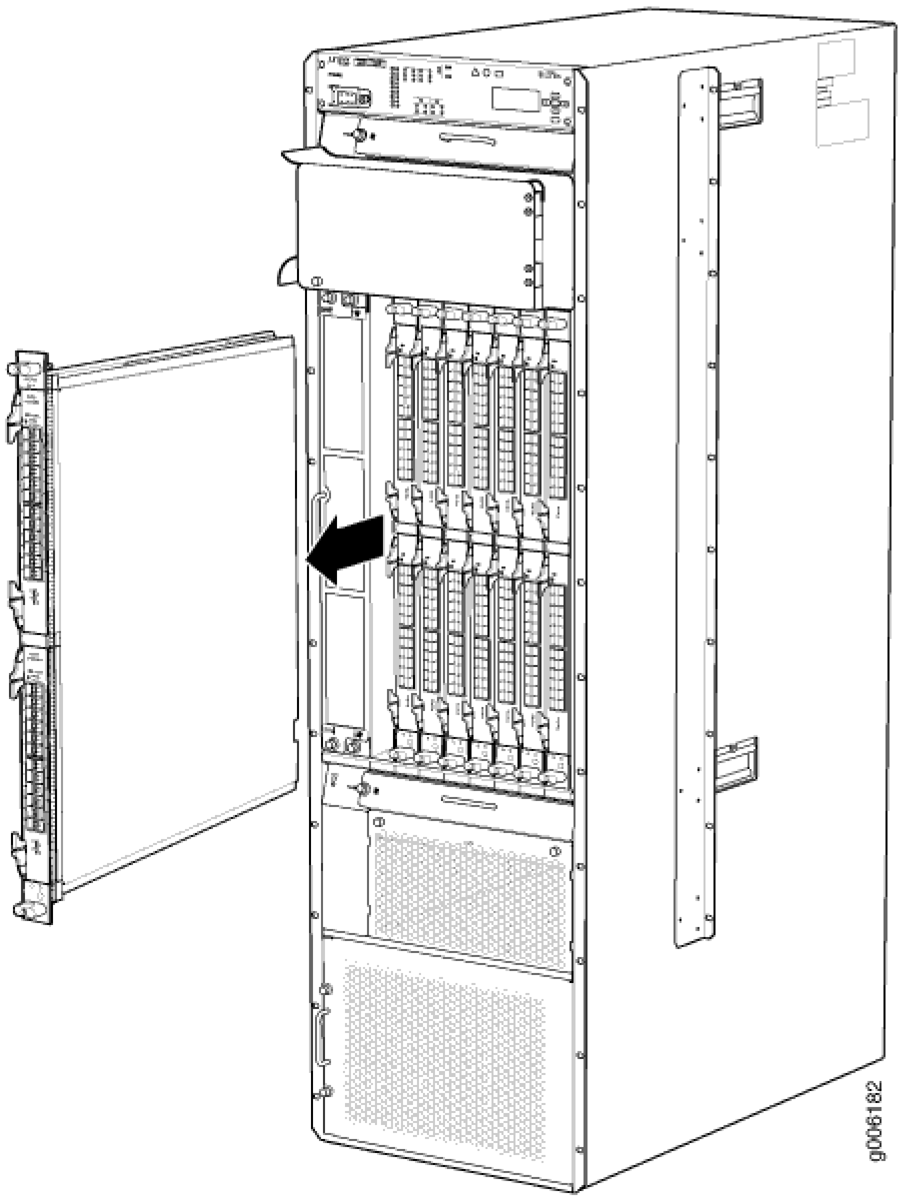
When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface. For detailed handling instructions, see "Holding PTX5000 FPCs" on page 488.

10. If you are not reinstalling a FPC into the emptied FPC slot within a short time, install a blank FPC panel over the slot to maintain proper airflow in the FPC card cage.

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

Figure 283: Removing an FPC



Installing a PTX5000 FPC

> ⚠ **CAUTION**: The FPC power connector is located in the corner where the bottom and the connector edges meet. If a power connector prong becomes bent, it no longer aligns with the socket connector on the midplane, and the FPC no longer functions.

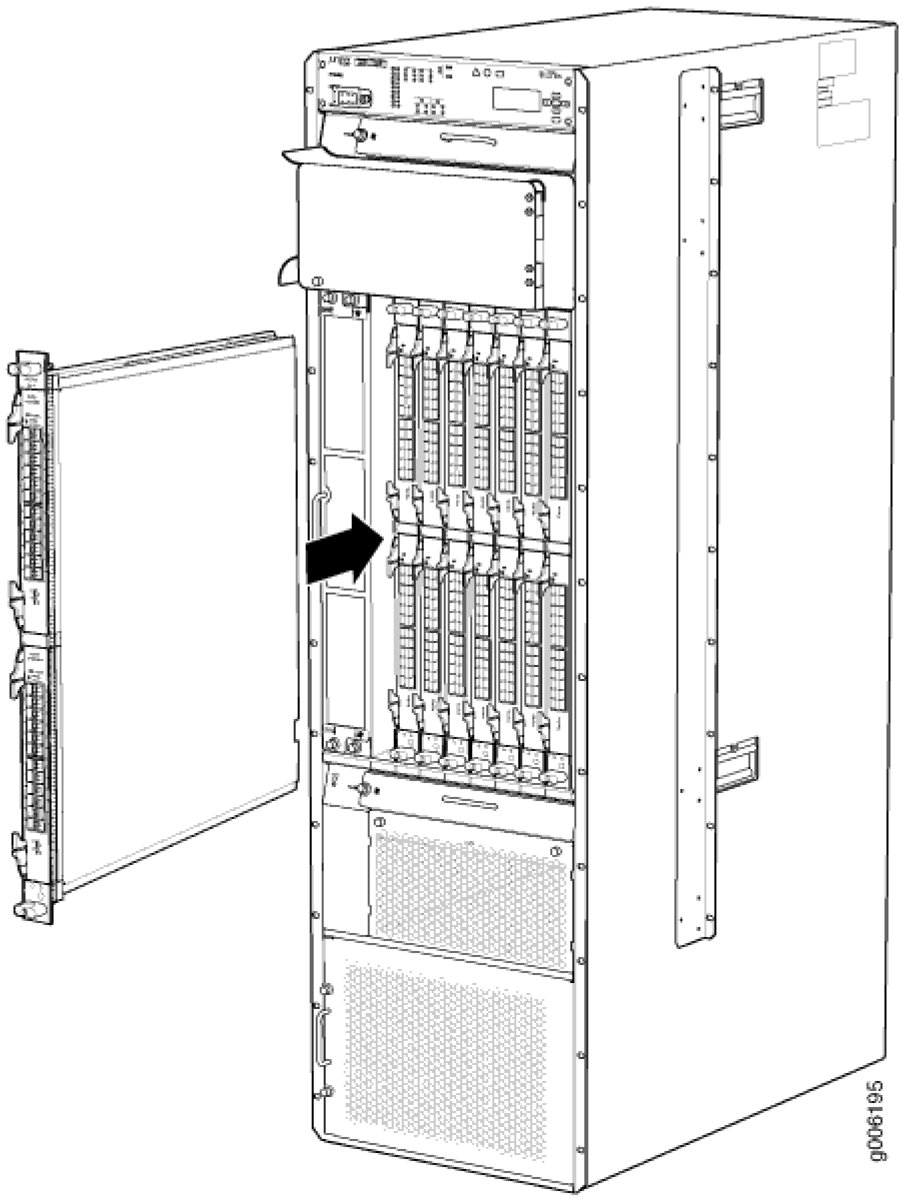
To install an FPC (see Figure 284 on page 498 and Figure 285 on page 500):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat.
3. Take each PIC to be installed in the replacement FPC out of its electrostatic bag and identify the slot on the FPC where it will be connected.
4. Verify that each fiber-optic PIC has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.
5. Install each PIC into the appropriate slot on the FPC. For information about installing a PIC, see the installation instructions in "Replacing a PTX5000 PIC" on page 501.
6. Locate the slot in the FPC card cage in which you plan to install the FPC.
7. Inspect the slot in the FPC card cage to verify that there are no missing or bent pins on the midplane.
8. Inspect the FPC to verify that the connectors are not misaligned or damaged.
9. Orient the FPC vertically with the component side facing to the right. Be sure the FPC is right-side up, with the components on the right of the FPC.

> **CAUTION**: When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

10. Carefully align the connector edge of the FPC with the appropriate empty slot in the chassis.
11. Lift the FPC into place and carefully align the bottom and top of the FPC with the guides inside the card cage.

Figure 284: Installing an FPC



12. Gently rest the bottom edge of the FPC on the bottom edge of the slot opening, making contact a short distance forward of the power connector.

> **CAUTION**: Take care not to bend or otherwise damage the power connector prongs.

13. Slowly slide the FPC into the slot until you feel resistance.
14. Align the ejector handles on the FPC faceplate in a position close to horizontal.

15. Simultaneously turn both ejector handles clockwise until you cannot turn them farther.
16. Remove the rubber safety cap from each fiber-optic transceiver and fiber-optic cable.

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

17. Insert the appropriate cable into the cable connector ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

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

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

18. Use one of the following methods to bring the FPC online:

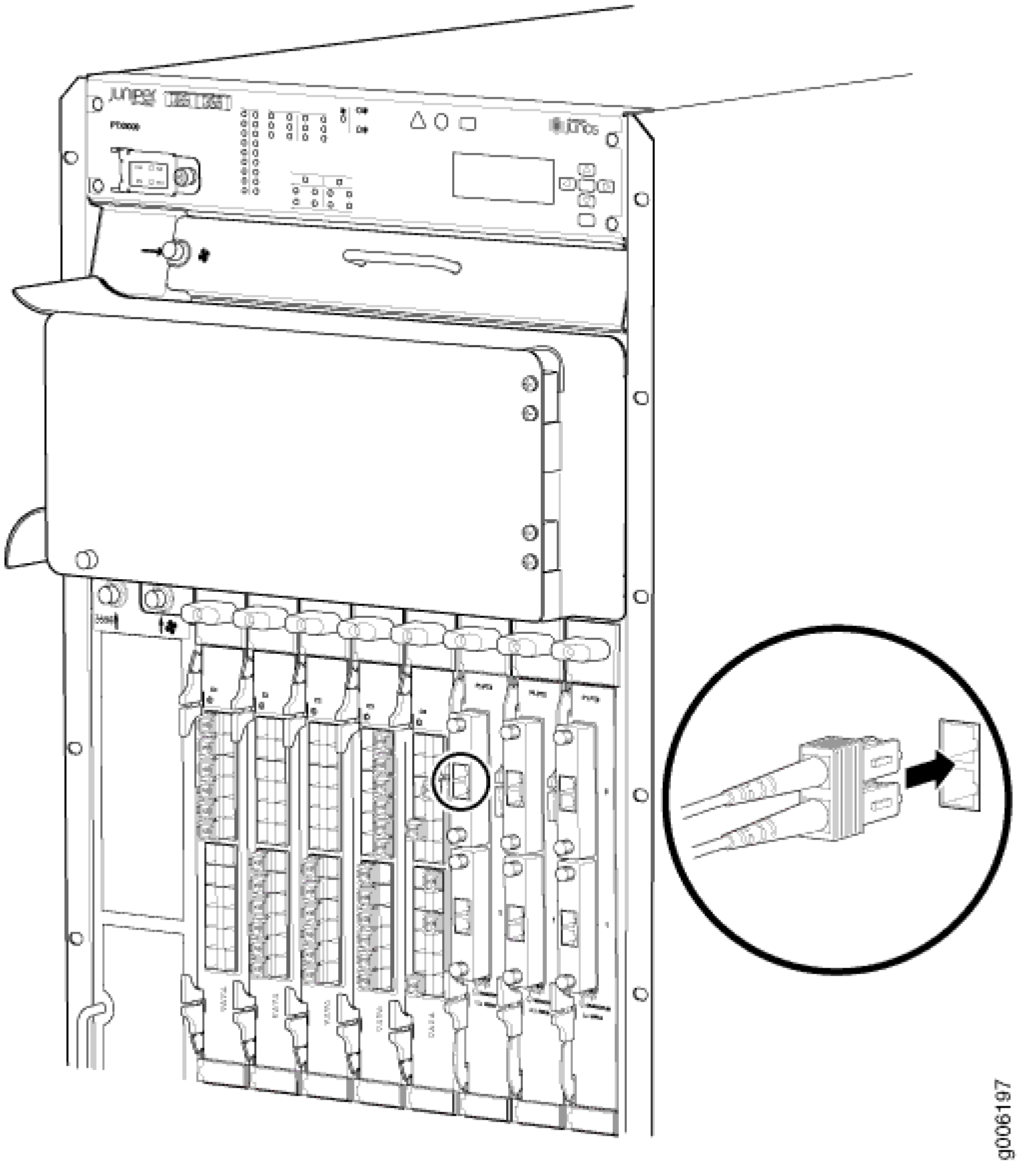
    - Press and hold the FPC online/offline button until the green **OK** LED next to the button lights steadily, in about 5 seconds.
    - Issue the following CLI command:

```
user@host>request chassis fpc slot slot-number online
```

> **CAUTION**: After the **OK** LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

You can also verify correct FPC and PIC functioning by issuing the `show chassis fpc` and `show chassis fpc pic-status` commands, as described in "Maintaining the PTX5000 FPCs" on page 487.

Figure 285: Connecting Fiber-Optic Cable to a PIC



Maintaining the PTX5000 PICs

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the PICs.

Action

On a regular basis:

- Check the LEDs on PIC faceplates. The meaning of the LED states differs for various PICs. For more information, see the PTX Series Interface Module Reference. If the FPC that houses the PIC detects a PIC failure, the FPC generates an alarm message to be sent to the Routing Engine.

  A PIC LED lit green indicates that the PIC is functioning normally.

- Issue the CLI `show chassis fpc pic-status` command. The PIC slots in an FPC are numbered from **0** through **1**, top to bottom.

Replacing a PTX5000 PIC

IN THIS SECTION

Removing a PTX5000 PIC

PICs are hot-insertable and hot-removable. When you remove a PIC, the PTX5000 continues to function, although the PIC interfaces being removed no longer function.

The PICs are located in the FPCs installed in the front of the PTX5000. A PIC weighs approximately 5 lb (2.3 kg).

To remove a PIC:

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

- Press and hold the online/offline button until the PIC LED goes out (about 5 seconds).
- Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
```

4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.
5. Disconnect the cables from the PIC. Immediately cover each transceiver and the end of each fiber-optic cable with a rubber safety cap.

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

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

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

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

7. Unseat the PIC: Flip the ejector handles outward.
8. Slide the PIC out of the FPC card carrier, and place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.

Installing a PTX5000 PIC

To install a PIC:

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

2. Verify that there is a rubber safety cap over each fiber-optic transceiver on the faceplate. Install a cap if necessary.
3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.

> **CAUTION**: Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.

4. Secure the PIC to the FPC faceplate: Grasp both ejector handles and press them inward to seat the PIC until the ejectors latch into the FPC.
5. Remove the rubber safety cap from each fiber-optic transceiver and the end of each fiber-optic cable.

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

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

6. Insert the appropriate cables into the cable connectors on the PIC.
7. Arrange each cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

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

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

8. Use one of the following methods to bring the PIC online:

- Press the PIC offline/online button until the PIC LED lights green.
- Issue the following CLI command:

```
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
```

The normal functioning status LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command.

Maintaining the PTX5000 PIC Cables

IN THIS SECTION

Purpose

For optimum performance, verify the condition of the cables.

Action

- Use the cable management system (shown in "PTX5000 Cable Management System" on page 18) to support cables and prevent cables from dislodging or developing stress points.
- Place excess cable out of the way in the cable management system. Do not allow fastened loops of cable to dangle from the connector or cable management system, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.
- Label both ends of the cables to identify them.
- When you unplug a fiber-optic cable from a transceiver, always place a rubber safety plug over the transceiver on the faceplate and on the end of the cable.

- Anchor fiber-optic cable to avoid stress on the connectors. When attaching fiber to a transceiver, be sure to secure the fiber so it is not supporting its own weight as it hangs to the floor. Never let fiber-optic cable hang free from the connector.

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

- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments, such as analyzers, can cause damage to the instruments that is expensive to repair. Instead, attach a short fiber extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, which is easy and inexpensive to replace.

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

Replacing a PTX5000 PIC Cable

IN THIS SECTION

Removing a PTX5000 PIC Cable

Removing and installing PIC cables does not affect router functionality, except that a PIC does not receive or transmit data while its cable is disconnected. To remove a PIC cable:

1. Have ready a rubber safety cap for each fiber-optic cable and fiber-optic transceiver.
2. If removing all cables connected to the PIC, use one of the following methods to take the PIC offline:
   - Press its online/offline button.
   - Issue the following CLI command:

   ```
   user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline
   ```

3. Unplug the cable from the cable connector port. Immediately cover each fiber-optic transceiver and the end of each fiber-optic cable with a rubber safety cap.

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

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

4. Remove the cable from the cable management system and detach it from the destination port.

Installing a PTX5000 PIC Cable

To install a PIC cable (see Figure 9):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the PTX Series Interface Module Reference.
2. Remove the rubber safety plug from the PIC cable connector port.

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

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

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

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

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

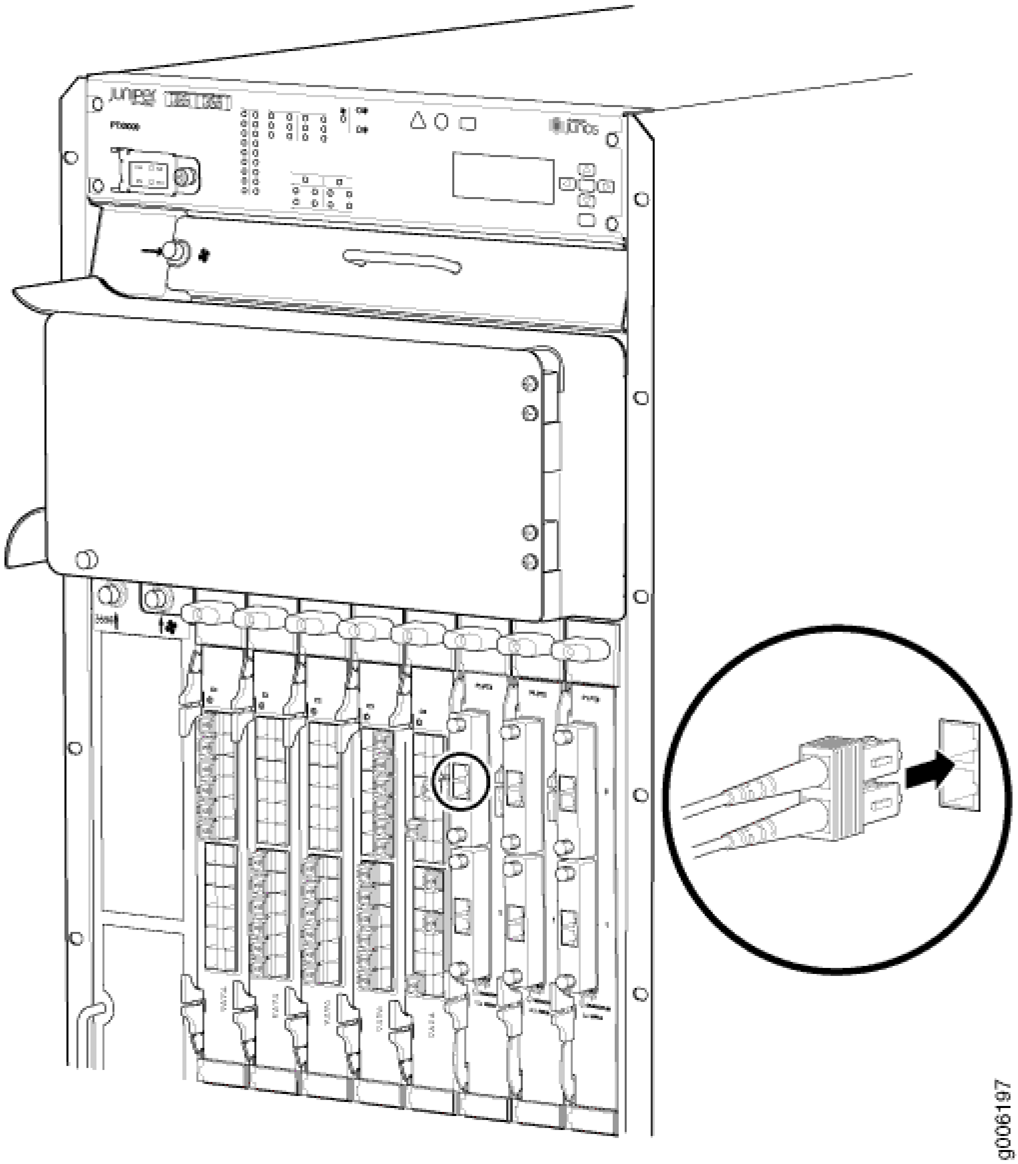
5. Insert the other end of the cable into the destination port.
6. Repeat the previous steps for any additional cables.
7. If the PIC is offline (its failure indicator LED is lit), use one of the following methods to bring the PIC online:

   - Press the PIC offline/online button until the PIC LED lights green.
   - Issue the following CLI command:

   ```
   user@host>request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
   ```

   The normal functioning indicator LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command.

Figure 286: Connecting Fiber-Optic Cable to a PIC



Replacing a PTX5000 PIC CFP Transceiver

IN THIS SECTION

Removing a PTX5000 PIC CFP Transceiver

C form-factor pluggables (CFPs) are transceivers that can be removed from a PIC. CFP transceivers are hot-insertable and hot-removable. Removing a CFP transceiver does not interrupt PIC functioning, but the removed CFP transceiver no longer receives or transmits data.

To remove a CFP transceiver:

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

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

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

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

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

6. Pull the ejector handle away from the CFP transceiver faceplate to unseat the CFP transceiver from the PIC. Pull the CFP transceiver out of the PIC and place it on the antistatic mat or in the electrostatic bag.

Installing a PTX5000 PIC CFP Transceiver

To install a replacement CFP:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the CFP transceiver, installing one if necessary.
3. Orient the CFP over the port in the PIC so that the connector end will enter the slot first and the CFP connector faces the appropriate direction.
4. Slide the CFP into the slot. If there is resistance, remove the CFP and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the PIC faceplate indicate that the CFP is functioning correctly. For more information about the PIC LEDs, see the PTX Series Interface Module Reference. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

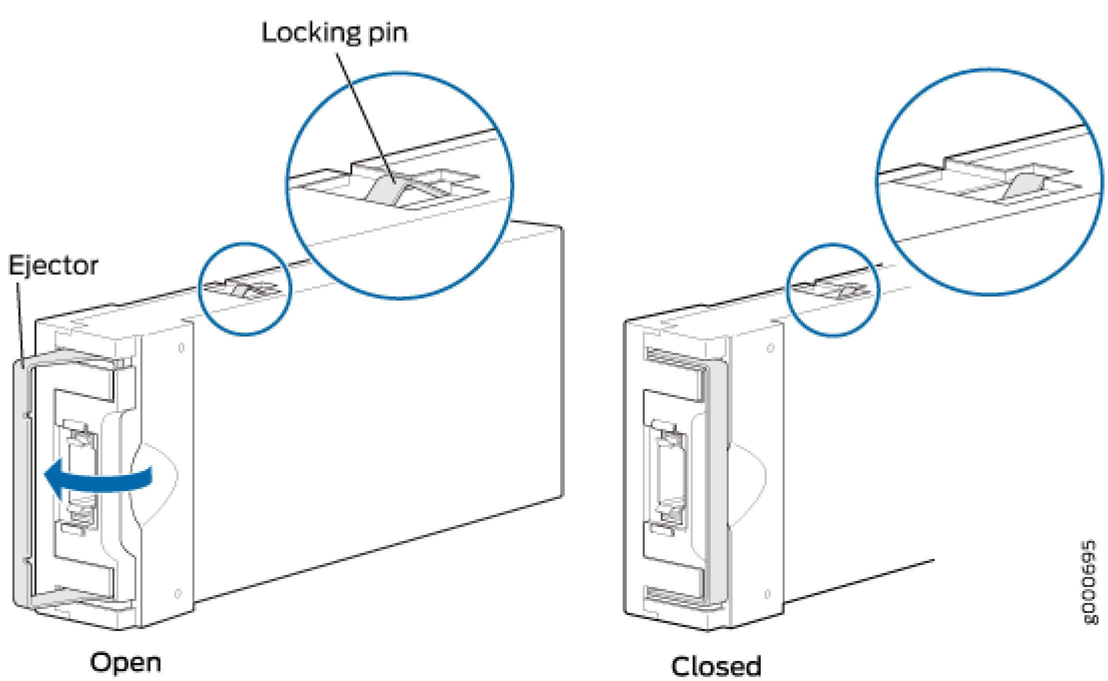
Replacing a CFP2 Transceiver

IN THIS SECTION

Removing a CFP2 Transceiver

C form-factor pluggables (CFPs) are transceivers that can be removed from a PIC. CFP2 transceivers are hot-insertable and hot-removable. Removing a CFP2 transceiver does not interrupt PIC functioning, but the removed CFP2 transceiver no longer receives or transmits data.

Figure 287: Form-Factor Pluggable (CFP2)



To remove a CFP2 transceiver (see Figure 10):

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

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

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

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

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

6. Pull the ejector latch to the extreme end away from the CFP2 transceiver faceplate to unseat the CFP2 transceiver from the PIC. Pull the CFP2 transceiver out of the PIC and place it on the antistatic mat or in the electrostatic bag.

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

Installing a CFP2 Transceiver

To install a replacement CFP2:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the CFP transceiver, installing one if necessary.
3. Orient the CFP2 over the port in the PIC so that the connector end will enter the slot first and the CFP2 connector faces the appropriate direction.
4. Slide the CFP2 into the slot. If there is resistance, remove the CFP2 and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the PIC faceplate indicate that the CFP2 is functioning correctly. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

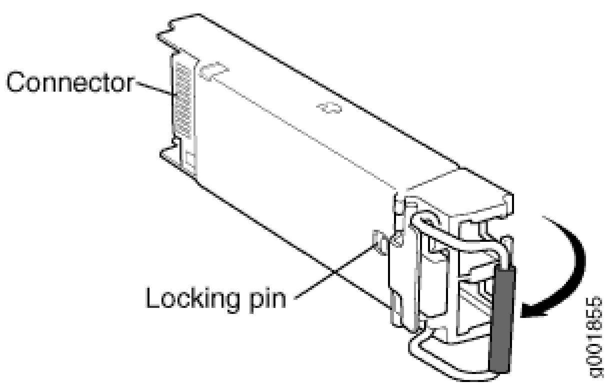
Replacing a PTX5000 PIC SFP+ Transceiver

IN THIS SECTION

Removing a PTX5000 PIC SFP+ Transceiver

Small form-factor pluggables (SFPs) are transceivers that can be removed from a PIC. SFPs are hot-insertable and hot-removable. Removing an SFP does not interrupt PIC functioning, but the removed SFP no longer receives or transmits data.

Figure 288: Small Form-Factor Pluggable (SFP)



To remove an SFP+ transceiver (see Figure 11):

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

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

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

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

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

6. Pull the ejector handle away from the SFP+ faceplate to unseat the SFP+ from the PIC. Pull the SFP+ out of the PIC and place it on the antistatic mat or in the electrostatic bag.

Installing a PTX5000 PIC SFP+ Transceiver

To install a replacement SFP+:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the SFP+ transceiver, installing one if necessary.
3. Orient the SFP+ over the port in the PIC so that the connector end will enter the slot first and the SFP+ connector faces the appropriate direction.
4. Slide the SFP+ into the slot. If there is resistance, remove the SFP+ and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the PIC faceplate indicate that the PIC is functioning correctly. For more information about the PIC LEDs, see the PTX Series Interface Module Reference. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

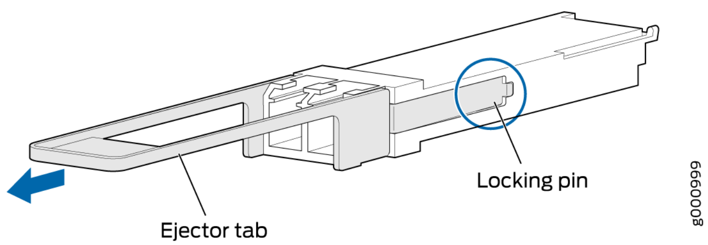
Replacing a QSFP28 Transceiver

IN THIS SECTION

Removing a QSFP28 Transceiver

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

Figure 289: 28-Gbps Quad Small Form-Factor Pluggable (QSFP28)



To remove a QSFP28 transceiver (see Figure 12):

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

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

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

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

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

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

Installing a QSFP28 Transceiver

To install a replacement QSFP28:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the QSFP28 transceiver, installing one if necessary.
3. Orient the QSFP28 over the port in the PIC so that the QSFP28 connector faces the appropriate direction.
4. Slide the QSFP28 into the slot until the locking pins lock in place. If there is resistance, remove the QSFP28 and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the PIC faceplate indicate that the QSFP28 is functioning correctly. For more information about the PIC LEDs, see the PTX Series Interface Module Reference. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

RELATED DOCUMENTATION

PTX5000 FPC Description | 134

PTX5000 FPC LEDs | 138

PTX5000 PIC Description | 139

Troubleshooting the PTX5000 FPCs | 597

Troubleshooting the PTX5000 PICs and PIC Transceivers | 602

Prevention of Electrostatic Discharge Damage

Upgrading the PTX5000 FPCs

IN THIS SECTION

Preparing to Upgrade the FPCs in a PTX5000

When you upgrade a PTX5000 to use second-generation or third-generation FPCs, the forwarding capacity increases. See "FPCs Supported on the PTX5000" on page 137 for more information about the forwarding capacity for each type of FPC.

To prepare to upgrade the FPCs in a PTX5000:

1. Ensure the site still meets the requirements—such as weight and power—when using the new components. See "Overview of Preparing the Site for the PTX5000" on page 150

2. Determine the model numbers of the following components already installed:

   - SIBs
   - FPCs
   - Power distribution units (PDUs)
   - Power supply modules (PSMs)

3. Ensure you have the required new components.

   - Up to eight FPCs
   - Nine SIBs
   - PDUs
   - PSMs
   - Fan trays

   NOTE: For the specific hardware requirements for each type of FPC, see "PTX5000 FPC Upgrade Kit" on page 521.

4. Review all safety guidelines and warnings for the PTX5000.

   WARNING: To avoid harm to yourself or the router as you install and maintain it, you must follow the safety procedures for working with Internet routers, as well as the guidelines and warnings for working with and near electrical equipment. However, providing an exhaustive set of guidelines for working with electrical equipment is beyond the scope of this documentation.
   See *General Safety Guidelines and Warnings*.

5. Upgrade the software on the PTX5000.

NOTE: To accommodate the change in the addressing scheme with eight Packet Forwarding Engines in the new FPC, you must upgrade the Junos OS on the PTX5000 to Junos OS Release 14.1. The upgrade to Junos OS Release 14.1 requires a reboot of the PTX5000.

PTX5000 FPC Upgrade Kit

- The following components are required to upgrade the FPCs to FPC2-PTX-P1A in a PTX5000:
  - FPC2-PTX-P1A FPCs
  - SIB2-I-PTX5K SIBs
  - PDU2-PTX-DC power distribution unit
  - PSM2-PTX-DC power supply module

    NOTE: PTX5K-PSM2TRAY is used only if you are upgrading the power supplies to high capacity PDUs and PSMs.

    NOTE: To install all eight FPC2-PTX-P1A FPCs, you must upgrade the PDUs and PSMs with PDU2-PTX-DC and PSM2-PTX-DC, respectively. Otherwise, you can only install a maximum of six FPC2-PTX-P1A FPCs. Refer to "Calculating PTX5000 Power Consumption" on page 166 for more details.

- The following components are required to upgrade the FPCs to FPC3-PTX-U2 in a PTX5000:
  - FPC3-PTX-U2 FPCs
  - SIB3-PTX5K SIBs
  - FAN3-PTX-H fan tray

  NOTE: When upgrading to FPC3-PTX-U2 FPCs, you are not required to upgrade to the PDU2-PTX-DC power distribution unit or the PSM2-PTX-DC power supply module.

- The following components are required to upgrade the FPCs to FPC3-PTX-U3 in a PTX5000:

- FPC3-PTX-U3 FPCs
- SIB3-PTX5K SIBs
- FAN3-PTX-H fan tray
- PDU2-PTX-DC power distribution unit
- PSM2-PTX-DC power supply module

> **NOTE**: PTX5K-PSM2TRAY is used only if you are upgrading the power supplies to high capacity PDUs and PSMs.

> **NOTE**: The PTX5000 supports two midplanes. The FPC3-PTX-U3 FPC must be installed in the PTX5000BASE2 model midplane.

Upgrading the FPCs in an Operational PTX5000

IN THIS SECTION

This topic describes the steps you take to upgrade your operational PTX5000 with new FPCs.

This topic does not describe the steps required to update an offline router with FPCs. See "Upgrading the FPCs in an Offline PTX5000" on page 535 for more information.

NOTE: When upgrading to third-generation FPCs (see "FPCs Supported on the PTX5000" on page 137), be aware of the following:

- When you are upgrading the FPCs on an operational PTX5000, make sure that the router is running Junos OS Release 15.1F5.
- If the PTX5000 is running Junos OS Release 15.1F3 or 15.1F4, you must use the offline upgrade procedure. See "Upgrading the FPCs in an Offline PTX5000" on page 535.

Before you begin to upgrade:

- Ensure that you understand how to prevent electrostatic discharge (ESD) damage.
- Unpack the upgrade components and verify the parts received.
- Gather the following tools required for the upgrade and integration:
  - Antistatic mat or antistatic bag for any components you remove from the chassis
  - Dust-free resealable plastic bags for temporary storage of port dust covers
  - ESD grounding wrist strap
  - Phillips (+) screwdriver, number 2

WARNING: To avoid harm to yourself or the PTX5000 as you install and maintain it, you must follow the safety procedures for working with Internet routers, as well as the guidelines and warnings for working with and near electrical equipment. However, providing an exhaustive set of guidelines for working with electrical equipment is beyond the scope of this documentation.

See *General Safety Guidelines and Warnings*.

To upgrade your operational PTX5000 with new FPCs follow these procedures:

Upgrading Junos OS on an Operational PTX5000

Upgrade Junos OS on the PTX5000 to the appropriate Junos OS Release for the FPC being upgraded to (see "FPCs Supported on the PTX5000" on page 137). For Junos OS upgrade information, see the Installation and Upgrade Guide.

Upgrading to the High Capacity Power System

The FPC that you are upgrading to might require you to upgrade your PTX5000 with the High Capacity power system. To determine whether an upgrade to the High Capacity power system is required, see "PTX5000 FPC Upgrade Kit" on page 521. To upgrade the power supply system, see "Upgrading to the High Capacity DC Power System" on page 434 and "Upgrading to the High Capacity AC Power System" on page 429.

Upgrading the Horizontal Fan Tray

The FPC that you are upgrading to might require an upgraded horizontal fan tray. To determine wether an upgrade to the horizontal fan tray is required, see "PTX5000 FPC Upgrade Kit" on page 521. To upgrade the horizontal fan tray, see "Replacing a PTX5000 Horizontal Fan Tray" on page 309.

Removing and Replacing SIBs in an Operational PTX5000

To remove a SIB:

1. Unpack the new SIBs and verify the parts received.
2. Issue the following commands to verify the current state of the PTX5000, and the SIBs and FPCs currently installed in the system. If there are errors or alarms, do not proceed until you resolve the issues.

   - Use the `show chassis alarms` command to view the overall condition of the PTX5000. Resolve any alarms before proceeding.

   - `show chassis fabric fpcs`—Check the switch fabric links between the FPCs and the SIBs. The value of the `Fabric management FPC state` field in the command output should be `Links ok`. The `Link error` state indicates that the link between the SIB and FPC has CRC errors. However, the link is still eligible to carry traffic.

   - `show chassis fabric sibs`—Check the switch fabric links between the SIBs and FPCs. The value of the `Fabric management SIB state` field in the command output should be `Links ok`. The `Link error` state indicates that the link between the SIB and the FPC is not operational.

   > **TIP**: If there are errors, the `show chassis fabric topology` command shows more details about the current fabric plane and link state. See "Troubleshooting the PTX5000 Switch Interface Boards" on page 593 for more information.

3. Reset the interface statistics by using the `clear interfaces statistics all` command so that you can easily determine whether any traffic drops are occurring during the procedure. Use the `show interfaces statistics` command to determine whether there are any errors.

4. Include the `fabric upgrade-mode default` statement in the configuration of the PTX5000 at the `[edit chassis]` hierarchy level.

   ```
   [edit]
   user@host# set chassis fabric upgrade-mode default
   ```

5. Commit the configuration on both the primary and the backup Routing Engines.

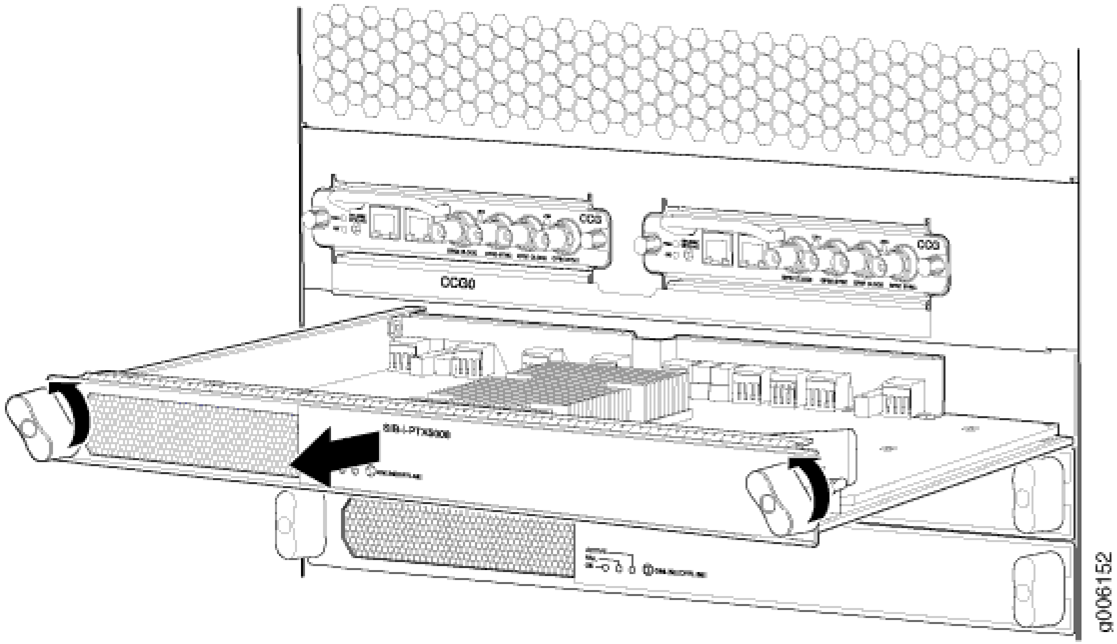
   ```
   [edit]
   user@host# commit synchronize
   ```

6. Use the `show configuration chassis` operational-mode command to verify that upgrade mode is set.
7. Place an electrostatic bag or antistatic mat on a flat, stable surface.
8. To prevent damage to the equipment caused by static discharge, attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
9. Take one of the old SIBs offline by using the `request chassis sib offline slot` *`slot-number`* command. Leave the remaining SIBs online.
10. Remove the offline SIB:

    a. Twist the ejector handles counterclockwise to unseat the SIB.

    b. Grasp both ejector handles, pull firmly, and slide the SIB about three-quarters of the way out of the chassis.

Figure 290: Removing a SIB from the PTX5000

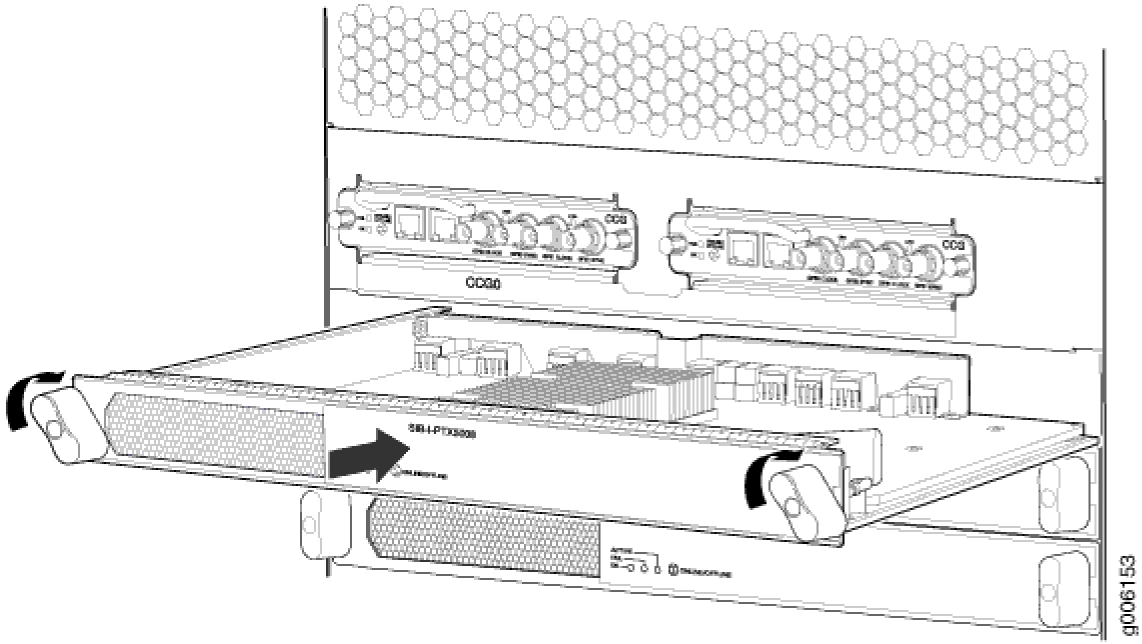


c. Place one hand underneath the SIB to support it and slide it completely out of the chassis. Place it on the antistatic mat.

> **CAUTION**: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

11. Install the new SIB:

Figure 291: Installing a SIB into the PTX5000



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

b. Place one hand underneath the SIB to support it. With the other hand, hold one of the ejector handles on the SIB faceplate.

c. Carefully align the sides of the SIB with the guides inside the chassis.

d. Slide the SIB into the chassis, carefully ensuring that it is correctly aligned.

e. Twist the ejector handles clockwise until they stop.

12. Bring the new SIB online by using the `request chassis sib online slot` *`slot-number`* command.

13. When the new SIB is online, check for any link errors or traffic drops with the following commands:

- `show chassis alarms`—Ensure there are no active alarms.

- `show chassis sibs` —The value of the `state` field should be `Online`, indicating that the SIBs are operational and running.

- `show interfaces statistics` and `show pfe statistics traffic`—Ensure that there are no traffic drops.

> **NOTE**: If link errors or traffic drops occur at any point during the upgrade, you can reverse the upgrade procedure and return the PTX5000 to its original state by taking the newly installed SIBs offline and replacing them with the original SIBs, one at a time. After the

original SIBs are installed, use the commands listed above to verify that there are no longer any link errors or traffic drops. Finally, delete the `fabric upgrade-mode default` statement from the configuration of the PTX5000 at the `[edit chassis]` hierarchy level, and commit the configuration change.

14. Repeat Step 9 through Step 13 until you have replaced each of the old SIBs with the new SIBs.
15. Delete the `fabric upgrade-mode default` statement from the configuration of the PTX5000 at the `[edit chassis]` hierarchy level.

```
[edit]
user@host# delete chassis fabric upgrade-mode
```

16. Commit the configuration on both the primary and the backup Routing Engines.

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

17. Check again for any issues with the following commands:
    - `show chassis alarms`
    - `show chassis fabric fpcs`
    - `show chassis fabric sibs`
    - `show interfaces statistics` and `show pfe statistics traffic`

Upgrading the FPCs in an Operational PTX5000

Before you begin upgrading the FPCs, use the `show chassis hardware` command to verify the following:

- That the correct SIBs are installed.
- That the correct PDUs and PSMs are installed.
- That the correct fan trays are installed.

To determine which hardware is required for the FPC that you are upgrading to, see "PTX5000 FPC Upgrade Kit" on page 521.

To remove an existing FPC:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

3. Use one of the following methods to take the FPC offline:

   - Press and hold the FPC **ONLINE/OFFLINE** button. The green **OK** LED next to the button begins to blink. Hold the button down until the LED turns off.

   - Issue the following CLI command:

     ```
     user@host> request chassis fpc slot slot-number offline
     ```

4. Disconnect the cables from the PICs installed in the FPC. Immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system, to prevent the cables from developing stress points.

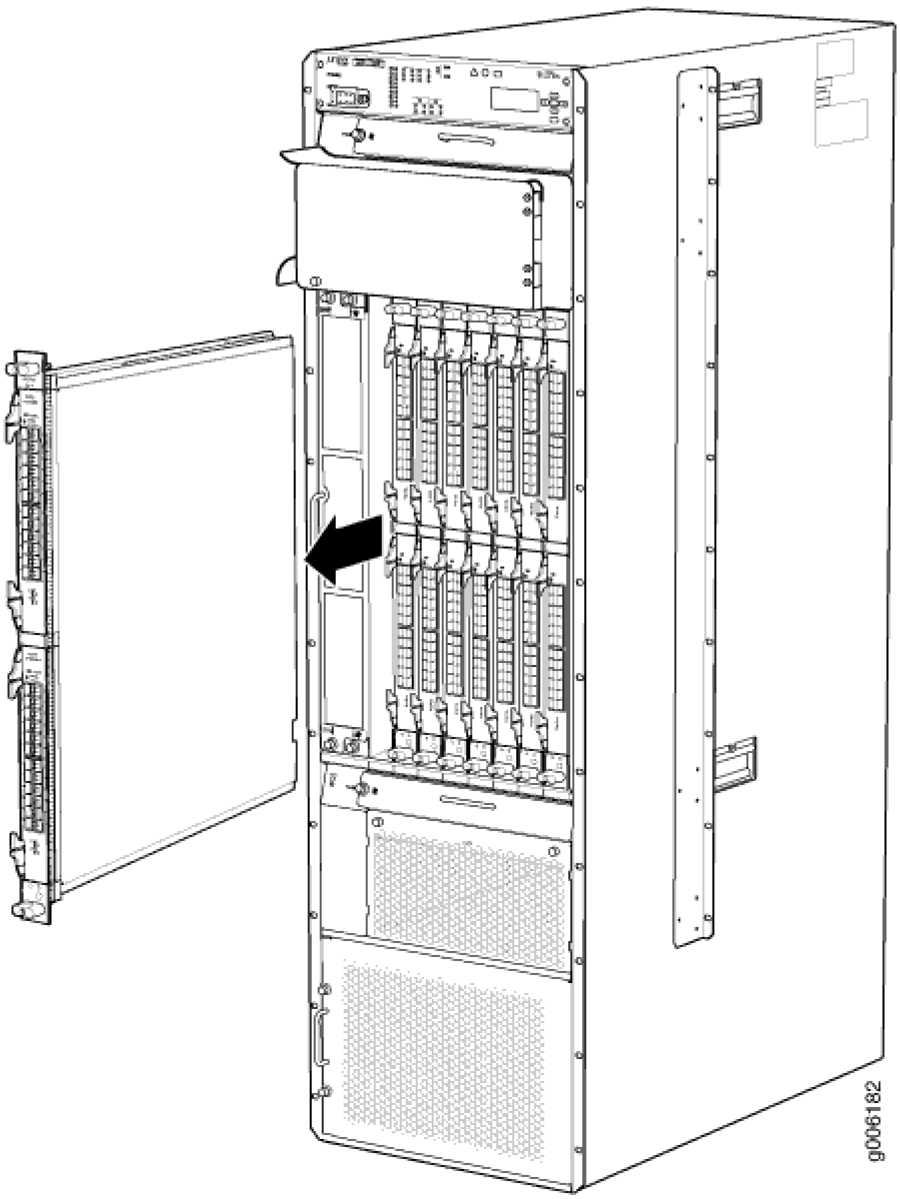
   WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

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

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

5. If necessary, remove each installed PIC from the FPC.
6. After you remove each PIC, immediately place it on an antistatic mat or in an electrostatic bag.
7. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.
8. Grasp the handles and slide the FPC straight out of the card cage halfway.

Figure 292: Removing an FPC from the PTX5000



9. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag. For detailed handling instructions, see "Holding PTX5000 FPCs" on page 488.

> **CAUTION**: The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 50 lb (22.7 kg)—as you slide the FPC out of the chassis.

When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. These components cannot support its weight.

Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

10. If you are not reinstalling an FPC into the emptied FPC slot within a short time, install a blank FPC panel over the slot to maintain proper airflow in the FPC card cage.

    CAUTION: After removing an FPC from the chassis, wait at least 30 seconds before reinserting it, installing another FPC in that slot, removing an FPC from a different slot, or inserting an FPC into a different slot.

To install an FPC:

CAUTION: The FPC power connector is located in the corner where the bottom and the connector edges meet. If a power connector prong becomes bent, it no longer aligns with the socket connector on the midplane, and the FPC no longer functions.

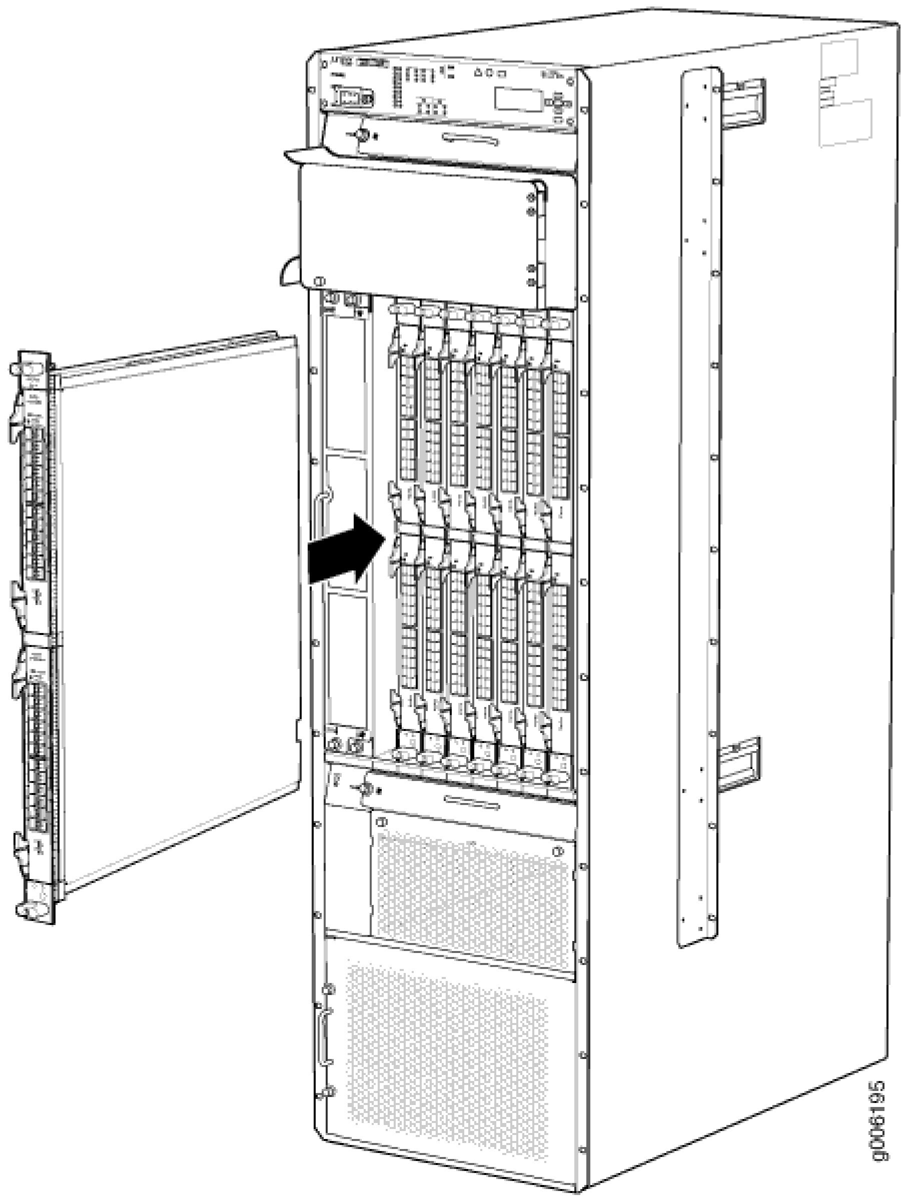
1. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Place the FPC on an antistatic mat.
3. Take each PIC to be installed in the replacement FPC out of its electrostatic bag and identify the slot on the FPC where it will be installed.
4. Verify that each fiber-optic transceiver has a rubber safety cap covering the transceiver. If it does not, cover the transceiver with a safety cap.
5. Install each PIC into the appropriate slot on the FPC. See *PTX Series PIC/FPC Compatibility* for installing the supported PICs on the FPC. For information about installing a PIC, see the installation instructions in "Replacing a PTX5000 PIC" on page 501.
6. Locate the slot in the FPC card cage in which you plan to install the FPC.
7. Inspect the slot in the FPC card cage to verify that there are no missing or bent pins on the midplane.
8. Inspect the FPC to verify that the connectors are not misaligned or damaged.
9. Orient the FPC vertically with the component side facing to the right. Be sure the FPC is right-side up, with the components on the right of the FPC.

CAUTION: When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. These components cannot support its weight.

10. Carefully align the connector edge of the FPC with the appropriate empty slot in the chassis.

11. Lift the FPC into place and carefully align the bottom and top of the FPC with the guides inside the card cage.

Figure 293: Installing an FPC into the PTX5000



12. Gently rest the bottom edge of the FPC on the bottom edge of the slot opening, making contact a short distance forward of the power connector.

> **CAUTION**: Take care not to bend or otherwise damage the power connector prongs.

13. Slowly slide the FPC into the slot until you feel resistance.

14. Align the ejector handles on the FPC faceplate in a position close to horizontal.

15. Simultaneously turn both ejector handles clockwise until you cannot turn them further.

16. Remove the rubber safety cap from each fiber-optic transceiver and fiber-optic cable.

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

17. Insert the appropriate cable into the cable connector ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

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

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

18. Use one of the following methods to bring the FPC online:

- Press and hold the FPC **ONLINE/OFFLINE** button until the green **OK** LED next to the button begins to blink, in about 5 seconds.

- Issue the following CLI command:

```
user@host> request chassis fpc slot slot-number online
```

> **CAUTION**: After the **OK** LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

19. Verify that all the eight FPCs are installed properly and working by using the `show chassis fpc` command. The replaced FPCs are displayed as `FPC E` in the command output.

You can also verify correct FPC and PIC functioning by issuing the `show chassis fpc` and `show chassis fpc pic-status` commands, as described in "Maintaining the PTX5000 FPCs" on page 487.

Upgrading the FPCs in an Offline PTX5000

IN THIS SECTION

This topic describes the steps you take to upgrade your offline PTX5000 with new FPCs.

NOTE: This topic does not describe the steps required to update an operational router with new FPCs. See "Upgrading the FPCs in an Operational PTX5000" on page 522 for more information.

Before you begin to upgrade:

- Perform the tasks described in"Preparing to Upgrade the FPCs in a PTX5000 " on page 519.
- Ensure that you understand how to prevent ESD damage.
- Unpack the upgrade components and verify the parts received.
- Gather the tools required for the upgrade and integration.
  - Antistatic mat or antistatic bag for any components you remove from the chassis
  - Dust-free resealable plastic bags for temporary storage of port dust covers
  - ESD grounding wrist strap

- Phillips (+) screwdriver, number 2

> **WARNING**: To avoid harm to yourself or the PTX5000 as you install and maintain it, you must follow the safety procedures for working with Internet routers, as well as the guidelines and warnings for working with and near electrical equipment. However, providing an exhaustive set of guidelines for working with electrical equipment is beyond the scope of this documentation.

See *General Safety Guidelines and Warnings*.

To upgrade your offline PTX5000 with new FPCs:

Upgrading Junos OS on an Offline PTX5000

Upgrade Junos OS on the PTX5000 to the appropriate Junos OS Release for the FPC being upgraded to (see "FPCs Supported on the PTX5000" on page 137). See the Installation and Upgrade Guide.

Powering Off the PTX5000 During FPC Upgrade

To power off the PTX5000, follow these steps:

1. On an external management device connected to the Routing Engine, issue the `request system halt both-routing-engines` operational mode command. The command shuts down the Routing Engines cleanly, so their state information is preserved.

   If the PTX5000 contains only one Routing Engine, issue the `request system halt` command.

   ```
   user@host> request system halt both-routing-engines
   ```

2. Wait until a message appears on the console confirming that the operating system has halted.

   ```
   Halt the system ? [yes,no] (no) yes

   *** FINAL System shutdown message from user@host ***

   System going down IMMEDIATELY

   Terminated

   ...

   syncing disks... 11 8 done
   ```

```
The operating system has halted.

Please press any key to reboot.
```

3. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Move the **OUTPUT** power switch on one PDU to the off (**O**) position.
5. - On a 120-A DC PDU, switch the circuit breaker on the PDU to the off (**O**) position.
   - On a 60-A DC PDU, switch the power input switches on the PDU to the off (**O**) position.
   - On a three-phase delta AC PDU or three-phase wye AC PDU, switch the circuit breaker on the PDU to the off (**O**) position.
6. Repeat step 4 and step 5 for the other PDU.
7. Verify that the **PDU OK** and the following LEDs on both PDU faceplates are off.
   - 120-A DC PDU—Verify that the **CB ON** LED is off.
   - 60-A DC PDU—Verify that the **SW ON** LED is off.
   - Three-phase delta AC PDU or three-phase wye AC PDU—Verify that the **CB ON** LED is off.

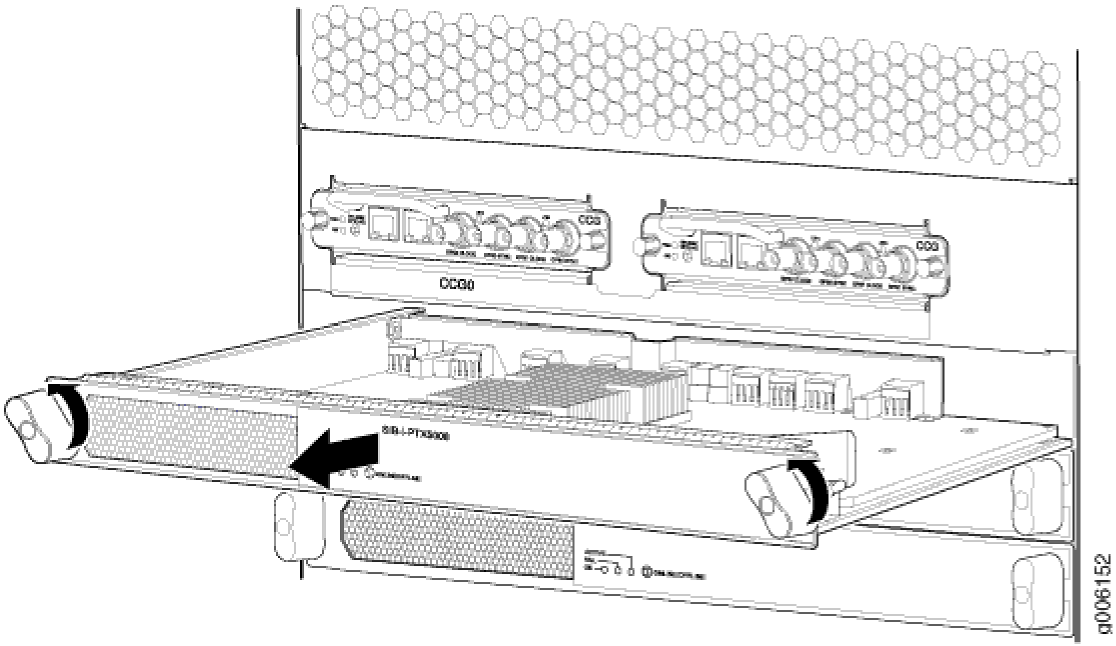
   NOTE: After powering off a power supply, you must wait at least 60 seconds before powering it on again.

Removing and Replacing SIBs in a PTX5000

To remove a SIB:

1. Prepare the chassis for the upgrade by issuing the `set chassis fabric upgrade-mode default` command at the `[edit]` hierarchy level.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Take the SIB offline. Press and hold the **ONLINE/OFFLINE** button on the SIB faceplate. The green **OK** LED on the faceplate turns off. Hold the button down until the LED completely turns off.
5. Twist the ejector handles counterclockwise to unseat the SIB.
6. Grasp both ejector handles, pull firmly, and slide the SIB about three-quarters of the way out of the chassis.

Figure 294: Removing a SIB

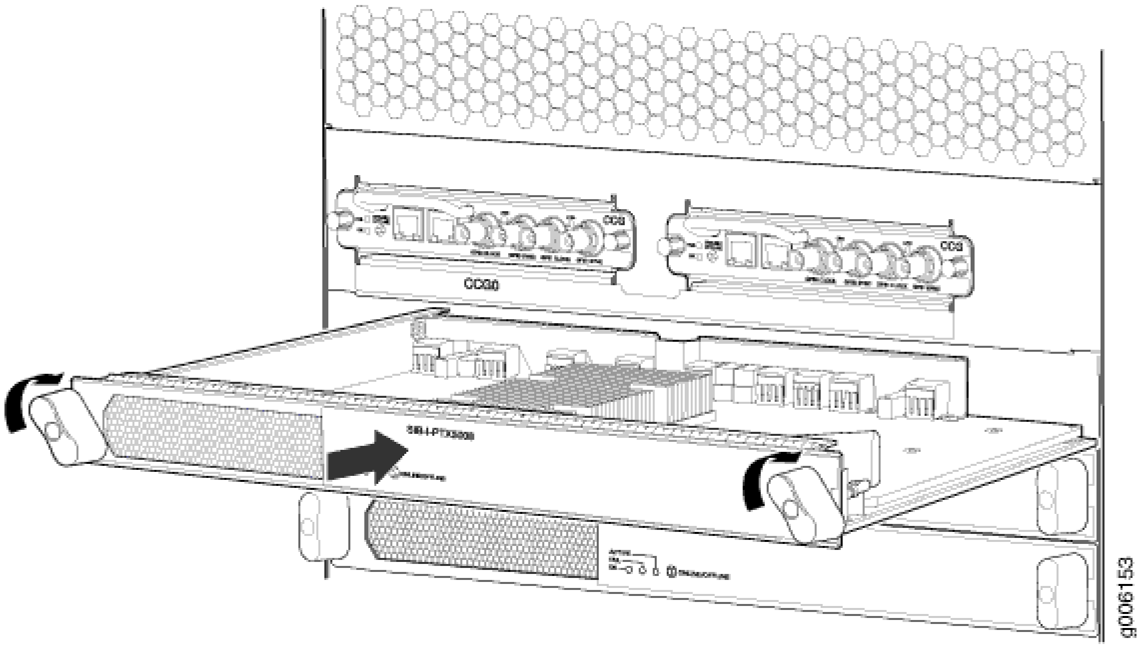


7. Place one hand underneath the SIB to support it and slide it completely out of the chassis. Place it on the antistatic mat.

> **CAUTION**: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

To install the new SIBs:

Figure 295: Installing a SIB



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

2. Press and hold the **ONLINE/OFFLINE** button on the SIB faceplate. The green **OK** LED on the faceplate turns off. Hold the button down until the LED completely turns off.

3. Place one hand underneath the SIB to support it. With the other hand, hold one of the ejector handles on the SIB faceplate.

4. Carefully align the sides of the SIB with the guides inside the chassis.

5. Slide the SIB into the chassis, carefully ensuring that it is correctly aligned.

6. Twist the ejector handles clockwise until they stop.

7. Install all the SIBs one by one.

Powering On the PTX5000

1. Verify that the PDUs and power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on the faceplates are tightened by using a number 2 Phillips (+) screwdriver.
2. Power on the router. Depending on the power supplies used on the router, see "Powering On the DC Powered PTX5000 with 120-A DC PDUs and 120-A DC PSMs" on page 284 or "Powering On the Three-Phase AC-Powered PTX5000" on page 279 or "Powering On the DC Powered PTX5000 with 60-A DC PDUs and 60-A DC PSMs" on page 282.

To power on the DC-powered PTX5000 with 120-A DC PDUs and 120-A DC PSMs, follow these steps:

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

3. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board (**AUXILIARY** or **CONSOLE**).

> **NOTE**: The management Ethernet port labeled **HOST/ETHERNET** on the Control Board is not available until after the initial software configuration. You can monitor the startup process during the initial installation by using devices connected to the **AUXILIARY** or **CONSOLE** ports.

4. Turn on power to the external management device.
5. Switch on the customer-site circuit breakers to provide voltage to the DC power source cables.
6. Attach an ESD grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
7. Verify that the green **–48 V 120 A** LEDs on the PDU faceplate are lit steadily green, indicating that the inputs are receiving power.
8. Switch all the circuit breakers on one of the PDUs to the on (|) position.
9. Verify that the green **CB ON** LEDs on the PDU faceplate are lit steadily. The **CB ON** LEDs blink momentarily, and then light steadily to indicate that the circuit breakers are on.

> **NOTE**: After a PDU is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDU and PSMs, the command output displays, and messages on the LCD display on the craft interface—to indicate that the PDU and PSMs are functioning normally. Ignore error indicators that appear during the first 60 seconds.

10. Move the **OUTPUT** power switch on the PDU to the on (|) position.
11. Verify that the **PDU OK** LED on the PDU faceplate is lit steadily and that the **FAULT** LED is off, indicating that the PDU is correctly installed and is functioning properly.

> **NOTE**: If the **PDU OK** LED does not light steadily, repeat the installation and cabling procedures.

12. Check the LEDs on the PSMs. For each PSM, verify that the **Input OK** and **Output OK** LEDs are lit steadily green, and that the **FAULT** LED is off.

NOTE: If the **Input OK** and **Output OK** LEDs do not light steadily or if the **FAULT** LED is lit, see "Troubleshooting the PTX5000 Power System" on page 568.

13. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
14. Repeat step 11 through step 14 for the other PDU.

NOTE: The Routing Engine boots as the PDU completes its startup sequence.

After powering on a power supply, you must wait at least 60 seconds before powering it off.

Verifying the Replaced SIBs

1. Bring the SIB online by using one of the following methods:
   - Press and hold the **ONLINE/OFFLINE** button on the SIB faceplate. The green **OK** LED on the faceplate begins to blink. Hold the button down until the LED blinks.
   - Issue the following CLI command on the PTX5000:

   ```
   user@host> request chassis sib online slot slot number
   ```

2. To verify that all the new SIBs are installed, use the `show chassis hardware` command. The new SIBs ID should be displayed in the command output (see "PTX5000 Hardware Component Overview" on page 7).

   To verify the status of the SIBs:

   - Issue the `show chassis fabric errors` command at the `[edit]` hierarchy level to verify the link status for each SIB.

     Also use the `show chassis fabric sibs` command to check the link status for each SIB.

   - Issue the `show chassis fabric fpcs` command at the `[edit]` hierarchy level to check whether any fabric error is logged.
   - Use the `show chassis fabric topology` to check the link status of all the SIBs and Packet Forwarding Engines.
3. If there are any errors in the replaced SIB, debug the errors. See "Troubleshooting the PTX5000 Switch Interface Boards" on page 593.
4. If all the replaced SIBs are functioning correctly, issue the `delete chassis fabric upgrade-mode default` to exit the upgrade mode.

Upgrading the FPCs

Before you begin upgrading the FPCs, use the `show chassis hardware` command to verify the following:

- That the correct SIBs are installed.
- That the correct PDU and PSM are installed.
- That the correct fan tray is installed.

To determine which hardware is required for the FPC that you are upgrading to, see "PTX5000 FPC Upgrade Kit" on page 521.

To upgrade the FPCs:

1. Verify that all the SIBs on the PTX5000 are correct, by using the `show chassis hardware` command.
2. Replace the FPCs on the PTX5000 with the new FPCs. Follow the replacement procedure in "Replacing a PTX5000 FPC" on page 493.
3. Verify that all eight FPCs are installed properly and working by using the `show chassis fpc` command.

RELATED DOCUMENTATION

Upgrading to the High Capacity DC Power System | **434**

5

CHAPTER

Troubleshooting Hardware

Troubleshooting PTX5000 Components

IN THIS SECTION

PTX5000 Troubleshooting Resources Overview

To troubleshoot a PTX5000, you use the Junos OS command-line interface (CLI), LCD, alarms, devices connected to the alarm relay contacts, and LEDs on both the components and craft interface.

- LEDs—When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate. In addition, you can also use the component-specific LEDs on the craft interface and on the faceplate of a component to troubleshoot the PTX5000.
- LCD—When a red or yellow alarm occurs, the cause of the alarm messages is displayed on the craft interface LCD. Use the CLI to display more information about the alarm.
- Alarm devices connected to the alarm relay contact—When a red or yellow alarm occurs, it trips the corresponding alarm relay contact.
- 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 the 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.

PTX5000 LED Overview

IN THIS SECTION

Craft Interface LEDs

The craft interface displays system status messages and allows you to troubleshoot the PTX5000. See "PTX5000 Craft Interface LEDs" on page 22.

NOTE: The FPC LEDs are located on the FPC faceplate.

LEDs on the craft interface include:

- Red and yellow alarm LEDs—One large red circular LED and one large yellow triangular LED indicate two levels of alarm conditions. You can determine the cause of the alarm condition by looking at the LCD on the craft interface.

- SIB LEDs—One bicolor green and red **OK** indicates the status of each SIB. One green (**ACT**) LED indicates if the SIB is active and passing traffic. The SIB LEDs are located on the left of the craft interface, and are labeled **SIB0** through **SIB8**.

- Host subsystem LEDs—Three LEDs (one green **MASTER**, one green **OK**, and one red **FAIL**) indicate the status of each host subsystem. The host subsystem LEDs are located on the upper right of the craft interface, and are labeled **HOST0** and **HOST1**.

- CCG LEDs—Three LEDs (one green **MASTER**, one green **OK**, and one red **FAIL**) indicate the status of each host subsystem. The CCG LEDs are located on the upper left of the craft interface, and are labeled **CCG0** and **CCG1**.
- Fan tray LEDs—One bicolor green and red LED for each fan tray labeled **0**, **1**, and **2** that indicates the status of the fan tray.
- PDU LEDs—One bicolor green and red **OK** LED for each PDU labeled **0** and **1**, which indicates the status of the PDU.
- PSM LEDs—One bicolor green and red LED for each PSM labeled **0** and, **1**, **2**, and **3**, which indicates the status of the PSM.

Component LEDs

The following LEDs are located on various PTX5000 components and display the status of those components:

- SIB LEDs—Three LEDs on each SIB faceplate—**ACTIVE**, **OK**, and **FAIL**—indicate the status of that SIB.

  See "PTX5000 Switch Interface Board LEDs" on page 133.

- Control Board LEDs—Three LEDs on each Control Board faceplate—**ACTIVE**, **OK**, and **FAIL**— indicate the status of that Control Board. Two port LEDs—**HOST/ETHERNET** and **ACT**—indicate the port speed and status.

  See "PTX5000 Control Board LEDs" on page 126.

- CCG LEDs—Three LEDs on each CCG faceplate indicate the status of that SCG. If no LEDs are lit, the CCG is not receiving power.

  See "PTX5000 Centralized Clock Generator LEDs" on page 30.

- PIC LEDs—Each port on each PIC has an LED that indicates the status of the port.

  See the *PTX Series Interface Module Reference*.

- PDU LEDs—The LEDs on each PDU faceplate indicate the status of that PDU.

  See "PTX5000 AC Power Distribution Unit LEDs" on page 54 and "PTX5000 DC Power Distribution Unit LEDs" on page 91.

- PSM LEDs—The LEDs on each PSM faceplate indicate the status of that PSM.

  See "PTX5000 AC Power Supply Module LEDs" on page 62 and "PTX5000 DC Power Supply Module LEDs" on page 97.

PTX5000 Alarm Messages Overview

IN THIS SECTION

When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate, trips the corresponding alarm relay contact, and reports the cause of the alarm in the craft interface LCD.

Chassis Alarm Messages

Chassis alarm messages Indicate a problem with a chassis component such as the cooling system or power system.To view a more detailed description of the alarm cause, issue the `show chassis alarms` CLI command:

```
user@host> show chassis alarms
17 alarms currently active
Alarm time               Class  Description
2011-12-07 11:28:52 PST  Minor  SIB 8 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 7 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 6 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 5 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 4 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 3 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 2 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 1 FPC Link Error
2011-12-07 11:28:52 PST  Minor  SIB 0 FPC Link Error
2011-12-07 11:15:42 PST  Minor  No Redundant Power for FPC 0-7
2011-12-07 11:15:42 PST  Minor  No Redundant Power for Rear Chassis
2011-12-07 11:15:42 PST  Minor  No Redundant Power for Fan 0-2
2011-12-07 11:15:42 PST  Minor  PDU 1 PSM 3 Absent
2011-12-07 11:15:42 PST  Minor  PDU 1 PSM 2 Absent
2011-12-07 11:15:42 PST  Minor  PDU 1 PSM 1 Absent
2011-12-07 11:15:42 PST  Minor  PDU 1 PSM 0 Absent
2011-12-07 11:15:42 PST  Minor  PDU 1 Absent
```

For more information and troubleshooting for chassis alarms, see the following documentation:

- See "Troubleshooting the PTX5000 Cooling System" on page 551.
- See "Troubleshooting the PTX5000 Centralized Clock Generators" on page 548.
- See "Troubleshooting the PTX5000 Control Boards" on page 588.
- See "Troubleshooting the PTX5000 FPCs" on page 597.
- See "Troubleshooting the PTX5000 Host Subsystem" on page 582 .
- See "Troubleshooting the PTX5000 PICs and PIC Transceivers" on page 602.
- See "Troubleshooting the PTX5000 Power System" on page 568.
- See "Troubleshooting the PTX5000 Routing Engines" on page 584
- See "Troubleshooting the PTX5000 Switch Interface Boards" on page 593.

Interface Alarm Messages

Interface alarms indicate a problem with a specific network interface.

SEE ALSO

System-Wide Alarms and Alarms for Each Interface Type

Troubleshooting the PTX5000 Centralized Clock Generators

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with a CCG:

- Table 82 on page 550 lists the alarms.
- Table 83 on page 550 lists the CCG LEDs.
- Table 84 on page 551 lists the CCG port LEDs.

Solution

To troubleshoot the CCGs:

1. Use the CLI to check for alarms. Issue the `show chassis alarms` command to view the alarms.

```
show chassis alarms
10 alarms currently active
Alarm time              Class  Description
2012-11-03 05:02:14 PDT Major  CCG 1 Failure
```

2. Check the LEDs on the faceplate of each CCG and on the craft interface.
3. Issue the `show chassis environment ccg` command to check the status of the CCGs.

```
user@host> show chassis environment ccg
CCG 0 status:
  State                          Online -  Master clock
  Temperature                    36 degrees C / 96 degrees F
  Power
    1.2 V bias                    1200 mV
    1.8 V                         1800 mV
    3.3 V                         3299 mV
    3.3 V bias                    3300 mV
  Bus Revision                   135
CCG 1 status:
  State                          Online - Standby
  Temperature                    37 degrees C / 98 degrees F
  Power
    1.2 V bias                    1199 mV
```

```
    1.8 V                    1799 mV
    3.3 V                    3300 mV
    3.3 V bias               3300 mV
  Bus Revision              135
```

In Table 82 on page 550, the text in the column labeled ”LCD Message” appears in the display of the craft interface. The text in the column labeled “CLI Message” appears in the output from the `show chassis alarms` command.

Table 82: Troubleshooting Chassis Alarm Messages for the CCGs

Alarm Type	LCD Message	CLI Message	Alarm Condition
Red	`CCG` *`CCG-number`* `Failure`	`CCG` *`CCG-number`* `Failure`	A CCG has failed.
	`No CG Online`	`No CG Online`	No CCGs are installed, or the CCGs installed are not online
	`CCG` *`CCG-number`* `Ext-A LOS`	`CCG` *`CCG-number`* `External-A LOS`	Loss of signal has occurred on the Bits-A port configured to be the primary or secondary clocking source, .
	`CCG` *`CCG-number`* `Ext-B LOS`	`CCG` *`CCG-number`* `External-B LOS`	Loss of signal has occurred on the Bits-B port configured to be the primary or secondary clocking source.
	`CCG` *`CCG-number`* `EXT SYNC UNSUPP`	`CCG` *`CCG-number`* `EXT SYNC UNSUPP`	External synchronization is not supported.
Yellow	`CCG` *`CCG-number`* `Not Online`	`CCG` *`CCG-number`* `Not Online`	A CCG is offline.

Table 83: Troubleshooting CCG LEDs

Label	Color	State	Description	Recovery
FAIL	Yellow	On steadily	The CCG has detected a failure.	Replace the CCG.
OK	–	Off	The CCG is not online or is not powered on.	Bring the CCG online.

Table 84: Troubleshooting CCG Port LEDs

Label	Color	State	Description
FAULT	Yellow	On steadily	The CCG has detected a failure.
LINK **NOTE**: The **LINK** LEDs are supported only for the BITS ports. This LED is not supported for the GPS ports.	Yellow	On steadily	BITS loss of signal
	–	Off	No loss of signal

SEE ALSO

PTX5000 Centralized Clock Generator LEDs | 30

Troubleshooting the PTX5000 Cooling System

IN THIS SECTION

Troubleshooting the PTX5000 Fan Trays

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with the fan trays:

- Table 4 lists the alarms.
- Table 5 lists the LEDs.

Solution

To troubleshoot the fan trays:

1. Check the alarms.
   - Issue the `show chassis alarms` command to get information about the source of an alarm condition:

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

   - Find the source of the problem by looking at the display on the craft interface. The number of alarm conditions, as well as the source of each alarm, appears on the screen.
2. Use the `show chassis fan` command to verify that the status of each fan is `OK`.

   NOTE: `Fan Tray 0` and `Fan Tray 1` refer to the fans in the horizontal fan trays that cool zone 1, and `Fan Tray 2` refers to fans in the vertical fan tray that cools zone 0.

   ```
   user@host> show chassis fan

         Item                       Status    % RPM     Measurement
         Fan Tray 0 Fan 1           OK        32%       3000 RPM
         Fan Tray 0 Fan 2           OK        33%       3042 RPM
         Fan Tray 0 Fan 3           OK        33%       3042 RPM
         Fan Tray 0 Fan 4           OK        33%       3042 RPM
         Fan Tray 0 Fan 5           OK        33%       3042 RPM
         Fan Tray 0 Fan 6           OK        33%       3042 RPM
         Fan Tray 0 Fan 7           OK        32%       3000 RPM
         Fan Tray 0 Fan 8           OK        33%       3042 RPM
         Fan Tray 0 Fan 9           OK        33%       3085 RPM
         Fan Tray 0 Fan 10          OK        33%       3042 RPM
   ```

```
    Fan Tray 0 Fan 11          OK        34%        3128 RPM
    Fan Tray 0 Fan 12          OK        34%        3128 RPM
    Fan Tray 0 Fan 13          OK        35%        3257 RPM
    Fan Tray 0 Fan 14          OK        33%        3042 RPM
    Fan Tray 1 Fan 1           OK        30%        2199 RPM
    Fan Tray 1 Fan 2           OK        31%        2299 RPM
    Fan Tray 1 Fan 3           OK        30%        2166 RPM
    Fan Tray 1 Fan 4           OK        32%        2333 RPM
    Fan Tray 1 Fan 5           OK        31%        2233 RPM
    Fan Tray 1 Fan 6           OK        32%        2366 RPM
    Fan Tray 2 Fan 1           OK        31%        2266 RPM
    Fan Tray 2 Fan 2           OK        31%        2233 RPM
    Fan Tray 2 Fan 3           OK        33%        2399 RPM
    Fan Tray 2 Fan 4           OK        31%        2266 RPM
    Fan Tray 2 Fan 5           OK        32%        2333 RPM
    Fan Tray 2 Fan 6           OK        30%        2166 RPM
```

3. If only one fan has failed and the other fans are functioning normally, the fan is probably faulty and you need to replace the fan tray.

4. Use the `show chassis zones` command to verify the status of each cooling zone.

```
user@host> show chassis zones

ZONE 0 Status
    Driving FRU                 Routing Engine 0
    Temperature                 72 degrees C / 161 degrees F
    Condition                   OK
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              0

ZONE 1 Status
    Driving FRU                 FPC 5 TL1
    Temperature                 66 degrees C / 150 degrees F
    Condition                   OK
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              0
```

5. Use the `show chassis zones detail` command to verify the status of each component in cooling zone 0 and cooling zone 1.

```
user@host> show chassis zones detail

ZONE 0 Status
Item                    Status                  Measurement
CB 0                    OK
CB 1                    OK
Routing Engine 0        OK
Routing Engine 1        OK
SIB 0                   OK
SIB 1                   OK
SIB 2                   OK
SIB 3                   OK
SIB 4                   OK
SIB 5                   OK
SIB 6                   OK
SIB 7                   OK
SIB 8                   OK
Fan Tray 0              OK                      Spinning at 35% fan tray speed

ZONE 1 Status
Item                    Status                  Measurement
FPC 0                   OK
PIC 0/0                 Absent
PIC 0/1                 Absent
FPC 1                   OK
PIC 1/0                 Absent
PIC 1/1                 Absent
FPC 2                   OK
PIC 2/0                 OK
PIC 2/1                 OK
FPC 3                   Absent
FPC 4                   Absent
FPC 5                   OK
PIC 5/0                 OK
PIC 5/1                 OK
FPC 6                   OK
PIC 6/0                 Absent
PIC 6/1                 Absent
FPC 7                   OK
```

```
PIC 7/0                 OK
PIC 7/1                 OK
Fan Tray 1              OK                    Spinning at 31% fan tray speed
Fan Tray 2              OK                    Spinning at 32% fan tray speed
```

In Table 4, the text in the column labeled ”LCD Message” appears in the display of the craft interface. The text in the column labeled “CLI Message” appears in the output from the `show chassis alarms` command.

Table 85: Troubleshooting Fan Tray Alarms

Alarm Type	LCD Message	CLI Message	Alarm Condition	Recovery
Red	`Fan Failure`	*fan-name* `Failure`	A fan has failed.	Replace the fan tray.
	`Fans Missing`	`Too many fans missing or failing`	A fan tray is missing or too many fan trays have failed.	Reinstall the fan tray in the chassis.
Yellow	`Fan Removed`	*fan-name* `Removed`	A fan tray has been removed.	Reinstall the fan tray in the chassis.

Table 86: Troubleshooting Fan Tray LEDs on the Craft Interface

Color	State	Description	Recovery
Red	On steadily	The fan tray has failed.	Replace the fan tray.
–	Off	The fan tray is offline or absent.	Reinstall the fan tray in the chassis.

Troubleshooting Temperature Alarms

IN THIS SECTION

Problem

Description

The following alarms or other conditions indicate a problem with the temperature of the hardware components:

- Table 87 on page 566 lists the alarms.
- The PTX5000 is powered off immediately if the temperature of a component exceeds the preconfigured maximum `Fire Shutdown` threshold.

Solution

To troubleshoot temperature alarms:

1. Find the source of the problem by looking at the display on the craft interface. The number of alarm conditions, as well as the source of each alarm, appears on the screen. Issue the `show chassis alarms` command to get information about the source of an alarm condition:

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

2. Verify that there is sufficient air flow. See "PTX5000 Clearance Requirements for Airflow and Hardware Maintenance" on page 157, "Maintaining the PTX5000 Fan Trays" on page 308, and "Maintaining the PTX5000 Air Filters" on page 316.

   Place your hand near the exhaust vents at the rear of the chassis to determine whether the fans are pushing air out of the chassis.

   - Zone 0: The air exhausts from the left side of the SIBs.
   - Zone 1: The exhaust vent is located at the upper rear of the chassis.
   - Power system: The air exhausts from the power supply modules (PSMs).

3. Verify that the cooling system in the chassis is operating properly. See "Troubleshooting the PTX5000 Cooling System" on page 551.

4. Verify that the room temperature is within acceptable limits. Use the `show chassis temperature-thresholds` to show the temperature thresholds for various components.

NOTE: `Exhaust A`, `Exhaust B`, `TL`*n*, `TQ`*n*, `Ambient`, `Exhaust`, and `Junction` correspond to temperature sensors located on the respective hardware component.

```
user@host> show chassis temperature-thresholds
show chassis temperature-thresholds
                           Fan speed      Yellow alarm      Red alarm      Fire  Shutdown
                          (degrees C)      (degrees C)     (degrees C)      (degrees C)
Item                     Normal  High   Normal  Bad fan   Normal  Bad fan     Normal
Routing Engine 0             80    90       95       85      105       95        115
CB 0 Exhaust A               60    65       78       75       85       80         95
CB 0 Exhaust B               60    65       78       75       85       80         95
CB 1 Exhaust A               60    65       78       75       85       80         95
CB 1 Exhaust B               60    65       78       75       85       80         95
FPC 3 Exhaust A              80    90       95       85      105       95        115
FPC 3 Exhaust B              80    90       95       85      105       95        115
FPC 3 TL5                    80    90       95       85      105       95        115
FPC 3 TQ5                    80    90       95       85      105       95        115
FPC 3 TL6                    80    90       95       85      105       95        115
FPC 3 TQ6                    80    90       95       85      105       95        115
FPC 3 TL1                    80    90       95       85      105       95        115
FPC 3 TQ1                    80    90       95       85      105       95        115
FPC 3 TL2                    80    90       95       85      105       95        115
FPC 3 TQ2                    80    90       95       85      105       95        115
FPC 3 TL4                    80    90       95       85      105       95        115
FPC 3 TQ4                    80    90       95       85      105       95        115
FPC 3 TL7                    80    90       95       85      105       95        115
FPC 3 TQ7                    80    90       95       85      105       95        115
FPC 3 TL0                    80    90       95       85      105       95        115
FPC 3 TQ0                    80    90       95       85      105       95        115
FPC 3 TL3                    80    90       95       85      105       95        115
FPC 3 TQ3                    80    90       95       85      105       95        115
SIB 0 Exhaust                60    65       78       75       85       80         95
SIB 0 Junction               75    80       90       85      105       95        115
SIB 1 Exhaust                60    65       78       75       85       80         95
SIB 1 Junction               75    80       90       85      105       95        115
SIB 2 Exhaust                60    65       78       75       85       80         95
SIB 2 Junction               75    80       90       85      105       95        115
SIB 3 Exhaust                60    65       78       75       85       80         95
SIB 3 Junction               75    80       90       85      105       95        115
SIB 4 Exhaust                60    65       78       75       85       80         95
```

```
SIB 4 Junction                75    80      90      85      105      95      115
SIB 5 Exhaust                 60    65      78      75       85      80       95
SIB 5 Junction                75    80      90      85      105      95      115
SIB 6 Exhaust                 60    65      78      75       85      80       95
SIB 6 Junction                75    80      90      85      105      95      115
SIB 7 Exhaust                 60    65      78      75       85      80       95
SIB 7 Junction                75    80      90      85      105      95      115
SIB 8 Exhaust                 60    65      78      75       85      80       95
SIB 8 Junction                75    80      90      85      105      95      115
```

5. Look at the PDU and PSM LEDs on the craft interface.

6. If both PDUs fail, the system temperature might have exceeded the threshold, causing the system to shut down. If the temperature exceeds the acceptable maximum, the Control Board turns off the PDUs.

7. Check the temperature of components that are monitored for temperature alarms by issuing the `show chassis environment monitored` command. For more information about temperature alarms, see Table 87 on page 566.

   Verify that the status of each component is `OK`.

   NOTE: `Exhaust A`, `Exhaust B`, `TL`*n*, `TQ`*n*, `Ambient`, `Exhaust`, and `Junction` correspond to temperature sensors located on the respective hardware component.

   The output is similar to the following:

```
user@host> show chassis environment monitored

Class Item                          Status     Measurement
      Routing Engine 0 CPU          OK         69 degrees C / 156 degrees F
      Routing Engine 1 CPU          OK         60 degrees C / 140 degrees F
      CB 0 Exhaust A                OK         44 degrees C / 111 degrees F
      CB 0 Exhaust B                OK         40 degrees C / 104 degrees F
      CB 1 Exhaust A                OK         38 degrees C / 100 degrees F
      CB 1 Exhaust B                OK         35 degrees C / 95 degrees F
      SIB 0 Exhaust                 OK         36 degrees C / 96 degrees F
      SIB 0 Junction                OK         40 degrees C / 104 degrees F
```

```
    SIB 1 Exhaust                OK          35 degrees C / 95 degrees F
    SIB 1 Junction               OK          42 degrees C / 107 degrees F
    SIB 2 Exhaust                OK          36 degrees C / 96 degrees F
    SIB 2 Junction               OK          40 degrees C / 104 degrees F
    SIB 3 Exhaust                OK          38 degrees C / 100 degrees F
    SIB 3 Junction               OK          41 degrees C / 105 degrees F
    SIB 4 Exhaust                OK          42 degrees C / 107 degrees F
    SIB 4 Junction               OK          51 degrees C / 123 degrees F
    SIB 5 Exhaust                OK          42 degrees C / 107 degrees F
    SIB 5 Junction               OK          60 degrees C / 140 degrees F
    SIB 6 Exhaust                OK          39 degrees C / 102 degrees F
    SIB 6 Junction               OK          63 degrees C / 145 degrees F
    SIB 7 Exhaust                OK          39 degrees C / 102 degrees F
    SIB 7 Junction               OK          62 degrees C / 143 degrees F
    SIB 8 Exhaust                OK          40 degrees C / 104 degrees F
    SIB 8 Junction               OK          64 degrees C / 147 degrees F
    FPC 0 Exhaust A              OK          50 degrees C / 122 degrees F
    FPC 0 Exhaust B              OK          43 degrees C / 109 degrees F
    FPC 0 TL0                    OK          48 degrees C / 118 degrees F
    FPC 0 TQ0                    OK          52 degrees C / 125 degrees F
    FPC 0 TL1                    OK          56 degrees C / 132 degrees F
    FPC 0 TQ1                    OK          57 degrees C / 134 degrees F
    FPC 0 TL2                    OK          54 degrees C / 129 degrees F
    FPC 0 TQ2                    OK          55 degrees C / 131 degrees F
    FPC 0 TL3                    OK          58 degrees C / 136 degrees F
    FPC 0 TQ3                    OK          58 degrees C / 136 degrees F
    FPC 2 Exhaust A              OK          50 degrees C / 122 degrees F
    FPC 2 Exhaust B              OK          51 degrees C / 123 degrees F
    FPC 2 TL0                    OK          53 degrees C / 127 degrees F
    FPC 2 TQ0                    OK          52 degrees C / 125 degrees F
    FPC 2 TL1                    OK          57 degrees C / 134 degrees F
    FPC 2 TQ1                    OK          57 degrees C / 134 degrees F
    FPC 2 TL2                    OK          54 degrees C / 129 degrees F
    FPC 2 TQ2                    OK          59 degrees C / 138 degrees F
    FPC 2 TL3                    OK          60 degrees C / 140 degrees F
    FPC 2 TQ3                    OK          63 degrees C / 145 degrees F
    PIC 2/0 Ambient              OK          48 degrees C / 118 degrees F
```

8. If there is a temperature alarm for a hardware component, issue on the following commands for more detail.

- Use the `show chassis environment routing-engine` command to check the temperature of each Routing Engine.

```
user@host> show chassis environment routing-engine
Routing Engine 0 status:
  State                      Online Master
  Temperature                55 degrees C / 131 degrees F
  CPU Temperature            66 degrees C / 150 degrees F
Routing Engine 1 status:
  State                      Online Standby
  Temperature                52 degrees C / 125 degrees F
  CPU Temperature            64 degrees C / 147 degrees F
```

- Use the `show chassis environment cb` command to check the temperature of each Control Board.

NOTE: `Exhaust A` and `Exhaust B` correspond to temperature sensors located on the Control Boards.

```
user@host> show chassis environment cb
CB 0 status:
  State                      Online Master
  Intake Temperature         38 degrees C / 100 degrees F
  Exhaust A Temperature      45 degrees C / 113 degrees F
  Exhaust B Temperature      42 degrees C / 107 degrees F
  Power 1
    1.2 V                     1200 mV
    1.25 V                    1250 mV
    2.5 V                     2500 mV
    3.3 V                     3300 mV
  Power 2
    1.0 V                     1000 mV
    3.3 V bias                3293 mV
    3.9 V                     3921 mV
  Bus Revision               132
  FPGA Revision              27
CB 1 status:
  State                      Online Standby
  Intake Temperature         34 degrees C / 93 degrees F
  Exhaust A Temperature      39 degrees C / 102 degrees F
```

```
  Exhaust B Temperature      36 degrees C / 96 degrees F
  Power 1
    1.2 V                     1199 mV
    1.25 V                    1250 mV
    2.5 V                     2499 mV
    3.3 V                     3299 mV
  Power 2
    1.0 V                     1000 mV
    3.3 V bias                3312 mV
    3.9 V                     3961 mV
  Bus Revision               132
  FPGA Revision              28
```

- Use the `show chassis environment sib` command to check the temperature of each SIB. In this example, `SIB 3 status` is not listed.

> **NOTE**: `Intake`, `Exhaust`, and `Junction` correspond to temperature sensors located on the sibs.

```
user@host> show chassis environment sib
SIB 0 status:
  State                      Online
  Intake Temperature         39 degrees C / 102 degrees F
  Exhaust Temperature        37 degrees C / 98 degrees F
  Junction Temperature       43 degrees C / 109 degrees F
  Power
    1.0 V                     1000 mV
    1.5 V                     1499 mV
    1.2 V                     1199 mV
    3.3 V                     3300 mV
    0.9 V                      900 mV
    2.5 V                     2500 mV
    3.3 V bias                3298 mV
SIB 1 status:
  State                      Online
  Intake Temperature         39 degrees C / 102 degrees F
  Exhaust Temperature        36 degrees C / 96 degrees F
  Junction Temperature       45 degrees C / 113 degrees F
  Power
    1.0 V                     1000 mV
    1.5 V                     1500 mV
```

```
    1.2 V                      1200 mV
    3.3 V                      3300 mV
    0.9 V                       900 mV
    2.5 V                      2499 mV
    3.3 V bias                 3321 mV
SIB 2 status:
  State                       Online
  Intake Temperature          37 degrees C / 98 degrees F
  Exhaust Temperature         37 degrees C / 98 degrees F
  Junction Temperature        41 degrees C / 105 degrees F
  Power
    1.0 V                       999 mV
    1.5 V                      1499 mV
    1.2 V                      1199 mV
    3.3 V                      3299 mV
    0.9 V                       900 mV
    2.5 V                      2500 mV
    3.3 V bias                 3339 mV
SIB 4 status:
  State                       Online
  Intake Temperature          47 degrees C / 116 degrees F
  Exhaust Temperature         45 degrees C / 113 degrees F
  Junction Temperature        57 degrees C / 134 degrees F
  Power
    1.0 V                      1000 mV
    1.5 V                      1500 mV
    1.2 V                      1199 mV
    3.3 V                      3299 mV
    0.9 V                       900 mV
    2.5 V                      2499 mV
    3.3 V bias                 3333 mV
...
```

- Use the `show chassis environment fpc` command to check the temperature of FPC.

NOTE: `PMB`, `Intake`, `Exhaust A`, `Exhaust B`, `TL`*n*, and `TQ`*n* correspond to temperature sensors located on the FPCs.

```
user@host> show chassis environment fpc
FPC 0 status:
```

```
State                       Online
PMB Temperature             35 degrees C / 95 degrees F
Intake Temperature          33 degrees C / 91 degrees F
Exhaust A Temperature       51 degrees C / 123 degrees F
Exhaust B Temperature       43 degrees C / 109 degrees F
TL0 Temperature             48 degrees C / 118 degrees F
TQ0 Temperature             53 degrees C / 127 degrees F
TL1 Temperature             56 degrees C / 132 degrees F
TQ1 Temperature             58 degrees C / 136 degrees F
TL2 Temperature             55 degrees C / 131 degrees F
TQ2 Temperature             57 degrees C / 134 degrees F
TL3 Temperature             59 degrees C / 138 degrees F
TQ3 Temperature             59 degrees C / 138 degrees F
Power
  PMB   1.05v                1049 mV
  PMB   1.5v                 1500 mV
  PMB   2.5v                 2500 mV
  PMB   3.3v                 3299 mV
  PFE0  1.5v                 1500 mV
  PFE0  1.0v                  999 mV
  TQ0   0.9v                  900 mV
  TL0   0.9v                  900 mV
  PFE1  1.5v                 1499 mV
  PFE1  1.0v                  999 mV
  TQ1   0.9v                  899 mV
  TL1   0.9v                  900 mV
  PFE2  1.5v                 1500 mV
  PFE2  1.0v                 1000 mV
  TQ2   0.9v                  900 mV
  TL2   0.9v                  900 mV
  PFE3  1.5v                 1499 mV
  PFE3  1.0v                 1000 mV
  TQ3   0.9v                  900 mV
  TL3   0.9v                  900 mV
  Bias  3.3v                 3327 mV
  FPC   3.3v                 3300 mV
  FPC   2.5v                 2500 mV
  SAM   0.9v                  900 mV
  A    12.0v                 2014 mV
  B    12.0v                 2030 mV
```

9. Use the `show chassis environment` command to verify that the status of each component is `OK`.

NOTE: `Exhaust A`, `Exhaust B`, `TL`*n*, `TQ`*n*, `Ambient`, `Intake`, `Exhaust`, and `Junction` correspond to temperature sensors located on the respective hardware component.

```
user@host> show chassis environment

Class Item                           Status     Measurement
Temp  PDU 0                          OK
      PDU 0 PSM 0                    OK         35 degrees C / 95 degrees F
      PDU 0 PSM 1                    OK         37 degrees C / 98 degrees F
      PDU 0 PSM 2                    OK         37 degrees C / 98 degrees F
      PDU 0 PSM 3                    OK         37 degrees C / 98 degrees F
      PDU 1                          Absent
      CCG 0                          OK         43 degrees C / 109 degrees F
      CCG 1                          Absent
      Routing Engine 0               OK         61 degrees C / 141 degrees F
      Routing Engine 0 CPU           OK         74 degrees C / 165 degrees F
      Routing Engine 1               OK         50 degrees C / 122 degrees F
      Routing Engine 1 CPU           OK         63 degrees C / 145 degrees F
      CB 0 Intake                    OK         39 degrees C / 102 degrees F
      CB 0 Exhaust A                 OK         45 degrees C / 113 degrees F
      CB 0 Exhaust B                 OK         41 degrees C / 105 degrees F
      CB 1 Intake                    OK         35 degrees C / 95 degrees F
      CB 1 Exhaust A                 OK         38 degrees C / 100 degrees F
      CB 1 Exhaust B                 OK         36 degrees C / 96 degrees F
      SIB 0 Intake                   OK         39 degrees C / 102 degrees F
      SIB 0 Exhaust                  OK         36 degrees C / 96 degrees F
      SIB 0 Junction                 OK         43 degrees C / 109 degrees F
      SIB 1 Intake                   OK         39 degrees C / 102 degrees F
      SIB 1 Exhaust                  OK         36 degrees C / 96 degrees F
      SIB 1 Junction                 OK         45 degrees C / 113 degrees F
      SIB 2 Intake                   OK         37 degrees C / 98 degrees F
      SIB 2 Exhaust                  OK         36 degrees C / 96 degrees F
      SIB 2 Junction                 OK         42 degrees C / 107 degrees F
      SIB 3 Intake                   OK         40 degrees C / 104 degrees F
      SIB 3 Exhaust                  OK         40 degrees C / 104 degrees F
      SIB 3 Junction                 OK         46 degrees C / 114 degrees F
      SIB 4 Intake                   OK         47 degrees C / 116 degrees F
      SIB 4 Exhaust                  OK         44 degrees C / 111 degrees F
      SIB 4 Junction                 OK         58 degrees C / 136 degrees F
      SIB 5 Intake                   OK         57 degrees C / 134 degrees F
```

```
        SIB 5 Exhaust                   OK          42 degrees C / 107 degrees F
        SIB 5 Junction                  OK          69 degrees C / 156 degrees F
        SIB 6 Intake                    OK          56 degrees C / 132 degrees F
        SIB 6 Exhaust                   OK          41 degrees C / 105 degrees F
        SIB 6 Junction                  OK          63 degrees C / 145 degrees F
        SIB 7 Intake                    OK          56 degrees C / 132 degrees F
        SIB 7 Exhaust                   OK          41 degrees C / 105 degrees F
        SIB 7 Junction                  OK          64 degrees C / 147 degrees F
        SIB 8 Intake                    OK          57 degrees C / 134 degrees F
        SIB 8 Exhaust                   OK          42 degrees C / 107 degrees F
        SIB 8 Junction                  OK          68 degrees C / 154 degrees F
        FPC 0 PMB                       OK          34 degrees C / 93 degrees F
        FPC 0 Intake                    OK          32 degrees C / 89 degrees F
        FPC 0 Exhaust A                 OK          50 degrees C / 122 degrees F
        FPC 0 Exhaust B                 OK          43 degrees C / 109 degrees F
        FPC 0 TL0                       OK          47 degrees C / 116 degrees F
        FPC 0 TQ0                       OK          52 degrees C / 125 degrees F
        FPC 0 TL1                       OK          55 degrees C / 131 degrees F
        FPC 0 TQ1                       OK          57 degrees C / 134 degrees F
        FPC 0 TL2                       OK          54 degrees C / 129 degrees F
        FPC 0 TQ2                       OK          55 degrees C / 131 degrees F
        FPC 0 TL3                       OK          57 degrees C / 134 degrees F
        FPC 0 TQ3                       OK          57 degrees C / 134 degrees F
        FPC 2 PMB                       OK          34 degrees C / 93 degrees F
        FPC 2 Intake                    OK          33 degrees C / 91 degrees F
        FPC 2 Exhaust A                 OK          50 degrees C / 122 degrees F
        FPC 2 Exhaust B                 OK          51 degrees C / 123 degrees F
        FPC 2 TL0                       OK          52 degrees C / 125 degrees F
        FPC 2 TQ0                       OK          52 degrees C / 125 degrees F
        FPC 2 TL1                       OK          56 degrees C / 132 degrees F
        FPC 2 TQ1                       OK          57 degrees C / 134 degrees F
        FPC 2 TL2                       OK          53 degrees C / 127 degrees F
        FPC 2 TQ2                       OK          58 degrees C / 136 degrees F
        FPC 2 TL3                       OK          59 degrees C / 138 degrees F
        FPC 2 TQ3                       OK          62 degrees C / 143 degrees F
        PIC 2/0 Ambient                 OK          48 degrees C / 118 degrees F
        FPM I2CS                        OK          36 degrees C / 96 degrees F
Fans    Fan Tray 0 Fan 1                OK          2700 RPM
        Fan Tray 0 Fan 2                OK          2528 RPM
        Fan Tray 0 Fan 3                OK          2700 RPM
        Fan Tray 0 Fan 4                OK          2742 RPM
        Fan Tray 0 Fan 5                OK          2700 RPM
        Fan Tray 0 Fan 6                OK          2700 RPM
```

```
      Fan Tray 0 Fan 7              OK         2700 RPM
      Fan Tray 0 Fan 8              OK         2700 RPM
      Fan Tray 0 Fan 9              OK         2657 RPM
      Fan Tray 0 Fan 10             OK         2871 RPM
      Fan Tray 0 Fan 11             OK         2871 RPM
      Fan Tray 0 Fan 12             OK         2871 RPM
      Fan Tray 0 Fan 13             OK         2785 RPM
      Fan Tray 0 Fan 14             OK         2742 RPM
 ..
```

In Table 87 on page 566, the text in the column labeled "LCD Message" appears in the display of the craft interface. The text in the column labeled "CLI Message" appears in the output from the `show chassis alarms` command. An alarm indicates that the temperature for a component exceeds the preconfigured `temperature warm` or `temperature hot` threshold.

Table 87: Troubleshooting Temperature Alarms

Alarm Type	LCD Message	CLI Message	Alarm Condition	Solution
Red	`Sensor Failure`	`Temperature sensor failure`	A temperature sensor failed.	Contact JTAC.
	cb-number `Hot`	*cb-numer* `Temperature Hot`	The Control Board temperature exceeded the hot temperature threshold. If this condition persists, the Control Board shuts down.	• Issue the `show chassis routing-engine` command.

Table 87: Troubleshooting Temperature Alarms *(Continued)*

Alarm Type	LCD Message	CLI Message	Alarm Condition	Solution
	`FPC` *`FPC-number`* `PIC` *`PIC-number`* `Hot`	`FPC` *`FPC-number`* `PIC` *`PIC-number`* `Temperature Hot`	The FPC temperature exceeded the hot temperature threshold. If this condition persists, the FPC shuts down.	• Issue the `show chassis fpc` command. • Verify that the room temperature is within acceptable limits. • Verify that there is sufficient air flow. • Verify that the cooling system in the chassis is operating properly.
	`sib-number` `Hot`	*`sib-number`* `Temperature Hot`	The SIB temperature exceeded the hot temperature threshold. If this condition persists, the SIB shuts down.	• Issue the `show chassis sib` command. • Verify that the room temperature is within acceptable limits. • Verify that there is sufficient air flow. • Verify that the cooling system in the chassis is operating properly.
Yellow	*`cb-number`* `Warm`	*`cb-number`*`Temperature Warm`	The Control Board temperature exceeded the warm temperature threshold.	• Verify that the fans in the vertical fan tray have not failed. • Verify that fans in the vertical fan tray are running at appropriate speed. • Issue the `show chassis routing-engine` command.

Table 87: Troubleshooting Temperature Alarms *(Continued)*

Alarm Type	LCD Message	CLI Message	Alarm Condition	Solution
	`*sib-number*` `Warm`	`*sib-number* Temperature Warm`	The SIB temperature exceeded the warm temperature threshold.	• Verify that the fans in the vertical fan tray have not failed. • Verify that fans in the vertical fan tray are running at appropriate speed. • Issue the `show chassis sib` command. • Verify that there is sufficient air flow to the rear fan tray.
	`FPC *FPC-number* PIC *PIC-number* Warm`	`FPC *FPC-number* PIC *PIC-number*Temperature Warm`	The FPC temperature exceeded the warm temperature threshold.	• Verify that the fans in the horizontal fan trays have not failed. • Verify that fans in the horizontal fan trays are running at the appropriate speed. • Issue the `show chassis fpc` command.

Troubleshooting the PTX5000 Power System

IN THIS SECTION

Troubleshooting the PTX5000 Power Distribution Units

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with the power system during normal operations:

- Table 7 lists alarms for the PDUs.
- Table 8 lists abnormal LED states for the PDUs.

Solution

1. Verify that the source customer-site circuit breaker has the proper current rating. See "PTX5000 DC Power Electrical Safety Guidelines" on page 670 or "PTX5000 AC Power Electrical Safety Guidelines" on page 667.

2. Verify that the power feeds are properly distributed.

   - All inputs on a DC PDU in slot **PDU0** must be powered by dedicated power feeds derived from feed A, and all inputs on a DC PDU in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

   - The AC power cord on an AC power supply in slot **PDU0** must be powered by a dedicated power feed derived from feed A, and The AC power cord on an AC power supply in slot **PDU1** must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.

3. Issue the `show chassis alarms` command to check for PDU alarms. See Table 7.

```
show chassis alarms
10 alarms currently active
Alarm time               Class  Description
2012-11-02 15:27:32 PDT  Major  CCG 1 Failure
```

```
2012-11-02 15:13:58 PDT  Minor  No Redundant Power for FPC 0-7
2012-11-02 15:13:57 PDT  Minor  No Redundant Power for Rear Chassis
2012-11-02 15:13:56 PDT  Major  PDU 0 PSM 2 Not OK
2012-11-02 15:13:56 PDT  Minor  No Redundant Power for Fan 0-2
2012-11-02 15:13:51 PDT  Minor  PDU 1 PSM 3 Absent
2012-11-02 15:13:51 PDT  Minor  PDU 1 PSM 2 Absent
2012-11-02 15:13:51 PDT  Minor  PDU 1 PSM 1 Absent
2012-11-02 15:13:51 PDT  Minor  PDU 1 PSM 0 Absent
2012-11-02 15:13:50 PDT  Minor  PDU 1 Absent
```

4. Check the display on the craft interface to determine the source of a yellow or red alarm). Junos OS constantly updates the screen with status information for each component.

   NOTE: From the rear of the chassis, the PDUs are labeled **PDU1** and **PDU0**, from left to right.

5. Check the LEDs on each PDU faceplate. See Table 8.

6. Verify that the DC power cable or the AC power cord from the power source to the PDU is not damaged. If the insulation is cracked or broken, immediately replace the DC power cable or AC power cord.

7. Check the status of the PDUs by issuing the `show chassis environment pdu` command. The state of the PDU must be online. If the output indicates that a PSM in the PDU is present, see "Troubleshooting the PTX5000 Power Supply Modules" on page 578.

```
user@host> show chassis environment pdu
```

   The following example shows output for a DC PDU.

```
user@host> show chassis environment pdu 0
PDU 0 status:
  State                     Online
  Hours Used                2161
  Firmware Version (MCU1)   02.03
  Firmware Version (MCU2)   02.01
  Firmware Version (MCU3)   02.01
  Firmware Version (MCU4)   02.01
PDU 0 PSM 0 status:
  State                     Online
  Temperature               OK   35 degrees C / 95 degrees F
```

```
  Fans                        OK
  DC Input                    OK
  DC Output                   OK
  Hours Used                  1379
  Firmware Version            02.03
PDU 0 PSM 1 status:
  State                       Online
  Temperature                 OK   37 degrees C / 98 degrees F
  Fans                        OK
  DC Input                    OK
  DC Output                   OK
  Hours Used                  1411
  Firmware Version            02.03
PDU 0 PSM 2 status:
  State                       Present
  Fans                        Fans 1 and 2 failed
  DC Input                    Check
  DC Output                   Failed
  Hours Used                  9918
  Firmware Version            02.03
...
```

The following example shows output for an AC PDU.

```
PDU 0 status:
  State                       Online
  Hours Used                  1702
  Firmware Version (MCU1)     00.02
  Firmware Version (MCU2)     00.01
  Firmware Version (MCU3)     00.01
  Firmware Version (MCU4)     00.01
PDU 0 PSM 0 status:
  State                       Online
  Temperature                 OK   35 degrees C / 95 degrees F
  Fans                        OK
  AC Input                    OK
  DC Output                   OK
  Hours Used                  1071
  Firmware Version            00.00
PDU 0 PSM 1 status:
  State                       Online
  Temperature                 OK   35 degrees C / 95 degrees F
```

```
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                1070
  Firmware Version          00.00
PDU 0 PSM 2 status:
  State                     Online
  Temperature               OK   34 degrees C / 93 degrees F
  Fans                      OK
  AC Input                  OK
  DC Output                 OK
  Hours Used                1065
  Firmware Version          00.00
```

8. Check the input voltage to the PDUs by issuing the `show chassis power` command.

   In the following example for a 120-A DC PDU, `Input 1` on `PSM 2` is not receiving input voltage.

```
user@host> show chassis power
Chassis Power        Input(V)      Used(W)

Total Power                         3533

  PDU 0                             3533
    PSM 0
      Input 1            54          859
    PSM 1
      Input 1            54          636
    PSM 2
      Input 1             0            0
    PSM 3
      Input 1            54         2038

  PDU 1                                0
    PSM 0
    PSM 1
    PSM 2
    PSM 3
```

In the following example for a delta AC PDU, the input voltage is within range for all PSM.

```
Chassis Power        Input(V)      Used(W)

Total Power                         5773

  PDU 0                             2919
    PSM 0
      Input 1          207           131
      Input 2          208           123
      Input 3          208           127
    PSM 1
      Input 1          207           164
      Input 2          207           162
      Input 3          207           193
    PSM 2
      Input 1          206           376
      Input 2          208           304
      Input 3          208           308
    PSM 3
      Input 1          208           379
      Input 2          208           371
      Input 3          208           281

  PDU 1                             2854
    PSM 0
      Input 1          207           123
      Input 2          207           112
      Input 3          208           123
    PSM 1
      Input 1          208           191
      Input 2          206           194
      Input 3          208            86
    PSM 2
      Input 1          207           387
      Input 2          206           306
      Input 3          208           353
    PSM 3
      Input 1          207           384
```

```
    Input 2           207         303
    Input 3           208         292
```

9. If you cannot determine the cause of the problem or need additional assistance, contact customer support.

Table 88: Troubleshooting Power Distribution Unit Alarms

Alarm Type	LCD Display Message	CLI Message	Alarm Condition	Solution
Red	`PDU` *`pdu-number`* `Not OK`	`PDU` *`pdu-number`* `Not OK`	An electronic fuse has tripped.	1. Remove and reinstall the component that caused the electronic fuse to trip. 2. Remove and reinstall the PDU to reset the electronic fuses.
	`PDU` *`pdu-number`* `Not Recognized`	`PDU` *`pdu-number`* `Not Recognized`	The PDU is not supported.	Install a supported PDU.
	`PDU` *`pdu-number`* `Absent`	`PDU` *`pdu-number`* `Absent`	The PDU is not installed.	Two PDU are required at all times. Install the PDU in the empty slot.
	`Mix of PDUs`	`Mix of PDUs`	Different types of PDUs are present in the chassis. **NOTE**: Both AC and DC PDUs might be present. Zoning and nonzoning PDUs might be present.	Install the same type of PDUs in each slot.
	`PDU %d Conv Failed`	`PDU %d Converter Failed`	One or more 36-V booster converter fails in a high-capacity PDU.	If two or more 36-V booster converter fails, fan trays fail and the router might get overheated. Therefore, when this alarm is raised, check the PDU and replace the PDU if required.

Table 89: Troubleshooting PDU LEDs

LED	State	Condition	Solution
–48 V 120 A on the 120-A DC PDU	Off	The input is not receiving voltage or is under –40 V.	• Verify that the customer-site circuit breakers are switched on. If the customer-site circuit breakers are off, switch them on. • Verify that the circuit breakers on the 120-A DC PDU are switched to the on position (|) . • Verify that the input power tray is receiving power within the supported voltage range. If the customer-site circuit breakers are switched on but the input power tray is not receiving power, switch off the customer-site circuit breakers, and reinstall the DC power source cables.
DC IN on the 60-A DC PDU	Off	The input voltage is not present or is under –40 V.	Verify that the customer-site circuit breakers are switched on and that the input power tray is receiving power within the supported voltage range. • If the customer-site circuit breakers are off, switch them on. • If the customer-site circuit breakers are switched on but the input power tray is not receiving power, switch off the customer-site circuit breakers, and reinstall the DC power source cables.
DC IN on the 60-A DC PDU	Off	The input voltage is not present or is under –40 V.	Verify that the customer-site circuit breakers are switched on and that the input power tray is receiving power within the supported voltage range. • If the customer-site circuit breakers are off, switch them on. • If the customer circuit breakers are switched on but the input power tray is not receiving power, switch off the customer-site circuit breakers, and reinstall the DC power source cables.

Table 89: Troubleshooting PDU LEDs *(Continued)*

LED	State	Condition	Solution
PSM_0 through **PSM_7** on the High Capacity DC PDU	Off	Input voltage is not present, or is under –20 V.	Verify that the customer-site circuit breakers are switched on and that the input terminals are receiving power within the supported voltage range. • If the customer-site circuit breakers are off, switch them on. • If the customer circuit breakers are switched on but the input terminals are not receiving power, switch off the customer-site circuit breakers, and reinstall the DC power source cables.
SW ON on the 60-A DC PDU	Off	The LED might be off for one of the following reasons: • The input power switches are off. • The host subsystem detected a problem and turned off the input power switches. • The input is not receiving any voltage.	1. Verify that the input power switches on the 60-A DC PDU are switched to the on position (|) . 2. If the input power switches on the 60-A DC PDU are switched to the on position (|), verify that the voltage is above –40 V.

Table 89: Troubleshooting PDU LEDs *(Continued)*

LED	State	Condition	Solution
CB ON on the 120-A DC PDU, delta AC PDU, or wye AC PDU	Off	The LED might be off for one of the following reasons: • The circuit breakers on the 120-A DC PDUare off. • The circuit breaker on a delta AC PDU or wye AC PDU is off. • The input is not receiving any voltage. • The host subsystem detected a problem and turned off one or more circuit breakers.	1. Verify that the circuit breaker on the PDU are switched to the **ON** position (|) . 2. Verify that the PDU is receiving input voltage within the supported range. • For the 120-A DC PDU, verify that the input voltage is above –40 V. • For the three-phase delta AC PDU or three-phase wye AC PDU, input voltage is not present, or is under –100 V.
PDU OK on the 60-a DC PDU, 120-a DC PDU, High Capacity DC PDU, delta AC PDU, and wye AC PDU	Red	The PDU has failed. An electronic fuse might have tripped or failed.	1. Verify that the fan trays in the power supply modules are operating and that no red alarm condition exits. 2. Check all air filters to be sure they are functioning and providing sufficient airflow through the chassis. 3. Issue the `show chassis environment pdu` command to determine the cause of the problem.

Table 89: Troubleshooting PDU LEDs *(Continued)*

LED	State	Condition	Solution
	Off	The LED might be off for one of the following reasons: • The PDU is starting. • The PDU is not receiving input voltage. • The circuit breakers on the 120-A DC PDU might be off. • The circuit breaker on the three-phase delta AC PDU or three-phase wye AC PDU might be off. • The input power switches on the 60-A DC PDU might be off.	1. Connect the PDU to a different power source with a new DC power cable or AC power cord. 2. If the **PDU OK** LED still does not light, the PDU might be the source of the problem. Replace the PDU with a spare. If the **PDU OK** LED on the installed spare is lit green, the PDU that was replaced might be faulty. To return it for replacement, see *Contact Customer Support to Obtain Return Material Authorization*.

Troubleshooting the PTX5000 Power Supply Modules

IN THIS SECTION

Problem

Description

The following alarms, LEDs, and other conditions indicate a problem with the power supply modules during normal operations:

- Table 90 on page 580 lists alarms.

Solution

1. Check the status of the PSMs by issuing the `show chassis environment pdu` command. The state of the PSM must be online for all installed PSMs.

```
user@host> show chassis environment pdu
user@host> show chassis environment pdu 0
PDU 0 status:
  State                       Online
  Hours Used                  2161
  Firmware Version (MCU1)     02.03
  Firmware Version (MCU2)     02.01
  Firmware Version (MCU3)     02.01
  Firmware Version (MCU4)     02.01
PDU 0 PSM 0 status:
  State                       Online
  Temperature                 OK   35 degrees C / 95 degrees F
  Fans                        OK
  DC Input                    OK
  DC Output                   OK
  Hours Used                  1379
  Firmware Version            02.03
PDU 0 PSM 1 status:
  State                       Online
  Temperature                 OK   37 degrees C / 98 degrees F
  Fans                        OK
  DC Input                    OK
  DC Output                   OK
  Hours Used                  1411
  Firmware Version            02.03
PDU 0 PSM 2 status:
  State                       Present
  Fans                        Fans 1 and 2 failed
  DC Input                    Check
  DC Output                   Failed
  Hours Used                  9918
  Firmware Version            02.03
PDU 0 PSM 3 status:
  State                       Online
  Temperature                 OK   36 degrees C / 96 degrees F
  Fans                        OK
  DC Input                    OK
```

```
DC Output                 OK
Hours Used                1323
Firmware Version          02.03
```

2. Issue the `show chassis alarms` command to check for alarms. See Table 90 on page 580.

3. Check the display on the craft interface to determine the source of a yellow or red alarm). Junos OS constantly updates the screen with status information for each component.

4. If you cannot determine the cause of the problem or need additional assistance, contact customer support.

Table 90: Troubleshooting PSM Chassis Alarms

Alarm Type	LCD Display Message	CLI Message	Alarm Condition	Solution
Red	`PSM` *`psm-number`* `Not OK`	`PSM` *`psm-number`* `Not OK`	The specified PSM has failed. The failure could be due to bad input, overtemperature, fan failure, and so on.	1. Use the `show chassis environment pdu` for more information about the failure. 2. Check that the input for the PSM on the PDU is correctly connected. 3. Reinstall the PSM to clear alarms. 4. If the input is correctly connected, replace the PSM.
	`PSM` *`psm-number`* `Not Recognized`	`PSM` *`psm-number`* `Not Recognized`	The PTX5000 does not support the PSM.	Replace the PSM with a supported PSM.
	`No Redundant Power for FPC 0-7`	`No Redundant Power for FPC 0-7`	One or more FPCs do not have redundant PSMs. If the PSM that provides power to the FPCs fails, the FPCs will lose service.	1. If any PSM is missing, install the missing PSM. 2. If a PSM fails, reinstall or replace the PSM.

Table 90: Troubleshooting PSM Chassis Alarms *(Continued)*

Alarm Type	LCD Display Message	CLI Message	Alarm Condition	Solution
	`No Power for FPC 0-7`	`No Power for FPC 0-7`	The FPCs will lose service. PSM2 and PSM3 in both PDU0 and PDU1 are `Absent` or `Not OK`.	1. Verify that the minimum number of PSMs are installed. See"Understanding Normal-Capacity Power System Power Zones" on page 172. For a PSM that is required but `Absent`, install the missing PSMs. 2. For a required PSM that is present but `Not OK` or failed, reinstall or replace the PSM.
	`No Redundant Power for Rear Chassis`	`No Rdnt Pwr Rear`	Redundant power is not available for the components in the rear of the chassis.	1. If any PSM is missing, install the missing PSM. 2. If a PSM fails, reinstall or replace the PSM.
	`No Redundant Power for Fan 0-2`	`No Redundant Power for Fan 0-2`	Redundant power is not available for the fan trays.	1. If PSM0 in either PDU is missing, install the missing PSM. 2. If a PSM fails, reinstall or replace the PSM.
	`No Power for Fan 0-2`	`No Power for Fan 0-2`	The router shuts down. PSM0 and PSM1 in both PDU0 and PDU1 are `Absent` or `Not OK`.	1. PSM0 is required in both PDUs. For an `Absent` PSM, install the missing PSM. 2. For a PSM that is present but `Not OK` or failed, reinstall or replace the PSM.

Table 90: Troubleshooting PSM Chassis Alarms *(Continued)*

Alarm Type	LCD Display Message	CLI Message	Alarm Condition	Solution
	`PSM` *`psm-number`* `Absent`	`PSM` *`psm-number`* `Absent`	The PSM is not installed. **NOTE**: This alarm is generated by the following Junos OS Releases: 12.1X48 12.3, and 13.2R1. Junos OS Release 13.2R2 and later does not generate this alarm.	If a required PSM is missing, install the PSM. If PSMs are not missing and you continue to get the alarm, you can install Junos OS Release 13.2R2 or later.
	`Pwr Mgmt Non Op`	`Power Manager Non Operational`	Different types of PSMs are present in the chassis. **NOTE**: Zoning and nonzoning PSMs might be present.	Install the same type of PSMs in each slot.

RELATED DOCUMENTATION

PTX5000 AC Power Distribution Unit LEDs | 54

PTX5000 DC Power Distribution Unit LEDs | 91

PTX5000 AC Power Supply Module LEDs | 62

PTX5000 DC Power Supply Module LEDs | 97

Troubleshooting the PTX5000 Host Subsystem

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with a host subsystem Control Board or Routing Engine:

- Table 91 on page 583 lists the alarms.
- Table 92 on page 584 lists the LEDs.

Solution

To troubleshoot the host subsystems:

1. Check the LEDs on the craft interface.

   If the red **HOST0 FAIL** or **HOST1 FAIL** LED is lit, look at the LCD on the craft interface to get more information about the cause of the problem.

2. Check the LEDs on the faceplate of each Control Board and Routing Engine. See "Troubleshooting the PTX5000 Control Boards" on page 588 and "Troubleshooting the PTX5000 Routing Engines" on page 584.

3. Use the CLI to check for alarms. Issue the `show chassis alarms` command to view the alarms.

In Table 91 on page 583, the text in the column labeled "LCD Message" appears in the display of the craft interface. The text in the column labeled "CLI Message" appears in the output from the `show chassis alarms` command.

Table 91: Troubleshooting Host Subsystem Alarm Messages

Alarm Type	LCD Message	CLI Message	Condition	Recovery
Red	`Host` *`host-number`* `Removed`	`Host` *`host-number`* `Removed`	The Routing Engine or Control Board has been removed.	Reinstall the Routing Engine and Control Board.
Yellow	`Host` *`host-number`* `Failure`	`Host` *`host-number`* `Failure`	The Routing Engine or Control Board has been failed.	Replace the Routing Engine or Control Board.

Table 92: Troubleshooting Host Subsystem LEDs

Label	Color	State	Description	Recovery
OK	–	Off	Host subsystem is offline or absent.	If the host subsystem is absent, reinstall the Routing Engine or Control Board. Bring the host subsystem online.
FAIL	Red	On steadily	Host subsystem has failed.	Replace the Routing Engine or Control Board.

SEE ALSO

PTX5000 Control Board LEDs | 126

PTX5000 Routing Engine LEDs | 114

Troubleshooting the PTX5000 Routing Engines

IN THIS SECTION

Problem

Description

The following indicate a problem with the Routing Engine:

- Table 93 on page 587 lists the LEDs.
- An alarm indicates that a host subsystem has been removed or failed.
- The **ONLINE** LED on the Routing Engine faceplate is lit steadily red.

Solution

1. Issue the `show chassis alarms` command to check for alarms.
2. Check the display on the craft interface to determine the source of a yellow or red alarm). Junos OS constantly updates the screen with status information for each component.
3. Check the **ONLINE** LED on the Routing Engine faceplate. If the **ONLINE** LED is red, issue the `chassis routing-engine` command to check the status of the Routing Engine.

```
user@host> show chassis routing-engine
user@host> show chassis routing-engine
Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature                 60 degrees C / 140 degrees F
    CPU temperature             73 degrees C / 163 degrees F
    DRAM                      17152 MB
    Memory utilization          11 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     4 percent
      Interrupt                  1 percent
      Idle                      94 percent
    Model                          RE-DUO-2600
    Serial ID                      P737A-002231
    Start time                     2011-12-07 09:54:43 PST
    Uptime                         3 hours, 9 minutes, 55 seconds
    Last reboot reason             Router rebooted after a normal shutdown.
    Load averages:                 1 minute   5 minute  15 minute
                                       0.04       0.04       0.01
Routing Engine status:
  Slot 1:
    Current state                  Backup
    Election priority              Backup (default)
    Temperature                 50 degrees C / 122 degrees F
    CPU temperature             62 degrees C / 143 degrees F
    DRAM                      17152 MB
    Memory utilization          11 percent
    CPU utilization:
      User                       0 percent
```

```
      Background                 0 percent
      Kernel                     0 percent
      Interrupt                  0 percent
      Idle                      99 percent
    Model                          RE-DUO-2600
    Serial ID                      P737A-002438
    Start time                     2011-12-07 09:53:16 PST
    Uptime                         3 hours, 11 minutes, 23 seconds
    Last reboot reason             Router rebooted after a normal shutdown.


Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature                 29 degrees C / 84 degrees F
    CPU temperature             48 degrees C / 118 degrees F
    DRAM                      49118 MB (49152 MB installed)
    Memory utilization           5 percent
    5 sec CPU utilization:
      User                       5 percent
      Background                 0 percent
      Kernel                    15 percent
      Interrupt                  1 percent
      Idle                      79 percent
    1 min CPU utilization:
      User                       5 percent
      Background                 0 percent
      Kernel                    15 percent
      Interrupt                  1 percent
      Idle                      79 percent
    5 min CPU utilization:
      User                       5 percent
      Background                 0 percent
      Kernel                    15 percent
      Interrupt                  1 percent
      Idle                      79 percent
    15 min CPU utilization:
      User                       5 percent
      Background                 0 percent
      Kernel                    15 percent
      Interrupt                  1 percent
      Idle                      79 percent
```

```
    Model                          RE-PTX-2X00x8
    Serial ID                      ACLZ6566
    Start time                     2015-10-04 18:39:45 PDT
    Uptime                         6 hours, 25 minutes, 15 seconds
    Last reboot reason             0x1:power cycle/failure
    Load averages:                 1 minute   5 minute  15 minute
                                       1.24       1.30       1.31
Routing Engine status:
  Slot 1:
    Current state                  Backup
    Election priority              Backup (default)
    Temperature                 30 degrees C / 86 degrees F
    CPU temperature             45 degrees C / 113 degrees F
    DRAM                      49118 MB (49152 MB installed)
    Memory utilization           6 percent
    5 sec CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     0 percent
      Interrupt                  0 percent
      Idle                     100 percent
    Model                          RE-PTX-2X00x8
    Serial ID                      ACLZ6560
    Start time                     2015-10-04 18:39:45 PDT
    Uptime                         6 hours, 25 minutes, 14 seconds
    Last reboot reason             0x1:power cycle/failure
    Load averages:                 1 minute   5 minute  15 minute
                                       0.21       0.18       0.16
```

4. Use the `show chassis alarms command` to display Routing Engine alarms.

Table 93: Troubleshooting Routing Engine LEDs

Label	Color	State	Description	Recovery
Online	Red	On steadily	Routing Engine is not functioning normally.	Replace the Routing Engine.
	–	Off	Routing Engine is not online or not functioning normally.	Bring the Routing Engine online.

SEE ALSO

PTX5000 Routing Engine LEDs | 114

Troubleshooting the PTX5000 Control Boards

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with a Control Board:

- Table 94 on page 589 lists the alarms.
- Table 95 on page 589 lists the Control Board LEDs.

Solution

To troubleshoot the Control Boards:

1. Check the LEDs on the faceplate of each Control Board and the craft interface.
2. Use the CLI to check for alarms. Issue the `show chassis alarms` command to view the alarms.

In Table 94 on page 589, the text in the LCD Message column appears in the display of the craft interface. The text in the CLI Message column appears in the output from the `show chassis alarms` command.

Table 94: Troubleshooting Control Board Alarms

Alarm Type	LCD Message	CLI Message	Alarm Condition	Recovery
Red	`CB` *`cb-number`* `Failure`	`CB` *`cb-number`* `Failure`	A Control Board failed.	Replace the Control Board
	`CB` *`cb-number`* `Removed`	`CB` *`cb-number`* `Removed`	A Control Board has been removed.	Reinstall the Control Board
Yellow	`CB` *`cb-number`* `Ethernet Switch Failure`	`CB` *`cb-number`* `Ethernet Switch Failure`	The Ethernet switch on the Control Board has failed.	Replace the Control Board.

Table 95: Troubleshooting Control Board LEDs

Label	Color	State	Description	Recovery
FAIL	Yellow	On steadily	Control Board has failed.	Replace the Control Board.
OK	–	Off	Control Board is offline.	Bring the Control Board online.

SEE ALSO

PTX5000 Control Board LEDs | 126

Troubleshooting the PTX5000 Switch Fabric

IN THIS SECTION

Problem

Description

The switch fabric in the PTX5000 includes the SIBs and the FPCs. A link that is in a down or error state indicates a problem with the switch fabric.

Solution

To troubleshoot the switch fabric:

1. Verify that all nine SIBs and all installed FPCs are online. Use the `show chassis fabric summary` command to check for errors.

```
user@host> show chassis fabric summary
FRU          State          Errors

SIB0         Online         None
SIB1         Online         None
SIB2         Online         None
SIB3         Online         None
SIB4         Online         None
SIB5         Online         None
SIB6         Online         None
SIB7         Online         None
SIB8         Online         None

FPC0         Empty
FPC1         Empty
FPC2         Online         None
FPC3         Empty
FPC4         Empty
FPC5         Online         None
FPC6         Empty
FPC7         Online         None
```

   If a SIB or FPC is `Offline`, see "Troubleshooting the PTX5000 FPCs" on page 597 and "Troubleshooting the PTX5000 Switch Interface Boards" on page 593 to correct the problem before proceeding.

2. Use the `show chassis fabric topology` command to query the state of the links between the SIBs and FPCs.

- For an FPC and a SIB that are online, the `Down` state indicates that the link between an FPC and a SIB is powered down. The `Down` state for the links can also indicate that an FPC or a SIB is offline.

- The `Error` state indicates that the link between an FPC and a SIB is not operational. The partner link may be in the `Down` or `OK` state. If the state of the link is `Error`, replace the FPC and SIB with a spare to determine if the fault follows the FPC or SIB. After removing an FPC or a SIB, inspect the FPC or SIB connectors for bent pins. If the FPC or SIB is faulty, return it. Before installing a spare FPC or SIB, use a flashlight to inspect the midplane for bent pins. If any pins on the midplane appear to be bent, contact JTAC immediately.

```
user@host> show chassis fabric topology
 In-link  : FPC# FE# TQ# (TQ-TX sub-chnl #) -->
            SIB# TF#_FCORE# (TF-RX port#, TF-RX sub-chn#, TF-RX inst#)

 Out-link : SIB# TF#_FCORE# (TF-TX port#, TF-TX sub-chn#, TF-TX inst#) -->
            FPC# FE# TQ# (TQ-RX sub-chnl #)
SIB 6 FCHIP 0 FCORE 1 :
-
          In-links               State             Out-links              State
-
FPC00FE0TQ0(13)-->S06F0_1(3,4,11) Down    S06F0_1(7,6,07)-->FPC00FE0TQ0(13) Down
FPC00FE1TQ1(13)-->S06F0_1(3,5,11) Down    S06F0_1(7,4,07)-->FPC00FE1TQ1(13) Down
FPC00FE2TQ2(13)-->S06F0_1(3,6,11) Down    S06F0_1(7,7,07)-->FPC00FE2TQ2(13) Down
FPC00FE3TQ3(13)-->S06F0_1(3,7,11) Down    S06F0_1(7,5,07)-->FPC00FE3TQ3(13) Down
FPC01FE0TQ0(13)-->S06F0_1(3,0,11) Down    S06F0_1(7,2,07)-->FPC01FE0TQ0(13) Down
FPC01FE1TQ1(13)-->S06F0_1(3,1,11) Down    S06F0_1(7,0,07)-->FPC01FE1TQ1(13) Down
FPC01FE2TQ2(13)-->S06F0_1(3,2,11) Down    S06F0_1(7,3,07)-->FPC01FE2TQ2(13) Down
FPC01FE3TQ3(13)-->S06F0_1(3,3,11) Down    S06F0_1(7,1,07)-->FPC01FE3TQ3(13) Down
FPC02FE0TQ0(13)-->S06F0_1(2,4,10) OK      S06F0_1(6,5,06)-->FPC02FE0TQ0(13) OK
FPC02FE1TQ1(13)-->S06F0_1(2,5,10) OK      S06F0_1(6,4,06)-->FPC02FE1TQ1(13) OK
FPC02FE2TQ2(13)-->S06F0_1(2,6,10) OK      S06F0_1(6,7,06)-->FPC02FE2TQ2(13) OK
FPC02FE3TQ3(13)-->S06F0_1(2,7,10) OK      S06F0_1(6,6,06)-->FPC02FE3TQ3(13) OK
FPC03FE0TQ0(13)-->S06F0_1(2,0,10) Down    S06F0_1(6,1,06)-->FPC03FE0TQ0(13) Down
FPC03FE1TQ1(13)-->S06F0_1(2,1,10) Down    S06F0_1(6,0,06)-->FPC03FE1TQ1(13) Down
FPC03FE2TQ2(13)-->S06F0_1(2,2,10) Down    S06F0_1(6,3,06)-->FPC03FE2TQ2(13) Down
FPC03FE3TQ3(13)-->S06F0_1(2,3,10) Down    S06F0_1(6,2,06)-->FPC03FE3TQ3(13) Down
FPC04FE0TQ0(13)-->S06F0_1(1,4,09) Down    S06F0_1(5,5,05)-->FPC04FE0TQ0(13) Down
FPC04FE1TQ1(13)-->S06F0_1(1,5,09) Down    S06F0_1(5,4,05)-->FPC04FE1TQ1(13) Down
FPC04FE2TQ2(13)-->S06F0_1(1,6,09) Down    S06F0_1(5,7,05)-->FPC04FE2TQ2(13) Down
FPC04FE3TQ3(13)-->S06F0_1(1,7,09) Down    S06F0_1(5,6,05)-->FPC04FE3TQ3(13) Down
FPC05FE0TQ0(13)-->S06F0_1(1,0,09) OK      S06F0_1(5,1,05)-->FPC05FE0TQ0(13) OK
FPC05FE1TQ1(13)-->S06F0_1(1,1,09) OK      S06F0_1(5,0,05)-->FPC05FE1TQ1(13) OK
```

```
FPC05FE2TQ2(13)-->S06F0_1(1,2,09) OK      S06F0_1(5,3,05)-->FPC05FE2TQ2(13) OK
FPC05FE3TQ3(13)-->S06F0_1(1,3,09) OK      S06F0_1(5,2,05)-->FPC05FE3TQ3(13) OK
FPC06FE0TQ0(13)-->S06F0_1(0,4,08) Down    S06F0_1(4,7,04)-->FPC06FE0TQ0(13) Down
FPC06FE1TQ1(13)-->S06F0_1(0,5,08) Down    S06F0_1(4,0,04)-->FPC06FE1TQ1(13) Down
FPC06FE2TQ2(13)-->S06F0_1(0,6,08) Down    S06F0_1(4,6,04)-->FPC06FE2TQ2(13) Down
FPC06FE3TQ3(13)-->S06F0_1(0,7,08) Down    S06F0_1(4,1,04)-->FPC06FE3TQ3(13) Down
FPC07FE0TQ0(13)-->S06F0_1(0,0,08) OK      S06F0_1(4,3,04)-->FPC07FE0TQ0(13) OK
FPC07FE1TQ1(13)-->S06F0_1(0,1,08) OK      S06F0_1(4,4,04)-->FPC07FE1TQ1(13) OK
FPC07FE2TQ2(13)-->S06F0_1(0,2,08) OK      S06F0_1(4,2,04)-->FPC07FE2TQ2(13) OK
FPC07FE3TQ3(13)-->S06F0_1(0,3,08) OK      S06F0_1(4,5,04)-->FPC07FE3TQ3(13) OK
```

3. Display the system log messages to obtain information about link failures. The **/var/log/messages** file is a commonly configured destination for system log messages. To display it, issue the `show log messages` command. For example:

```
user@host> show log messages
```

For more information about system log messages, see the System Log Explorer.

Your customer support representative can assist you with using the information in the system log to determine if you have a faulty SIB or FPC.

4. Use the `show chassis fabric fpcs` command to check that the fabric planes are enabled.

```
FPC #2
    PFE #0
        SIB0_Fcore0 (plane  0)   Plane Enabled, Links OK
        SIB0_Fcore1 (plane  1)   Plane Enabled, Links OK
        SIB1_Fcore0 (plane  2)   Plane Enabled, Links OK
        SIB1_Fcore1 (plane  3)   Plane Enabled, Links OK
        SIB2_Fcore0 (plane  4)   Plane Enabled, Links OK
        SIB2_Fcore1 (plane  5)   Plane Enabled, Links OK
        SIB3_Fcore0 (plane  6)   Plane Enabled, Links OK
        SIB3_Fcore1 (plane  7)   Plane Enabled, Links OK
        SIB4_Fcore0 (plane  8)   Plane Enabled, Links OK
        SIB4_Fcore1 (plane  9)   Plane Enabled, Links OK
        SIB5_Fcore0 (plane 10)   Plane Enabled, Links OK
        SIB5_Fcore1 (plane 11)   Plane Enabled, Links OK
        SIB6_Fcore0 (plane 12)   Plane Enabled, Links OK
        SIB6_Fcore1 (plane 13)   Plane Enabled, Links OK
        SIB7_Fcore0 (plane 14)   Plane Enabled, Links OK
        SIB7_Fcore1 (plane 15)   Plane Enabled, Links OK
```

```
        SIB8_Fcore0 (plane 16)   Plane Enabled, Links OK
        SIB8_Fcore1 (plane 17)   Plane Enabled, Links OK
```

5. Use the `show chassis fabric plane-location` command to display which SIBs correspond to the planes.

```
user@host>show chassis fabric plane-location

Fabric Plane Locations-
SIB            Planes
 0              0    1
 1              2    3
 2              4    5
 3              6    7
 4              8    9
 5             10   11
 6             12   13
 7             14   15
 8             16   17
```

6. Use the `show chassis fabric match error` command.

Troubleshooting the PTX5000 Switch Interface Boards

IN THIS SECTION

Problem

Description

The following alarms and LEDs indicate a problem with a SIB:

- Table 96 on page 596 lists alarms.

- Table 97 on page 597 lists the LEDs.

Solution

To troubleshoot the SIBs:

1. Check the SIB LEDs on the SIB faceplate and on the craft interface.

2. Use the CLI to check for alarms. Issue the `show chassis alarms` command to view the alarms.

```
show chassis alarms
1 alarms currently active
Alarm time               Class  Description
2012-11-02 15:17:41 PDT  Major  SIB 3 Absent
```

3. Check the status of the sibs. Issue the `show chassis sib` command.

```
show chassis sib
Slot  State         Fabric links        Errors
 0    Online             Active         None
 1    Online             Active         None
 2    Online             Active         None
 3    Empty              Unused         None
 4    Online             Active         None
 5    Online             Active         None
 6    Online             Active         None
 7    Online             Active         None
 8    Online             Active         None
```

```
user@host> show chassis environment sib
user@host> show chassis environment sib
SIB 0 status:
  State                       Online
  Intake Temperature          37 degrees C / 98 degrees F
  Exhaust Temperature         36 degrees C / 96 degrees F
  Junction Temperature        41 degrees C / 105 degrees F
  Power
    1.0 V                      1000 mV
    1.5 V                      1500 mV
    1.2 V                      1199 mV
```

```
    3.3 V                      3300 mV
    0.9 V                       900 mV
    2.5 V                      2500 mV
    3.3 V bias                 3299 mV
SIB 1 status:
  State                      Online
  Intake Temperature         37 degrees C / 98 degrees F
  Exhaust Temperature        35 degrees C / 95 degrees F
  Junction Temperature       43 degrees C / 109 degrees F
  Power
    1.0 V                      1000 mV
    1.5 V                      1500 mV
    1.2 V                      1199 mV
    3.3 V                      3300 mV
    0.9 V                       900 mV
    2.5 V                      2500 mV
    3.3 V bias                 3322 mV
SIB 2 status:
  State                      Online
  Intake Temperature         36 degrees C / 96 degrees F
  Exhaust Temperature        35 degrees C / 95 degrees F
  Junction Temperature       41 degrees C / 105 degrees F
  Power
    1.0 V                       999 mV
    1.5 V                      1500 mV
    1.2 V                      1200 mV
    3.3 V                      3299 mV
    0.9 V                       900 mV
    2.5 V                      2500 mV
    3.3 V bias                 3339 mV
...
```

In Table 96 on page 596, the text in the column labeled ”LCD Message” appears in the display of the craft interface. The text in the column labeled “CLI Message” appears in the output from the `show chassis alarms` command.

Table 96: Troubleshooting SIB Alarms

Alarm Type	LCD Message	CLI Message	Alarm Condition	Recovery
Red	`SIB` *`sib-number`* `Failure`	`SIB` *`sib-number`* `Fault`	A SIB has failed. This might affect traffic-forwarding capacity.	Replace the failed SIB. Restart the SIB. If this does not fix the issue, contact JTAC.
Yellow	`SIB` *`sib-number`* `FPC Links`	`SIB` *`sib-number`* `FPC Link Error`	The SIB has detected link errors between the SIB and FPCs. This error may affect FPC traffic forwarding.	To isolate the problem: **1.** Restart the SIB and then the FPC. This may affect the traffic. **2.** If the problem persists, replace the SIB. **3.** If the problem still persists, replace the particular FPC that was associated with the link error. **4.** If you are unable to isolate the problem, contact JTAC. JTAC has to analyze the logs to determine further action.
	SIB *sib-number* Cell drops	SIB *sib-number* Cell Drop error	The SIB has detected fabric cell drops. This might affect traffic-forwarding capacity	Restart the SIB. If this does not fix the issue, contact JTAC.
	`SIB` *`sib-number`* `Not Online`	`SIB` *`sib-number`* `Not Online`	The SIB is not in an active state. This might affect the traffic-forwarding capacity.	Bring the SIB online. Issue the `request chassis sib online slot` *`slot-number`* command. If this does not fix the issue, contact JTAC.
	`SIB` *`sib-number`* `Absent`	`SIB` *`sib-number`* `Absent`	A SIB has been removed.	Reinstall the SIB in the chassis.

Table 97: Troubleshooting SIB LEDs

Label	Color	State	Description
OK	–	Off	SIB is offline or not seated properly.
FAIL	Yellow	On steadily	SIB has failed.

SEE ALSO

PTX5000 Switch Interface Board LEDs | 133

Troubleshooting the PTX5000 FPCs

IN THIS SECTION

Problem

Description

Alarms listed in Table 98 on page 600 and Table 99 on page 601 indicate a problem with an FPC.

Solution

To troubleshoot an FPC:

1. Look at the display on the craft interface to check the status of the FPC and the PICs that are plugged into it.

2. Issue the `show chassis alarms` command.

```
user@host> show chassis alarms
2 alarms currently active
Alarm time               Class  Description
2012-11-02 17:46:53 PDT  Major  FPC 3 PIC 1 Failure
```

3. Verify that the FPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight. Use a screwdriver to check that the screws inside the ejector handles are tight.

4. Check the status of an FPC using the following CLI command:

```
user@host> show chassis fpc

                     Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State            (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online            50      5          0       2816        7         28
  1  Empty
  2  Online            51      5          0       2816        9         27
  3  Online            53      5          0       2816        7         27
  4  Offline         ---Configured power off---
  5  Online            50      9          0       2816        9         27
  6  Online            50      5          0       2816        7         28
  7  Offline         ---No power---
```

5. To determine the cause of link errors between the FPCs and SIBs, use the `show chassis fabric summary` command to check the status of the FPCs and SIBs.

```
user@host> show chassis fabric summary

FRU          State          Errors

SIB0         Online         None
SIB1         Online         None
SIB2         Online         None
SIB3         Empty
SIB4         Online         None
SIB5         Online         None
```

```
SIB6        Online        None
SIB7        Online        None
SIB8        Online        None

FPC0        Online        None
FPC1        Online        None
FPC2        Online        None
FPC3        Online        None
FPC4        Offline
FPC5        Online        None
FPC6        Online        None
FPC7        Offline
```

6. Use the following `show chassis fpc detail` command to display more detailed information. The following examples specify a slot number, which is optional:

```
user@host> show chassis fpc detail 7
Slot 7 information:
  State                             Offline
  Reason                            No power
```

```
user@host> show chassis fpc detail 4
Slot 4 information:
  State                             Offline
  Reason                            Configured power off
```

The output states indicate the following:

- `Diagnostics`—The FPC failed to initialize.
- `No power`—The FPC is not receiving enough power. Check the chassisd messages for power allocation information.

```
Chassis Power        Input(V)      Used(W)

Total Power                         3043

  PDU 0                             3043
```

```
PSM 0
  Input 1          54         348
PSM 1
  Input 1          54         630
PSM 2
  Input 1           0           0
PSM 3
  Input 1          54        2065
```

- `Offlined due to config`—Check if the FPC is configuration to be off. See *Configuring a FPC to Stay Offlinepower*.
- `Unresponsive`—There might be a hardware failure on the FPC. Reseat the FPC and reboot.

In Table 98 on page 600, the text in the LCD Message column appears in the display of the craft interface. The text in the CLI Message column appears in the output of the `show chassis alarms` command.

Table 98: Troubleshooting FPC Alarms

Alarm Type	LCD Message	CLI Message	Alarm Condition	Recovery
Red	`FPC` *`fpc-number`* `unreachable PFEs detected`	`FPC` *`fpc-number`* `unreachable PFEs detected`	FPC is not able to forward traffic because of a fabric failure.	Contact JTAC. JTAC needs to analyze the logs to see the reason for the fabric failure.
	`FPC` *`fpc-number`* `unreachable PFEs offlined`	`FPC` *`fpc-number`* `unreachable PFEs offlined`	FPC is not able to forward traffic due to a fabric failure.	Contact JTAC. JTAC needs to analyze the logs to see the reason for the fabric failure.
Yellow	`Power Budget: Minor alarm`	`Power Budget: No redundant power`	Redundant power is not available for one or more FPCs. If the nonredundant PSM providing power to an FPC fails, the FPC will lose service.	• If any PSM is missing, add the PSM. • If any PSM fails, replace the PSM.

Table 98: Troubleshooting FPC Alarms *(Continued)*

Alarm Type	LCD Message	CLI Message	Alarm Condition	Recovery
	`FPC` *`fpc-number`* `SIB Link Error`	`FPC` *`fpc-number`* `detects link error`	An FPC detected link errors on the high speeds links between an FPC and SIB. This alarm might be caused by an error either on an FPC or on a SIB. The Packet Forwarding Engine's forwarding capacity might be affected.	1. Restart the SIB, and then the FPC. This might affect the traffic. 2. If the problem persists, replace the FPC. 3. If the problem still persists, replace the particular SIB that was associated with the link error. 4. If you are unable to isolate the problem, contact JTAC. JTAC needs to analyze the logs to determine further action.

Table 99: Troubleshooting FPC LEDs

Label	Color	State	Description	Recovery
OK	-	Off	FPC is offline or not seated properly.	Reinstall the FPC and verify the FPC.
FAULT	Red	On steadily	FPC has failed.	Replace the FPC.

SEE ALSO

PTX5000 FPC LEDs | **138**

Troubleshooting the PTX5000 PICs and PIC Transceivers

IN THIS SECTION

Troubleshooting PTX5000 PICs

IN THIS SECTION

Problem

Description

A PIC LED lit red indicates a problem with the PIC.

Solution

To troubleshoot a PIC:

1. Check the **STATUS** LED of the PIC. Look at the LEDs located on the PIC faceplate. For information about the meaning of LED states on different PICs, see the PTX Series Interface Module Reference.

2. Issue the `show chassis alarms` command to check for alarms. For information about the alarms on different PICs, see the PTX Series Interface Module Reference

```
user@host> show chassis alarms
1 alarm currently active
Alarm time               Class  Description
2012-11-02 17:46:53 PDT  Major  FPC 3 PIC 1 Failure
```

3. Check the status of the PICs. issue the `show chassis fpc pic-status` command. The PIC slots in each FPC are numbered from **0** through **1**, top to bottom:

```
user@host> show chassis fpc pic-status

Slot 0   Online       FPC E
  PIC 0  Online       24x 10GE(LAN) SFP+
  PIC 1  Online       24x 10GE(LAN) SFP+
Slot 2   Online       FPC E
  PIC 0  Online       24x 10GE(LWO) SFP+
  PIC 1  Online       4x100GE CFP2
Slot 3   Online       FPC E
  PIC 0  Online       4x100GE CFP2
  PIC 1  Online       4x100GE CFP2
Slot 4   Online       FPC
  PIC 0  Online       2x 100GE CFP
  PIC 1  Online       2x 100GE CFP
Slot 7   Online       FPC E
  PIC 0  Online       48x10G/12x40G(LWO)QSFP+
  PIC 1  Offline      4x100GE OTN CFP2
```

4. Issue the `show chassis pic fpc-slot` *`fpc-slot`* `pic-slot` *`pic-slot`* command for more information about a specific PIC.

```
user@host>show chassis pic fpc-slot 3 pic-slot 0

FPC slot 3, PIC slot 0 information:
  Type                       4x100GE CFP2
  State                      Online
  PIC version                1.1
  Uptime                     13 minutes, 35 seconds
```

```
user@host>show chassis pic fpc-slot 2 pic-slot 1
FPC slot 2, PIC slot 0 information:
  Type                           24x 10GE(LAN) SFP+
  State                          Online
  PIC version               1.14
  Uptime                       3 hours, 6 minutes, 30 seconds
```

```
PIC port information:
                           Fiber                        Xcvr vendor
  Port  Cable type         type  Xcvr vendor            part number       Wavelength
  0     10GBASE SR         MM    SumitomoElectric       SPP5200SR-J6-M    850 nm
  1     10GBASE LR         SM    FINISAR CORP.          FTLX1471D3BNL-J1  1310 nm
  3     10GBASE LR         SM    FINISAR CORP.          FTLX1471D3BNL-J1  1310 nm
  6     10GBASE SR         MM    OPNEXT, INC.           TRS2001EM-0014    850 nm
  7     10GBASE SR         MM    OPNEXT, INC.           TRS2001EM-0014    850 nm
  10    10GBASE SR         MM    SumitomoElectric       SPP5200SR-J6-M    850 nm
  11    10GBASE SR         MM    FINISAR CORP.          FTLX8571D3BNL-J1  850 nm
  12    10GBASE SR         MM    SumitomoElectric       SPP5200SR-J6-M    850 nm
  14    10GBASE SR         MM    SumitomoElectric       SPP5200SR-J6-M    850 nm
  15    10GBASE SR         MM    FINISAR CORP.          FTLX8571D3BNL-J1  850 nm
  16    10GBASE SR         MM    FINISAR CORP.          FTLX8571D3BNL-J1  850 nm
  19    10GBASE LR         SM    OPNEXT,INC             TRS5020EN-S201    1310 nm
  21    10GBASE SR         MM    FINISAR CORP.          FTLX8571D3BNL-J1  850 nm
  22    10GBASE LR         SM    FINISAR CORP.          FTLX1471D3BNL-J1  1310 nm
  23    10GBASE SR         MM    FINISAR CORP.          FTLX8571D3BNL-J1  850 nm
user@host>show chassis pic fpc-slot 3 pic-slot 0

FPC slot 3, PIC slot 0 information:
  Type                              4x100GE CFP2
  State                             Online
  PIC version                               1.1
  Uptime                          13 minutes, 35 seconds

PIC port information:
                          Fiber                        Xcvr vendor       Wave-    Xcvr
  Port Cable type         type  Xcvr vendor            part number       length   Firmware
  0    100GBASE LR4       SM    Oclaro Inc.            TRB5E20ENF-LF150  1309 nm  0.0
  1    100GBASE LR4       SM    Oclaro Inc.            TRB5E20ENF-LF150  1309 nm  0.0
  2    100GBASE LR4       SM    Oclaro Inc.            TRB5E20ENF-LF150  1309 nm  0.0
  3    100GBASE LR4       SM    Oclaro Inc.            TRB5E20ENF-LF150  1309 nm  0.0
```

To troubleshoot the PIC cables:

1. Check if the optical cables are plugged into the optics properly and ensure that they are intact.

Troubleshooting PTX5000 PIC Transceivers

IN THIS SECTION

Problem

Description

A problem has occurred with a PIC transceiver.

Solution

To troubleshoot a PIC transceiver:

1. Check the status of the optical transceivers. Issue the `show interfaces diagnostics optics` command. Alarms and warnings should be `Off`.

```
user@host> show interfaces diagnostics optics

Physical interface: et-0/0/0
    Module temperature                        :  39 degrees C / 102 degrees F
    Module voltage                            :  1.1470 V
    Module temperature high alarm             :  Off
    Module temperature low alarm              :  Off
    Module temperature high warning           :  Off
    Module temperature low warning            :  Off
    Module voltage high alarm                 :  Off
    Module voltage low alarm                  :  Off
    Module voltage high warning               :  Off
    Module voltage low warning                :  Off
    Module not ready alarm                    :  Off
    Module low power alarm                    :  Off
    Module initialization incomplete alarm    :  Off
    Module fault alarm                        :  Off
    PLD Flash initialization fault alarm      :  Off
    Power supply fault alarm                  :  Off
```

```
    Checksum fault alarm                      :  Off
    Tx laser disabled alarm                   :  Off
    Tx loss of signal functionality alarm     :  Off
    Tx CDR loss of lock alarm                 :  Off
    Rx loss of signal alarm                   :  Off
    Rx CDR loss of lock alarm                 :  Off
    Module temperature high alarm threshold   :  80 degrees C / 176 degrees F
    Module temperature low alarm threshold    :  -5 degrees C / 23 degrees F
    Module temperature high warning threshold :  75 degrees C / 167 degrees F
    Module temperature low warning threshold  :  0 degrees C / 32 degrees F
    Module voltage high alarm threshold       :  6.3000 V
    Module voltage low alarm threshold        :  5.5000 V
    Module voltage high warning threshold     :  6.1500 V
    Module voltage low warning threshold      :  5.8490 V
    Laser bias current high alarm threshold   :  100.000 mA
    Laser bias current low alarm threshold    :  4.000 mA
    Laser bias current high warning threshold :  96.000 mA
    Laser bias current low warning threshold  :  12.000 mA
    Laser output power high alarm threshold   :  0.2000 mW / -6.99 dBm
    Laser output power low alarm threshold    :  0.0000 mW / - Inf dBm
    Laser output power high warning threshold :  0.1700 mW / -7.70 dBm
    Laser output power low warning threshold  :  0.0290 mW / -15.38 dBm
    Laser rx power high alarm threshold       :  1.5849 mW / 2.00 dBm
    Laser rx power low alarm threshold        :  0.0158 mW / -18.01 dBm
    Laser rx power high warning threshold     :  1.0000 mW / 0.00 dBm
    Laser rx power low warning threshold      :  0.0251 mW / -16.00 dBm
    Laser temperature high alarm threshold    :  80 degrees C / 176 degrees F
    Laser temperature low alarm threshold     :  -5 degrees C / 23 degrees F
    Laser temperature high warning threshold  :  70 degrees C / 158 degrees F
    Laser temperature low warning threshold   :  -1 degrees C / 30 degrees F
  Lane 0
    Laser bias current                        :  101.660 mA
    Laser output power                        :  0.126 mW / -9.00 dBm
    Laser temperature                         :  31 degrees C / 89 degrees F
    Laser receiver power                      :  0.055 mW / -12.60 dBm
    Laser bias current high alarm             :  Off
    Laser bias current low alarm              :  Off
    Laser bias current high warning           :  Off
    Laser bias current low warning            :  Off
    Laser output power high alarm             :  Off
    Laser output power low alarm              :  Off
    Laser output power high warning           :  Off
    Laser output power low warning            :  Off
```

```
    Laser temperature high alarm            :  Off
    Laser temperature low alarm             :  Off
    Laser temperature high warning          :  Off
    Laser temperature low warning           :  Off
    Laser receiver power high alarm         :  Off
    Laser receiver power low alarm          :  Off
    Laser receiver power high warning       :  Off
    Laser receiver power low warning        :  Off
    Tx loss of signal functionality alarm   :  Off
    Tx CDR loss of lock alarm               :  Off
    Rx loss of signal alarm                 :  Off
    Rx CDR loss of lock alarm               :  Off
    APD supply fault alarm                  :  Off
    TEC fault alarm                         :  Off
    Wavelength unlocked alarm               :  Off

Physical interface: et-6/0/0
    Module temperature                      :  41 degrees C / 105 degrees F
    Module voltage                          :  3.2560 V
    Module temperature high alarm           :  Off
    Module temperature low alarm            :  Off
    Module temperature high warning         :  Off
    Module temperature low warning          :  Off
    Module voltage high alarm               :  Off
    Module voltage low alarm                :  Off
    Module voltage high warning             :  Off
    Module voltage low warning              :  Off
    Module not ready alarm                  :  Off
    Module low power alarm                  :  Off
    Module initialization incomplete alarm  :  Off
    Module fault alarm                      :  Off
    PLD Flash initialization fault alarm    :  Off
    Power supply fault alarm                :  Off
    Checksum fault alarm                    :  Off
    Tx laser disabled alarm                 :  Off
    Tx loss of signal functionality alarm   :  Off
    Tx CDR loss of lock alarm               :  Off
    Rx loss of signal alarm                 :  Off
    Rx CDR loss of lock alarm               :  Off
    Module temperature high alarm threshold   :  70 degrees C / 158 degrees F
    Module temperature low alarm threshold    :  0 degrees C / 32 degrees F
    Module temperature high warning threshold :  68 degrees C / 154 degrees F
    Module temperature low warning threshold  :  2 degrees C / 36 degrees F
```

```
    Module voltage high alarm threshold       :  3.4640 V
    Module voltage low alarm threshold        :  3.1340 V
    Module voltage high warning threshold     :  3.4310 V
    Module voltage low warning threshold      :  3.1670 V
    Laser bias current high alarm threshold   :  175.000 mA
    Laser bias current low alarm threshold    :  75.000 mA
    Laser bias current high warning threshold :  162.500 mA
    Laser bias current low warning threshold  :  87.500 mA
    Laser output power high alarm threshold   :  2.8180 mW / 4.50 dBm
    Laser output power low alarm threshold    :  0.3710 mW / -4.31 dBm
    Laser output power high warning threshold :  2.5110 mW / 4.00 dBm
    Laser output power low warning threshold  :  0.4160 mW / -3.81 dBm
    Laser rx power high alarm threshold       :  2.8184 mW / 4.50 dBm
    Laser rx power low alarm threshold        :  0.0251 mW / -16.00 dBm
    Laser rx power high warning threshold     :  2.5119 mW / 4.00 dBm
    Laser rx power low warning threshold      :  0.0501 mW / -13.00 dBm
    Laser temperature high alarm threshold    :  57 degrees C / 135 degrees F
    Laser temperature low alarm threshold     :  25 degrees C / 77 degrees F
    Laser temperature high warning threshold  :  55 degrees C / 131 degrees F
    Laser temperature low warning threshold   :  27 degrees C / 81 degrees F
    SOA bias current high alarm threshold     :  0.000 mA
    SOA bias current low alarm threshold      :  0.000 mA
    SOA bias current high warning threshold   :  0.000 mA
    SOA bias current low warning threshold    :  0.000 mA
  Lane 0
    Laser bias current                        :  132.255 mA
    Laser output power                        :  1.002 mW / 0.01 dBm
    Laser temperature                         :  50 degrees C / 122 degrees F
    Laser receiver power                      :  1.140 mW / 0.57 dBm
    Laser bias current high alarm             :  Off
    Laser bias current low alarm              :  Off
    Laser bias current high warning           :  Off
    Laser bias current low warning            :  Off
    Laser output power high alarm             :  Off
    Laser output power low alarm              :  Off
    Laser output power high warning           :  Off
    Laser output power low warning            :  Off
    Laser temperature high alarm              :  Off
    Laser temperature low alarm               :  Off
    Laser temperature high warning            :  Off
    Laser temperature low warning             :  Off
    Laser receiver power high alarm           :  Off
    Laser receiver power low alarm            :  Off
```

```
    Laser receiver power high warning         :  Off
    Laser receiver power low warning          :  Off
    Tx loss of signal functionality alarm     :  Off
    Tx CDR loss of lock alarm                 :  Off
    Rx loss of signal alarm                   :  Off
    Rx CDR loss of lock alarm                 :  Off
    APD supply fault alarm                    :  Off
    TEC fault alarm                           :  Off
    Wavelength unlocked alarm                 :  Off
```

RELATED DOCUMENTATION

PTX5000 Craft Interface LEDs | 22

6

CHAPTER

Returning the Chassis or Components

Returning the PTX5000 Chassis or Components

IN THIS SECTION

Displaying PTX5000 Component Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the PTX5000 or component. To list all of the PTX5000 components and their serial numbers, enter the following command-line interface (CLI) command:

```
user@host> show chassis hardware
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                JN11D1FD7AJA      PTX5000
Midplane         REV 03   711-031896   ABAC5589          Midplane-8S
FPM              REV 08   760-030647   EG1679            Front Panel Display
PDU 0            Rev 05   740-032019   ZE00006           DC Power Dist Unit
  PSM 0          Rev 05   740-032022   ZJ00018           DC 12V Power Supply
  PSM 1          Rev 04   740-032022   ZC00052           DC 12V Power Supply
  PSM 2          Rev 04   740-032022   ZD00051           DC 12V Power Supply
  PSM 3          Rev 05   740-032022   ZJ00060           DC 12V Power Supply
CCG 0            REV 04   750-030653   EG3703            Clock Generator
Routing Engine 0 REV 05   740-026942   P737A-002231      RE-DUO-2600
Routing Engine 1 REV 06   740-026942   P737A-002438      RE-DUO-2600
CB 0             REV 08   750-030625   EG5519            Control Board
CB 1             REV 08   750-030625   EG5516            Control Board
FPC 0            REV 18   750-036844   EJ3080            FPC
```

```
  CPU            REV 12   711-030686   EJ3260           SNG PMB
FPC 2            REV 13   750-036844   EG5065           FPC
  CPU            REV 09   711-030686   EG4082           SNG PMB
  PIC 0          REV 14   750-031913   EG5127           24x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   143363A00240     SFP+-10G-SR
    Xcvr 1       REV 01   740-031981   UK90PZ1          SFP+-10G-LR
    Xcvr 3       REV 01   740-031981   UK90Q46          SFP+-10G-LR
    Xcvr 6       REV 01   740-031980   B11H02560        SFP+-10G-SR
    Xcvr 7       REV 01   740-031980   B11C01589        SFP+-10G-SR
    Xcvr 10      REV 01   740-031980   123363A01094     SFP+-10G-SR
    Xcvr 11      REV 01   740-031980   AK80LKF          SFP+-10G-SR
    Xcvr 12      REV 01   740-031980   183363A01528     SFP+-10G-SR
    Xcvr 14      REV 01   740-031980   193363A01079     SFP+-10G-SR
    Xcvr 15      REV 01   740-031980   AK80MC8          SFP+-10G-SR
    Xcvr 16      REV 01   740-031980   AJC0BHC          SFP+-10G-SR
    Xcvr 19      REV 01   740-021309   J08D26856        SFP+-10G-LR
    Xcvr 21      REV 01   740-031980   AK80KCT          SFP+-10G-SR
    Xcvr 22      REV 01   740-031981   UK90PZL          SFP+-10G-LR
    Xcvr 23      REV 01   740-031980   AK80N1V          SFP+-10G-SR
FPC 3            REV 13   750-036844   EG5074           FPC
  CPU            REV 09   711-030686   EG4064           SNG PMB
  PIC 1          REV 10   750-031903   EG0325           SNG Load
FPC 5            REV 06   750-036844   EH3198           FPC
  CPU
  PIC 0          REV 14   750-031913   EG5134           24x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   AK80LBH          SFP+-10G-SR
    Xcvr 1       REV 01   740-031980   B11B03724        SFP+-10G-SR
    Xcvr 5       REV 01   740-031980   B11J00818        SFP+-10G-SR
    Xcvr 7       REV 01   740-031980   B11B06125        SFP+-10G-SR
    Xcvr 10      REV 01   740-031980   B11H02529        SFP+-10G-SR
    Xcvr 11      REV 01   740-031980   AK80LFB          SFP+-10G-SR
    Xcvr 15      REV 01   740-031980   B11J00687        SFP+-10G-SR
    Xcvr 18      REV 01   740-031980   AK80MQX          SFP+-10G-SR
    Xcvr 19      REV 01   740-021309   J08C17257        SFP+-10G-LR
    Xcvr 22      REV 01   740-031980   B11J00730        SFP+-10G-SR
    Xcvr 23      REV 01   740-031980   AK80KEE          SFP+-10G-SR
  PIC 1          REV 08   750-036710   EG3105           2x 40GE CFP
    Xcvr 0       REV 01   740-034554   B260HLT          CFP-40G-LR4
    Xcvr 1       REV 01   740-034554   B11C02847        CFP-40G-LR4
FPC 6            REV 18   750-036844   EJ4391           FPC
  CPU            REV 12   711-030686   EJ3257           SNG PMB
FPC 7            REV 18   750-036844   EJ4382           FPC
  CPU            REV 12   711-030686   EJ3238           SNG PMB
```

```
SPMB 0          REV 10   711-030686   EG5418            SNG PMB
SPMB 1          REV 09   711-030686   EG5373            SNG PMB
SIB 0           REV 07   750-030631   EG4858            SIB-I-8S
SIB 1           REV 07   750-030631   EG4872            SIB-I-8S
SIB 2           REV 07   750-030631   EG4866            SIB-I-8S
SIB 3           REV 07   750-030631   EG6011            SIB-I-8S
SIB 4           REV 07   750-030631   EG4907            SIB-I-8S
SIB 5           REV 07   750-030631   EG4879            SIB-I-8S
SIB 6           REV 07   750-030631   EG4864            SIB-I-8S
SIB 7           REV 07   750-030631   EG4899            SIB-I-8S
SIB 8           REV 07   750-030631   EG4880            SIB-I-8S
Fan Tray 0      REV 04   760-032784   EG1496            Vertical Fan Tray
Fan Tray 1      REV 04   760-030642   EG1335            Horizontal Fan Tray
Fan Tray 2      REV 02   760-030642   ED4952            Horizontal Fan Tray
```

Most components also have a small rectangular serial number ID label (see Figure 296 on page 613) attached to the component body.

Figure 296: Serial Number ID Label

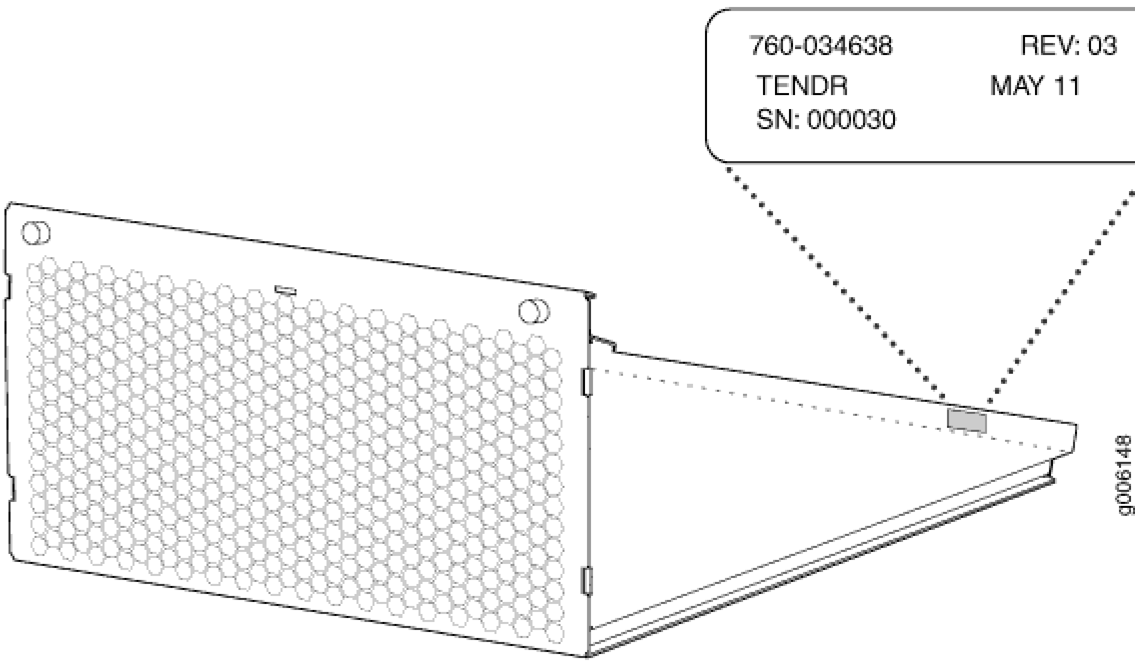
PTX5000 Component Serial Number Locations

IN THIS SECTION

Horizontal Air Filter Serial Number Label

The serial number label is located on the horizontal air filter as shown in Figure 297 on page 614.

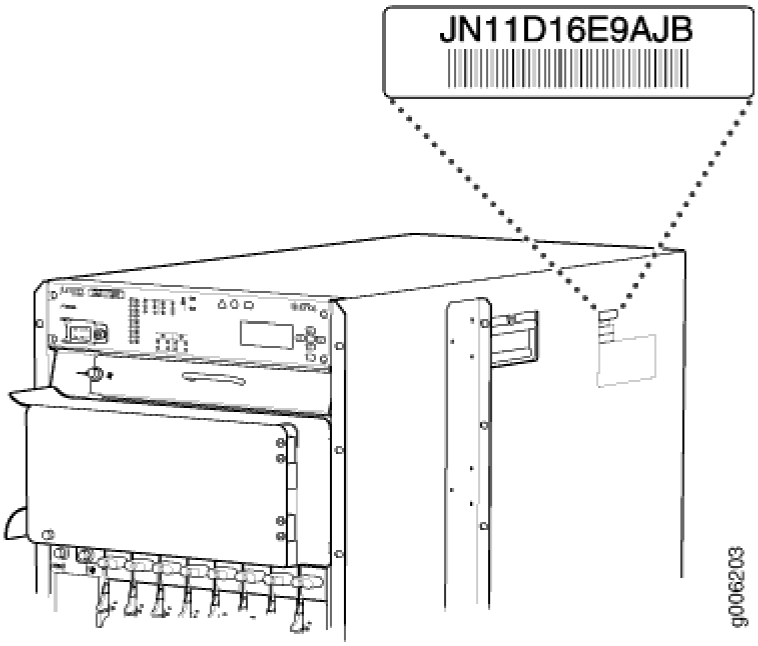
Figure 297: Horizontal Air Filter Serial Number Label



Chassis Serial Number Label

The serial number label is located on the chassis as shown in Figure 298 on page 615.

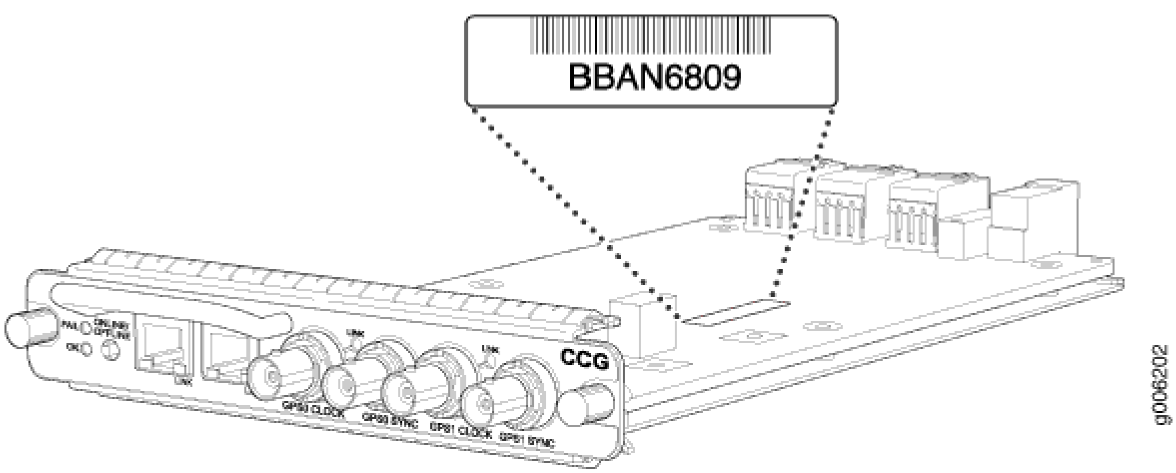
Figure 298: Chassis Serial Number Label



CCG Serial Number Label

The serial number label is located a shown in Figure 299 on page 615.

Figure 299: CCG Serial Number Label



Control Board Serial Number Label

The serial number label is located as shown in Figure 299 on page 615.

Figure 300: Control Board Serial Number Label

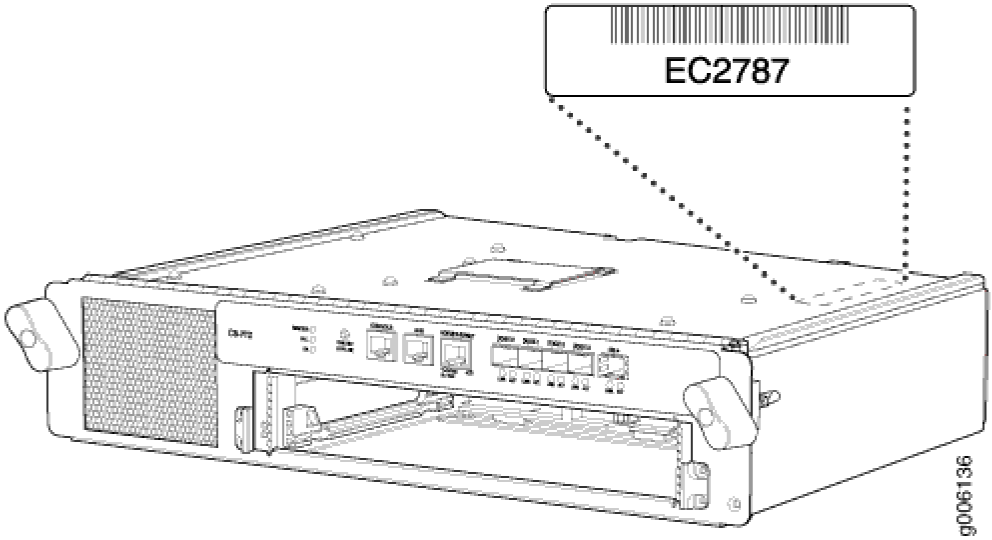
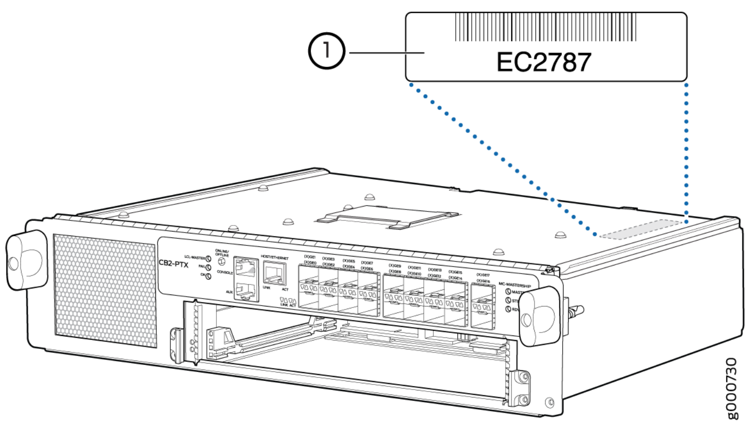


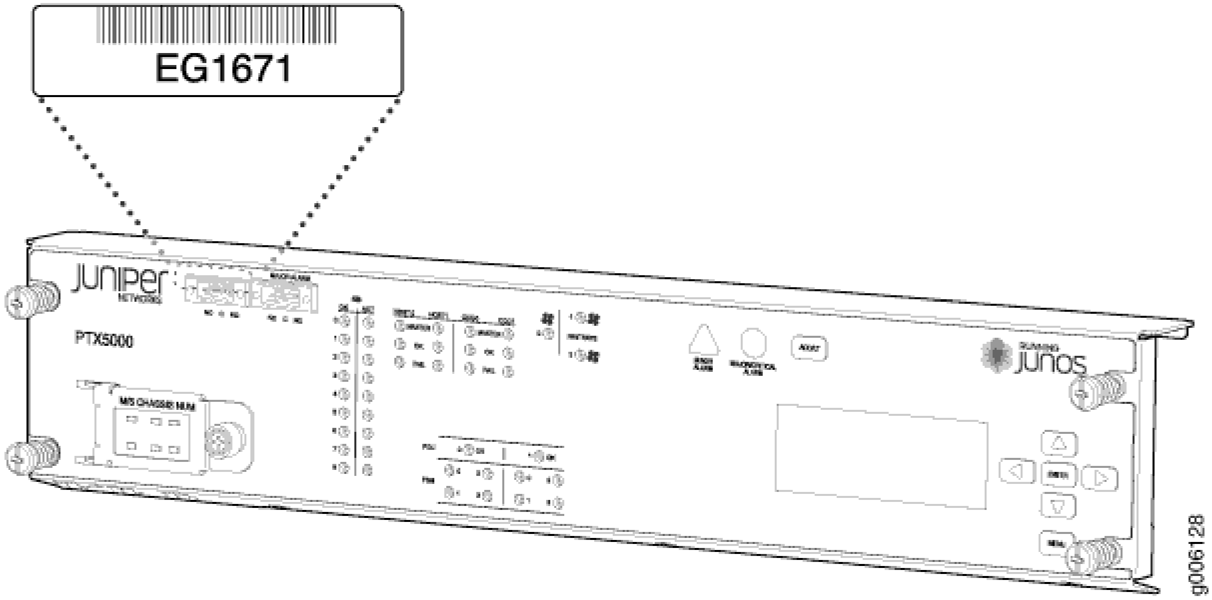
Figure 301: CB2-PTX Control Board Serial Number Label



Craft Interface Serial Number Label

The serial number label is located as shown in Figure 302 on page 617.

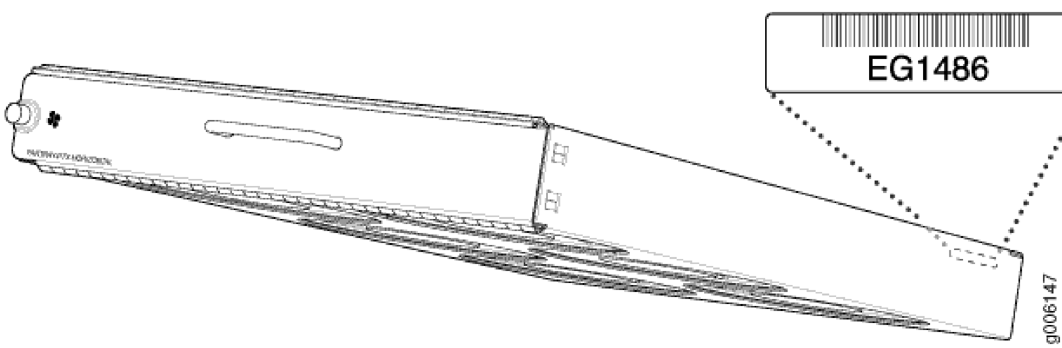
Figure 302: Craft Interface Serial Number Label



Horizontal Fan Tray Serial Number Label

The serial number label is located as shown in Figure 303 on page 617.

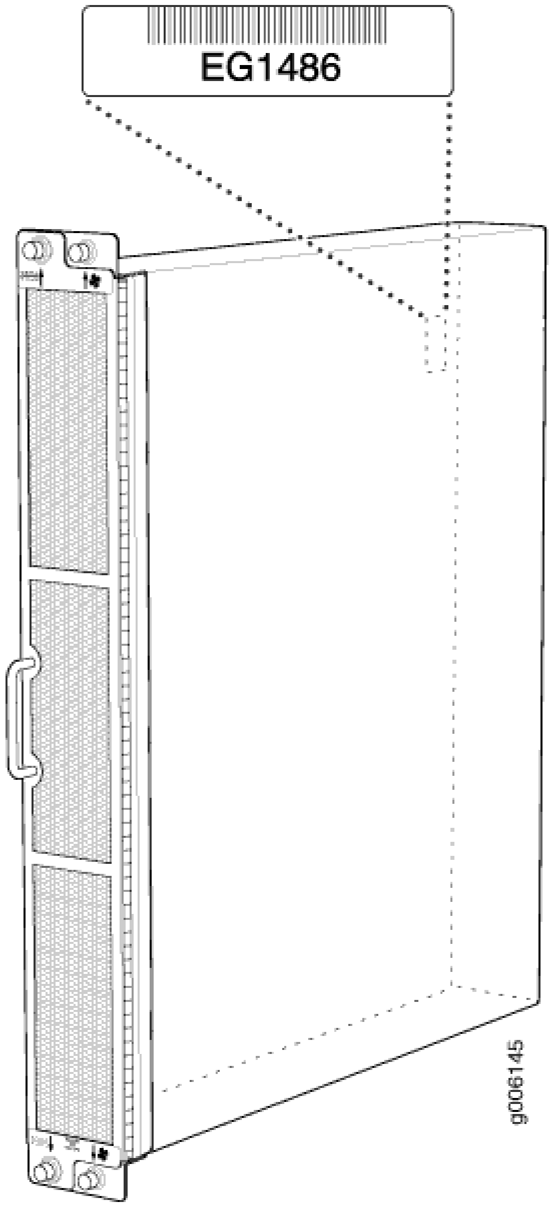
Figure 303: Horizontal Fan Tray Serial Number Label



Vertical Fan Tray Serial Number Label

The serial number label is located as shown in Figure 304 on page 618.

Figure 304: Vertical Fan Tray Serial Number Label



FPC Serial Number Label

The location of the FPC serial number label depends on the FPC model number, as shown in Figure 305 on page 619, Figure 306 on page 620, and Figure 307 on page 621.

Figure 305: FPC-PTX-P1-A Serial Number Label

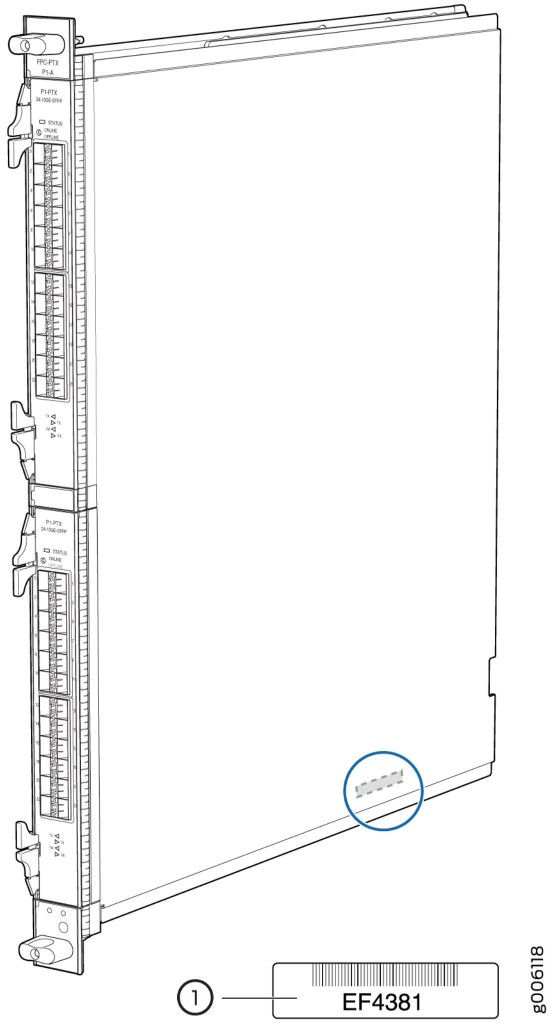


Figure 306: FPC2-PTX-P1A Serial Number Label

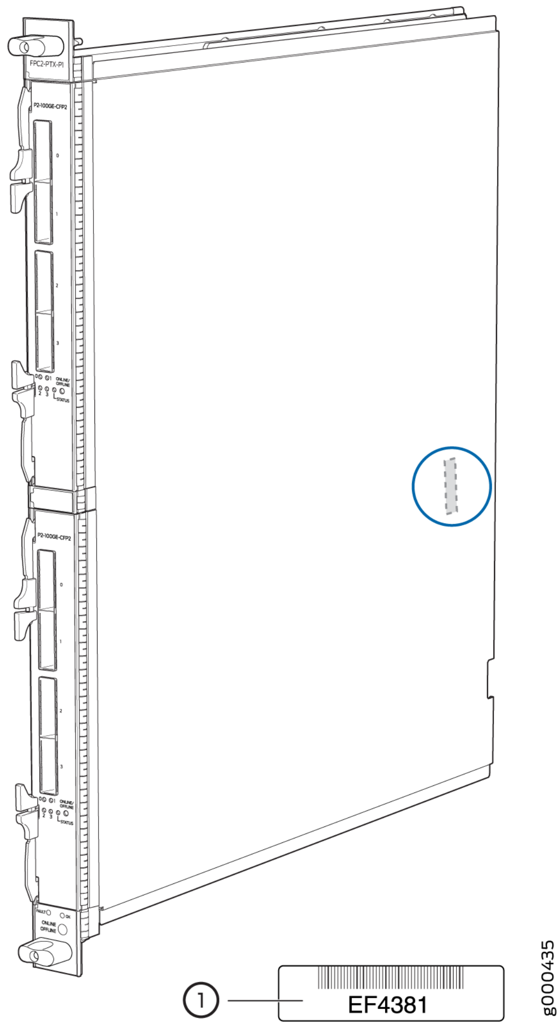
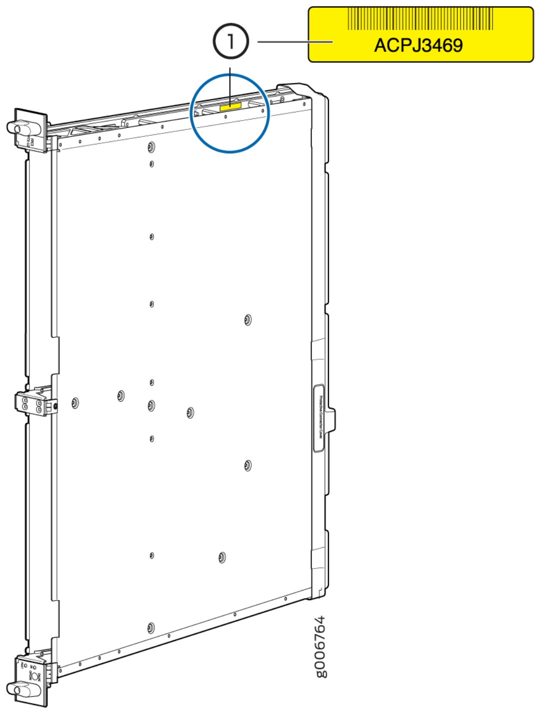


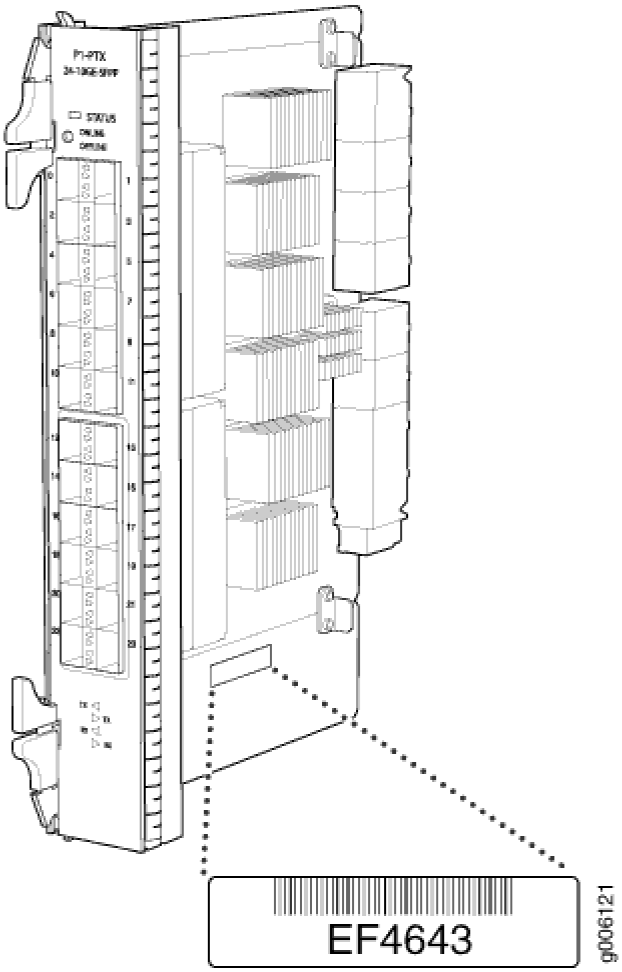
Figure 307: FPC3-PTX-U2 and FPC3-PTX-U3 Serial Number Label



PIC Serial Number Label

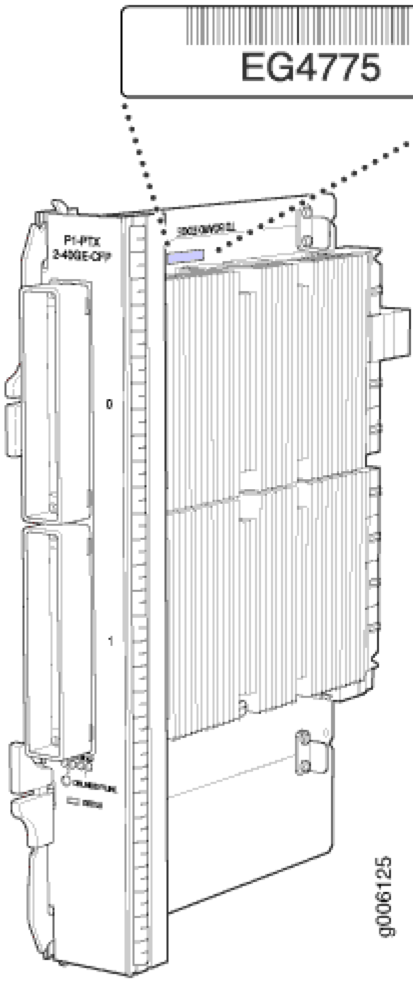
The serial number label for the 10-Gigabit Ethernet PIC is located on the PIC as shown in Figure 308 on page 622.

Figure 308: 10-Gigabit Ethernet PIC Serial Number Label



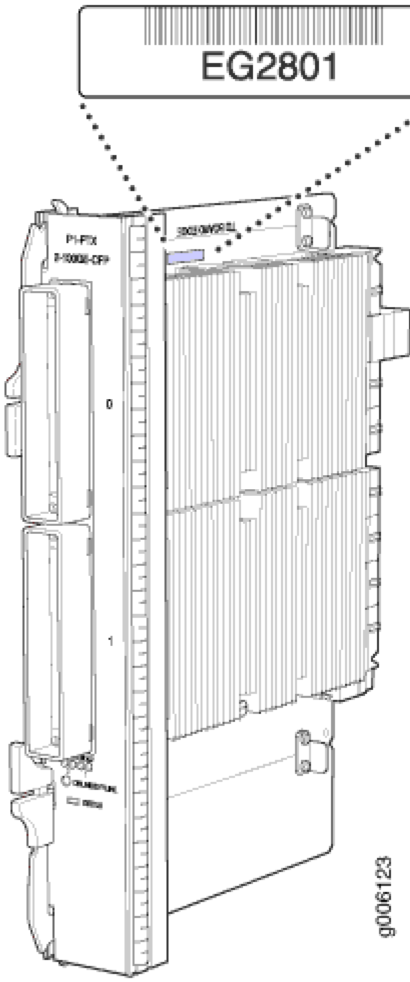
The serial number label for the 40-Gigabit Ethernet PIC is located on the PIC as shown in Figure 309 on page 623.

Figure 309: 40-Gigabit Ethernet PIC Serial Number Label



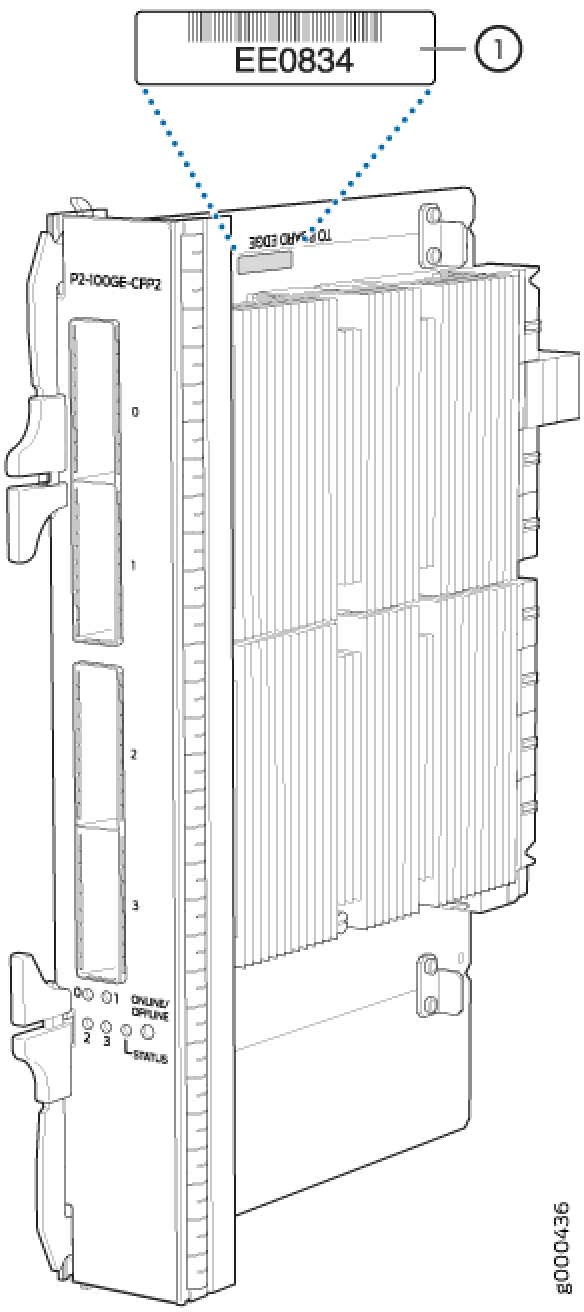
The serial number label for the 100-Gigabit Ethernet PIC is located on the PIC as shown in Figure 310 on page 624.

Figure 310: 100-Gigabit Ethernet PIC Serial Number Label



The serial number label for the 100-Gigabit Ethernet CFP2 PIC is located on the PIC as shown in Figure 311 on page 625.

Figure 311: 100-Gigabit Ethernet CFP2 PIC Serial Number Label



PDU Serial Number Label

The serial number label is located as shown in Figure 312 on page 626 and Figure 313 on page 627).

Figure 312: DC PDU Serial Number Label

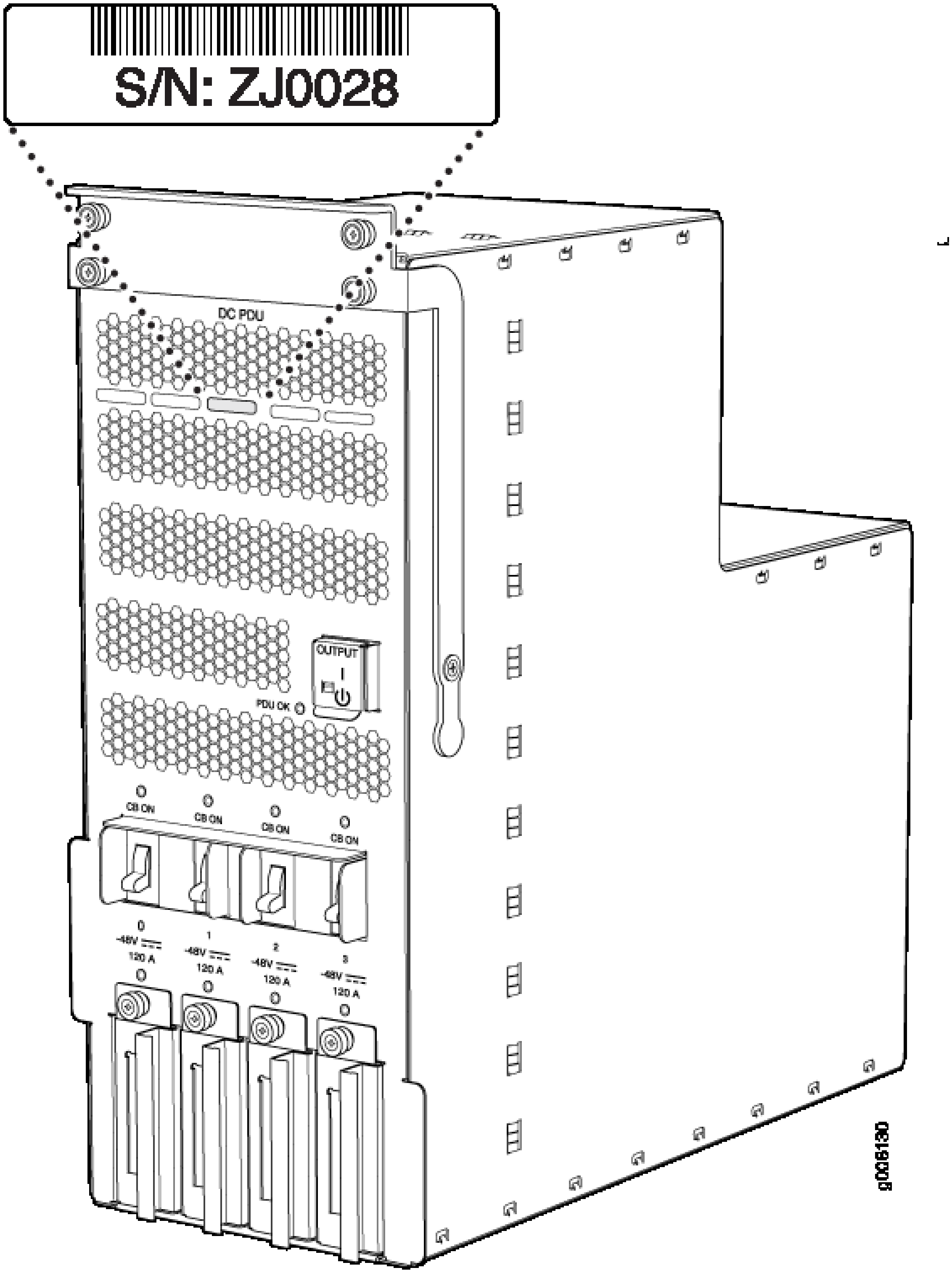
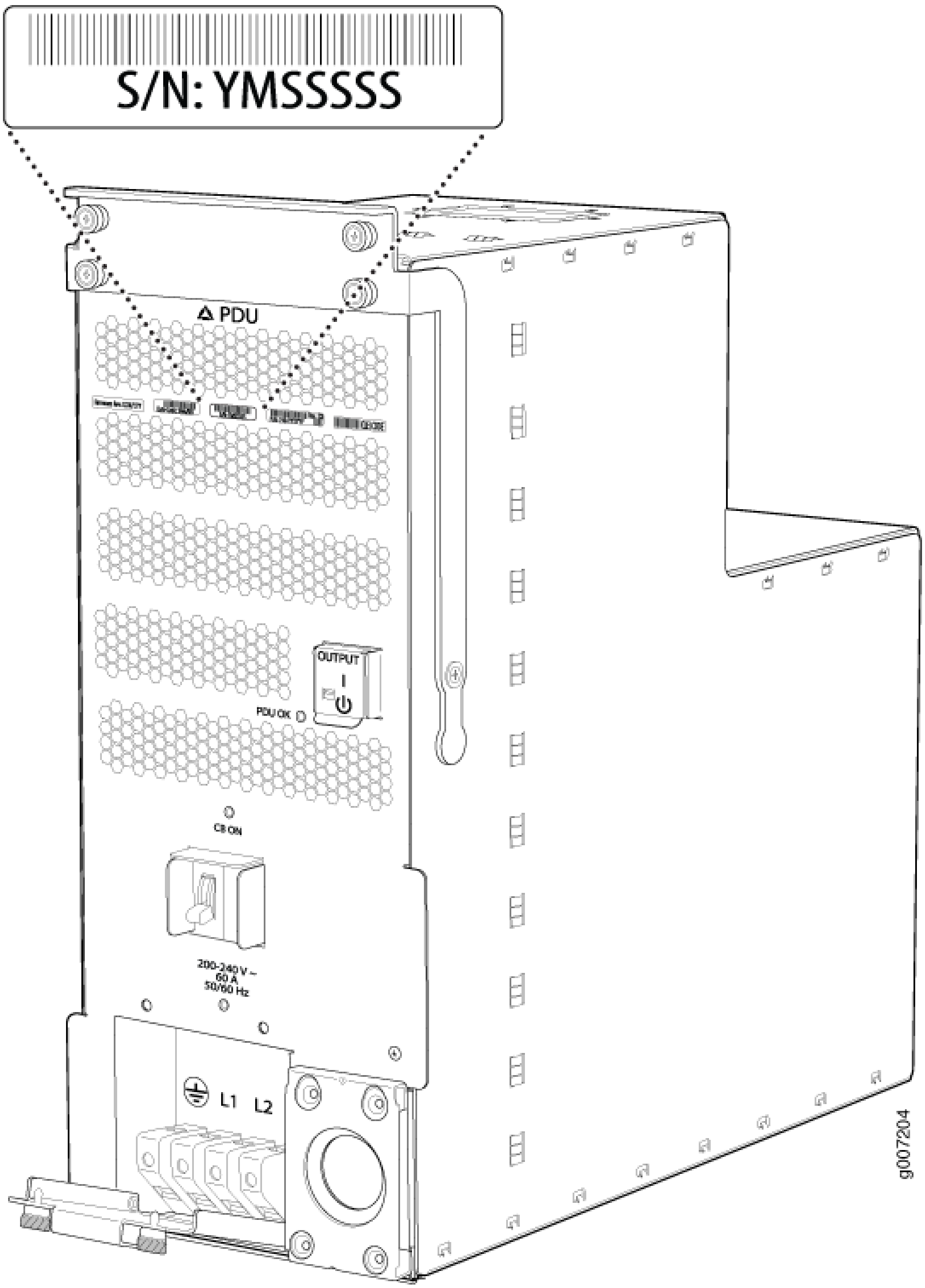


Figure 313: AC PDU Serial Number Label



PSM Serial Number Label

The serial number label is located as shown in Figure 314 on page 628 and Figure 315 on page 629.

Figure 314: DC PSM Serial Number Label

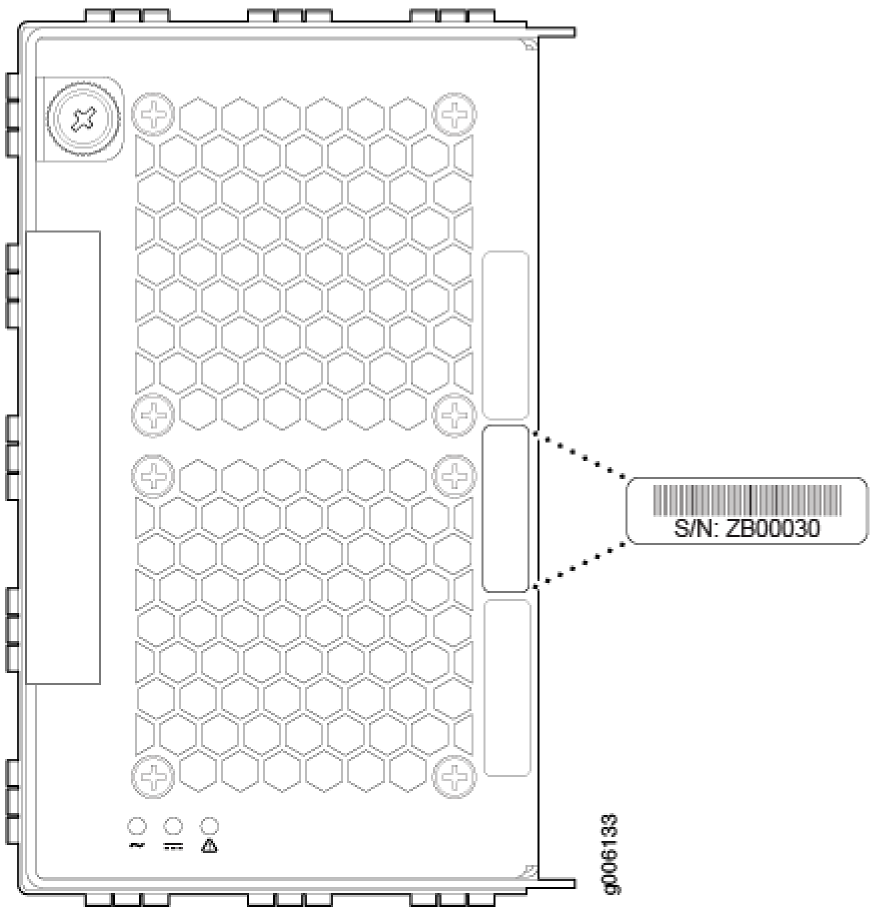
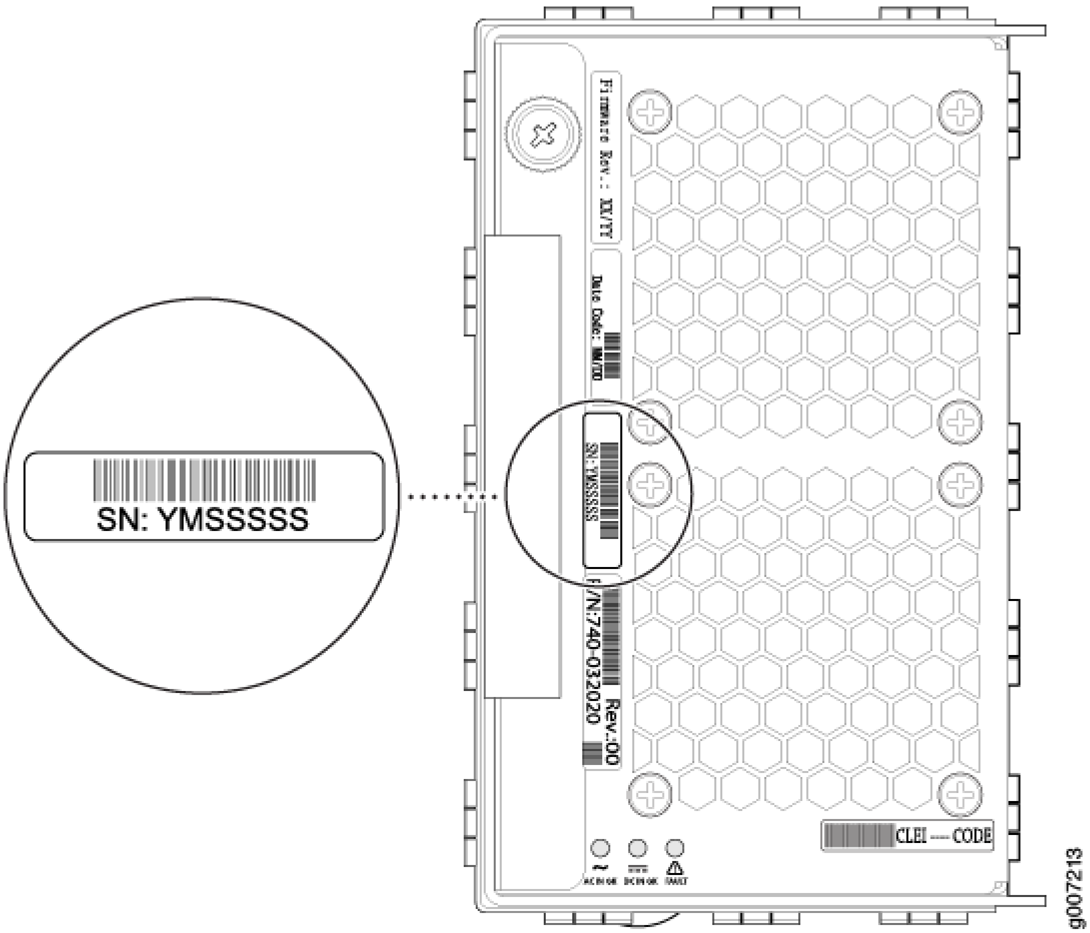


Figure 315: AC PSM Serial Number Label



Routing Engine Serial Number Label

The serial number label is located as shown in Figure 316 on page 630.

Figure 316: Routing Engine Serial Number Label

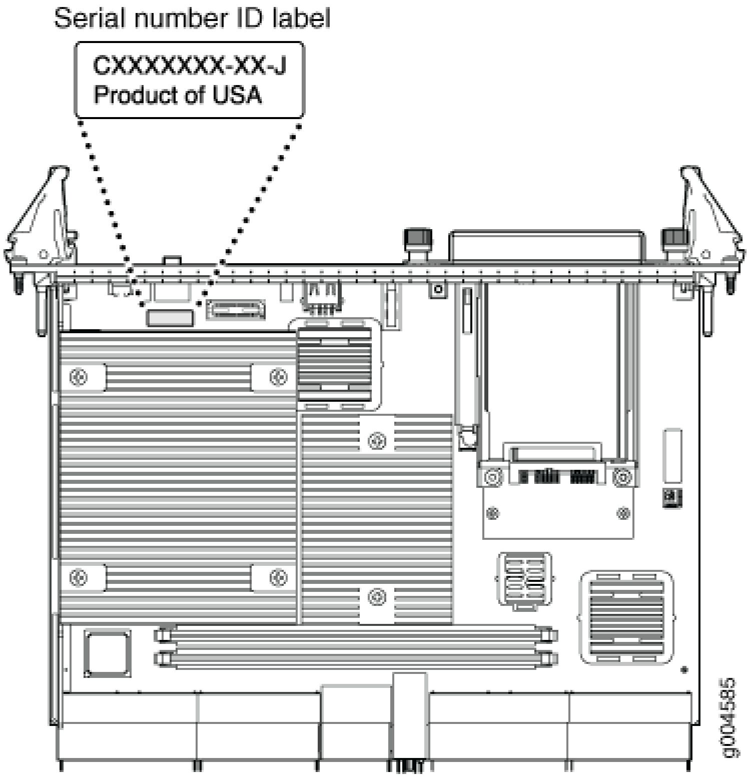
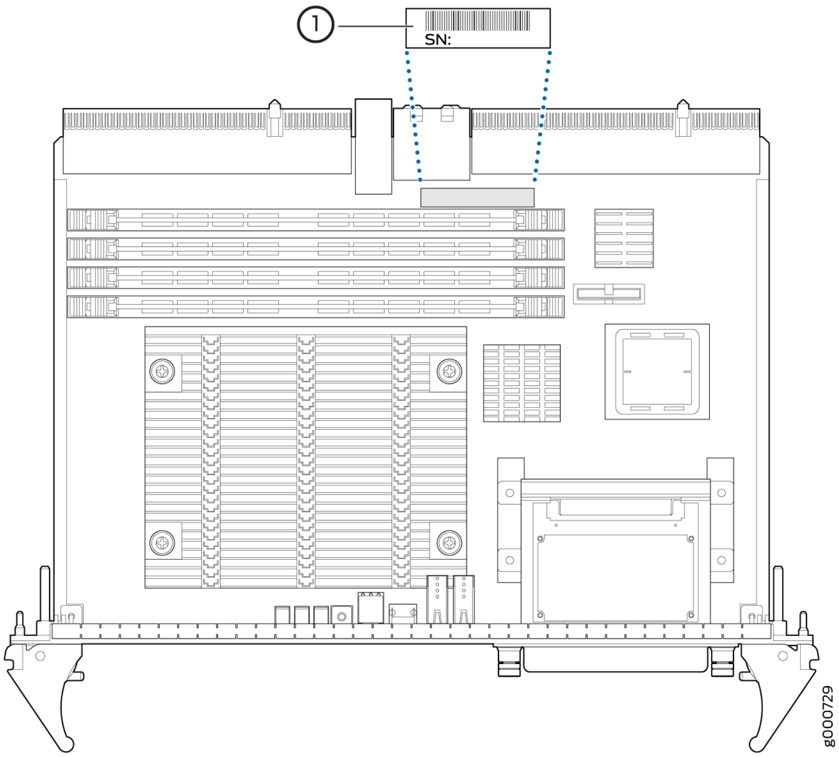


Figure 317: RE-PTX-X8-64G Routing Engine Serial Number Label



SIB Serial Number Label

The serial number label is located as shown in Figure 318 on page 631 and Figure 319 on page 631.

Figure 318: SIB Serial Number Label

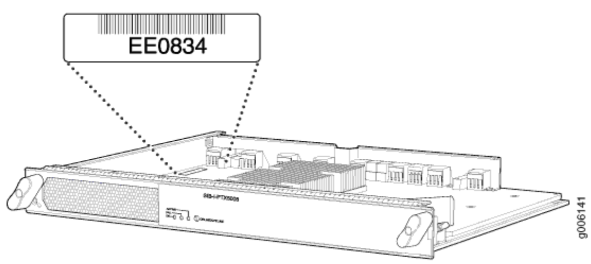
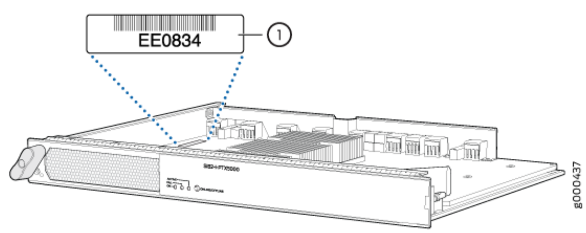


Figure 319: SIB2 Serial Number Label



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.

Tools and Parts Required to Remove Components from a PTX5000

To remove components from the PTX5000 or the PTX5000 from a rack, you need the following tools and parts:

- 2.5-mm flat-blade (–) screwdriver, for detaching alarm relay terminal block
- 7/16-in. (11-mm) nut driver
- Blank panels to cover empty slots
- Electrostatic bag or antistatic mat, for each component
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (–) screwdriver
- Mechanical lift (for the chassis)
- Phillips (+) screwdrivers, numbers 1 and 2
- Rubber safety cap for fiber-optic interfaces and cable
- Wire cutters

Packing the PTX5000 for Shipment

To pack the PTX5000 for shipment:

1. Retrieve the shipping crate and packing materials in which the PTX5000 was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. On the console or other management device connected to the primary Routing Engine, enter CLI operational mode. To power off the PTX5000, see "Powering Off the PTX5000" on page 287.
4. Disconnect power from the PTX5000. For instructions, see the procedure to disconnect power in"Replacing a PTX5000 120-A DC PDU" on page 411.
5. Remove the cables that connect to all external devices..
6. Remove all Field Replaceable Units (FRUs) from the PTX5000.
7. Remove the PTX5000 from the rack. Place the mechanical lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.

8. Place the PTX5000 in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
9. Cover the PTX5000 with an ESD bag and place the packing foam on top of and around the router.
10. Replace the accessory box on top of the packing foam.
11. Securely tape the box closed or place the crate cover over the PTX5000.
12. Write the RMA number on the exterior of the box to ensure proper tracking.

Packing PTX5000 Components for Shipment

To pack and ship individual components:

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

> **CAUTION**: Do not stack any of the PTX5000 components.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

7

CHAPTER

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.

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.

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.

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.

PTX5000 Agency Approvals and Compliance Statements

IN THIS SECTION

PTX5000 Agency Approvals

IN THIS SECTION

The PTX5000 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-61000-3-2 Power Line Harmonics
  - 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
  - EN-61000-4-11 Voltage Dips and Sags
- ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

The PTX5000 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

אזהרה

מוצר זה הוא מוצר Class A.
בסביבה ביתית,מוצר זה עלול לגרום הפרעות בתדר רדיו,ובמקרה זה המשתמש עשוי להידרש
לנקוט אמצעים מתאימים.

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

Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

The preceding translates as follows:

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

United States

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

Compliance Statements for Environmental Requirements

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

PTX5000 Compliance Statements for NEBS

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (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.
- During power supply and air filter maintenance, the cover is intended to be removed from the chassis.

SEE ALSO

PTX5000 Agency Approvals | 660

PTX5000 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 70dB(A) per EN ISO 7779.

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 320 on page 667) 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).

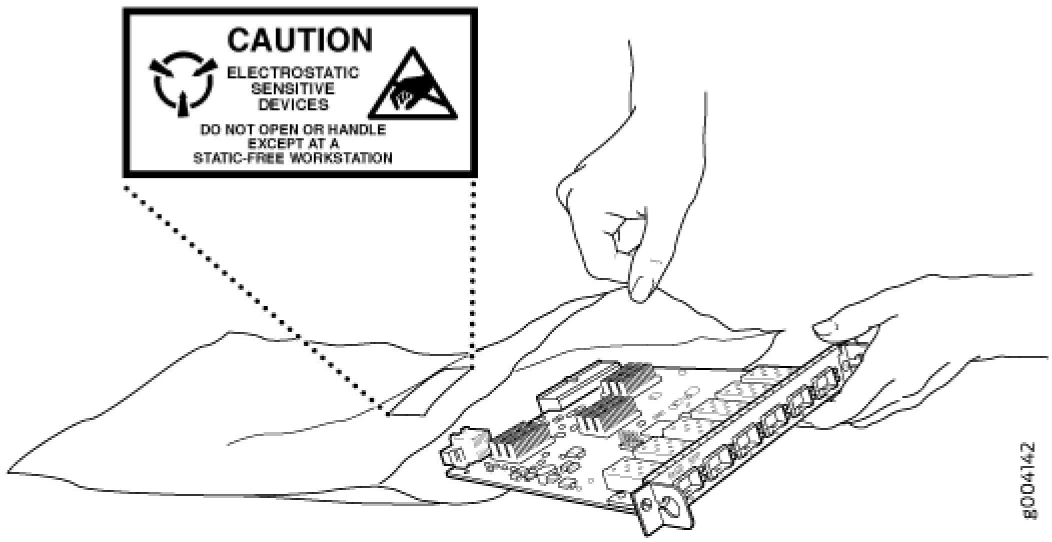
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  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 320 on page 667). If you are returning a component, place it in an antistatic bag before packing it.

Figure 320: 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.

PTX5000 AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to an AC-powered PTX5000 with three-phase AC power supplies:

- AC-powered PTX5000 routers are shipped with three-phase electrical cords with grounding. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.

- For each three-phase delta AC power distribution unit (PDU), you must provide an external listed customer-site circuit breaker rated minimum 60 A (240 VAC) in the building installation, or as required by local code.
- For each three-phase wye AC PDU, you must provide an external listed customer-site circuit breaker. See "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 for details, or as required by local code.
- The delta cores in the mains lead are labeled as follows:
  - Wire labeled **GND**—Earth
  - Wire labeled **L1**
  - Wire labeled **L2**
  - Wire labeled **L3**
- The wye cores in the mains lead are labeled as follows:
  - Wire labeled **GND**—Earth
  - Wire labeled **L1**
  - Wire labeled **L2**
  - Wire labeled **L3**
  - Wire labeled **N**

RELATED DOCUMENTATION

PTX5000 Three-Phase Delta AC Power Distribution Unit Specifications | **67**

PTX5000 Three-Phase Wye AC Power Distribution Unit Specifications | **67**

PTX5000 AC Power Electrical Safety Warnings | **669**

PTX5000 AC Power Electrical Safety Warnings

IN THIS SECTION

AC Power Warning

WARNING: High touch current. Earth connection is essential before connecting supply.

Avertissement Courant de contact éléve raccordement à la terre indispensable avant le raccordement à l'alimentation.

Warnung Hoher Ableitstrom! Ein Erdungsanschluss ist vor dem Einschalten der Stromzufuhr erforderlich.

警 告 接通□源前，高接触□流必□接地

RELATED DOCUMENTATION

General Electrical Safety Guidelines and Warnings | 664

PTX5000 AC Power Electrical Safety Guidelines | 667

Connecting Power to the PTX5000 Three-Phase Delta AC PDUs | 213

Connecting Power to the PTX5000 Three-Phase Wye AC PDUs | 220

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.

PTX5000 DC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to a DC-powered router:

- A DC-powered router that is equipped with a DC terminal block is intended for installation only 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 should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.

- Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the –48 VDC facility should be equipped with a circuit breaker (see "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 for details) in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.

  Each –48-VDC facility DC source input power cable connected to a 60-A DC PDU must be equipped with a current-limiting fuse or circuit breaker (see, "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 or as required by local code). The voltage rating of the facility DC source circuit breaker must be 80 V minimum. We recommend an 80 A–rated circuit breaker or current-limiting fuse for each 60-A DC power cable.

- A DC-powered router is equipped with a DC terminal block that is rated for the power requirements of a maximally configured router. To supply sufficient power, terminate the DC input wiring on a facility DC source (see "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 for details) for the 60-A DC PDU.

- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire (see "PTX5000 AC and DC PDU Electrical and External Circuit Breaker Specifications" on page 156 for details).

RELATED DOCUMENTATION

PTX5000 DC Power System Electrical Specifications | 101

General Electrical Safety Guidelines and Warnings | 664

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.

Midplane Energy Hazard Warning

WARNING: High levels of electrical energy are distributed across the midplane. Be careful not to contact the midplane connectors, or any component connected to the midplane, with any metallic object while servicing components.

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.