Engineering Simplicity

MX2010 Universal Routing Platform Hardware Guide

Published
2023-10-06

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MX2010 Universal Routing Platform Hardware Guide

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About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the MX2010 Universal Routing Platform. After completing the installation and basic configuration procedures covered in this guide, refer to the Junos OS documentation for information about further software configuration.

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CHAPTER 1

MX2010 Router Overview

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MX2010 Router Overview

The MX2010 Universal Routing Platform is an Ethernet-optimized router that provides both switching and carrier-class Ethernet routing. The MX2010 router supports service provider core, converged core and edge, and edge applications, and enables a wide range of business and residential and services, including high-speed transport and VPN services, next-generation broadband multiplay services, and high-volume Internet data center internetworking.

The MX2010 chassis provides redundancy and resiliency. All major hardware components including the power system, the cooling system, the Control Board and the switch fabrics are fully redundant.

The MX2010 router is 34 rack units (U) tall. One router can be installed in an open-frame rack, four-post rack, or cabinet. The MX2010 router has 10 dedicated line-card slots which means a maximum of 10 Modular Port Concentrators (MPCs) including adapter cards (ADCs), and Modular Interface Cards (MICs), a host subsystem consisting of 2 Control Board with Routing Engines (CB-REs), and 8 Switch Fabric Boards (SFBs).

Up to 2 MICs can be installed in each MPC. Fully populated, the MX2010 router supports up to 20 MICs.

For a list of the supported MPCs, and MICs, see the *MX Series Interface Module Reference*.

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MX Series Router Architecture

The key components of the Juniper Networks MX Series 5G Universal Routing Platforms are:

- Dense Port Concentrators (DPC)
- Modular Port Concentrators (MPC)
- Modular Interface Cards (MIC)
- Control Board and Routing Engine (CB-RE)
- Switch Control Board (SCB)
- Switch Fabric Board (SFB)

NOTE: The MX80 Universal Routing Platform leverages the technology used in the MPCs, common across the MX Series, and can accommodate multiple combinations of Modular Interface Cards (MICs) for increased flexibility. The MX80 is a single board router with a built-in RE and one Packet Forwarding Engine (PFE). The PFE has two “pseudo” Flexible PIC Concentrators (FPC 0 and FPC 1). Because there is no switching fabric, the single PFE takes care of both ingress and egress packet forwarding.

The MX Series router has been optimized for Ethernet services. Examples of the wide range of Ethernet services provided by the MX Series include:

- Virtual private LAN service (VPLS) for multipoint connectivity—Native support for VPLS services
- Virtual leased line (VLL) for point-to-point services—Native support for point-to-point services
- RFC 2547.bis IP/MPLS VPN (L3VPN)—Full support for MPLS VPNs throughout the Ethernet network
- Video distribution IPTV services
- Ethernet aggregation at the campus/enterprise edge—Supports dense 1-Gigabit Ethernet, 10-Gigabit Ethernet, and 100-Gigabit Ethernet configurations, and provides full Layer 3 support for campus edge requirements
- Ethernet aggregation at the multiservice edge—Supports up to 480 1-Gigabit Ethernet ports or 48 10-Gigabit Ethernet ports for maximum Ethernet density along, with full Layer 2 and Layer 3 VPN support for MSE applications

NOTE: You can configure MX Series routers to provide simultaneous support for Layer 2 and Layer 3 Ethernet services. In many cases, Layer 2 protocols run on some interfaces, and Layer 3 protocols run on others.

The Junos OS Layer 2 Switching and Bridging Library topic discusses Layer 2 configurations on supported routers, including Layer 2 statement summaries and *configuration statement* examples. For more complete Layer 2 configuration examples for MX Series routers, see the Ethernet Networking User Guide for MX Series Routers.

For more information about configuring Layer 3 features and functions (such as *class of service*), see the relevant Junos configuration guides.

RELATED DOCUMENTATION

Line Cards Supported on MX Series Routers | 24

MX2010 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see Figure 1 on page 7, Figure 2 on page 9, and Figure 3 on page 11). The chassis measures 59.50 in. (151.13 cm) high, 36.20 in. (91.95 cm) deep, and 19 in. (48.26 cm) wide. The chassis can be installed in a standard 19-in. open-frame rack, four-post rack, or an enclosed cabinet.

NOTE: There must be a minimum of 34-U of usable rack space when installing the MX2010 router into a 34-U rack.

NOTE: If you are installing the MX2010 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 34-U rack space from access during installation.

The chassis includes the following features (see Figure 1 on page 7, Figure 2 on page 9, and Figure 3 on page 11).

- Front-mounting flanges for mounting in a four-post rack or cabinet.
- Center-mounting metal brackets for center-mounting in an open-frame rack (optional).

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.

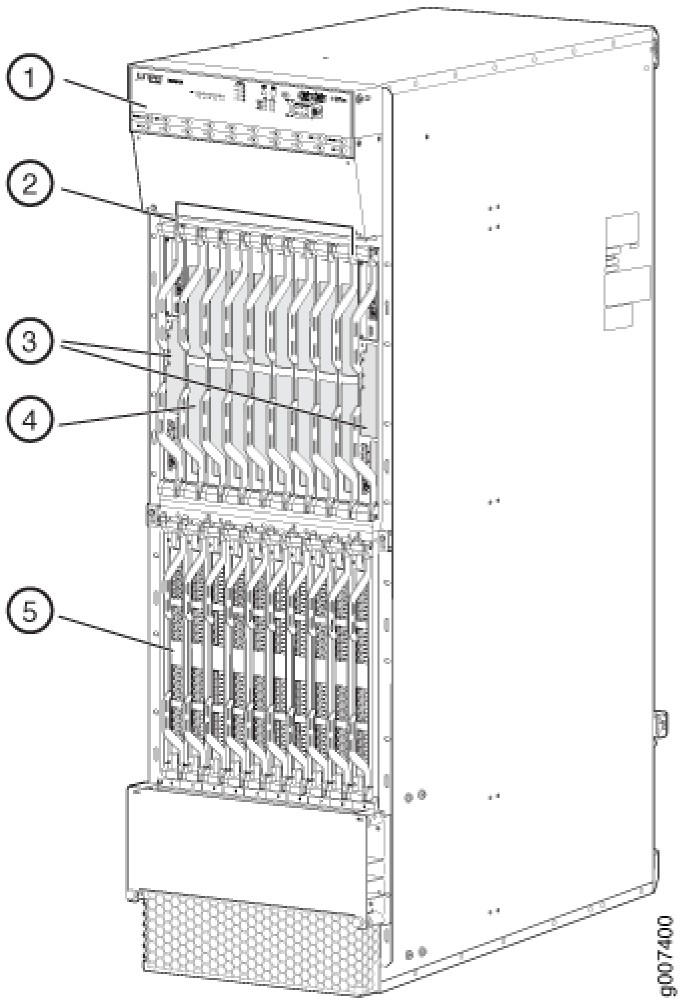
WARNING: The router must be connected to earth ground during normal operation.

The chassis with standard cable managers and EMI cover measures 59.50 in. (151.13 cm) high, 19 in. (48.26 cm) wide, and 36.20 in. (91.95 cm) deep (from the front-mounting flanges to the rear of the chassis). An extended cable manager extends the depth to 40.15 in. (102 cm).

One router can be installed in a 34-U or taller open-frame or four-post rack if the rack can support the combined weight, which can be greater than 985 lb (446.79 kg).

NOTE: The dimensions also include the cable managers and EMI cover.

Figure 1: Front View of a Fully Configured MX2010 Router Chassis



NOTE: Remove field replacement units (FRUs) from the front of the MX2010 router before you install the router.

See Table 1 on page 7 for information about the components on the front of the MX2010 router.

Table 1: Front Components in a Fully Configured MX2010 Router

Component No.	Component Description	Slots	Number of FRUs
1	Craft interface	–	1

Table 1: Front Components in a Fully Configured MX2010 Router *(Continued)*

Component No.	Component Description	Slots	Number of FRUs
2	Card-cage air filter	–	1
3	Control Board and Routing Engine (CB-RE)	0 and 1	2
4	Switch Fabric Boards (SFBs)	0 through 7	8
5	MPCs with ADCs and MICs	0 through 9	10

NOTE: A combination card-cage cable manager and air filter is installed over the CB-REs and SFBs.

NOTE: Remove field replacement units (FRUs) from the rear of the MX2010 router before you install the router.

See Table 2 on page 9 for information about components on the back of an AC-powered MX2010 router.

Figure 2: Rear View of a Fully Configured AC-Powered MX2010 Router Chassis

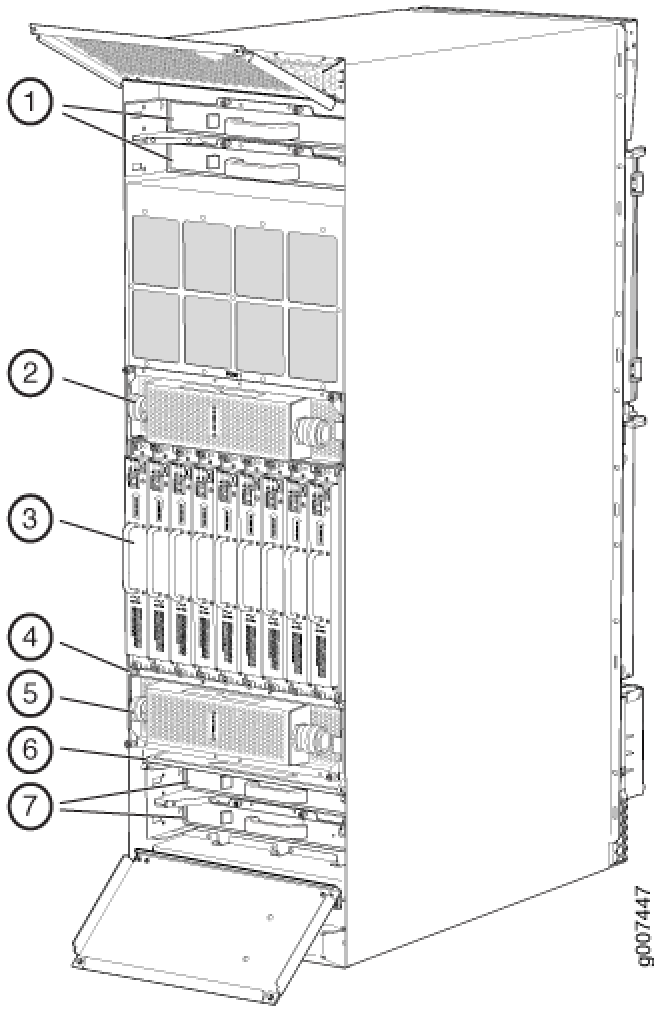


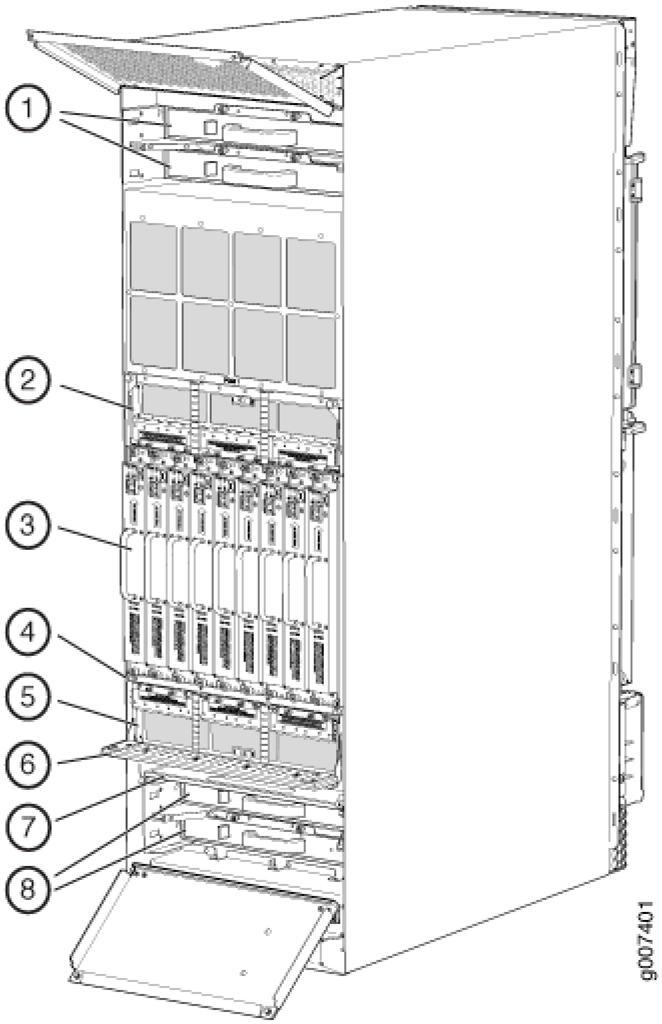
Table 2: Rear Components in a Fully Configured AC-Powered MX2010 Router

Component No.	Component Description	Slots	Number of FRUs
1	Upper fan trays (two).	Fan tray 2 and fan tray 3 (behind cage door)	2

Table 2: Rear Components in a Fully Configured AC-Powered MX2010 Router *(Continued)*

Component No.	Component Description	Slots	Number of FRUs
2	AC PDM—Three-phase delta or wye, or a single-phase AC PDM, or a high-voltage second-generation universal (HVAC/HVDC) PDM. **NOTE**: The universal PDM accepts either an HVAC/ HVDC input.	PDM1/Input1	1
3	AC or a high-voltage second-generation universal (HVAC/ HVDC) PSM.	0 through 8	9
4	PSM air filter.	–	1
5	AC PDM—Three-phase delta or wye, or a single-phase AC PDM, or a high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM0/Input0	1
6	Fan tray air filter.	–	1
7	Lower fan trays (two).	Fan tray 0 and fan tray 1 (behind access door)	2

Figure 3: Rear View of a Fully Configured DC-Powered MX2010 Router Chassis



NOTE: Remove field replacement units (FRUs) from the rear of the MX2010 router before you install the router.

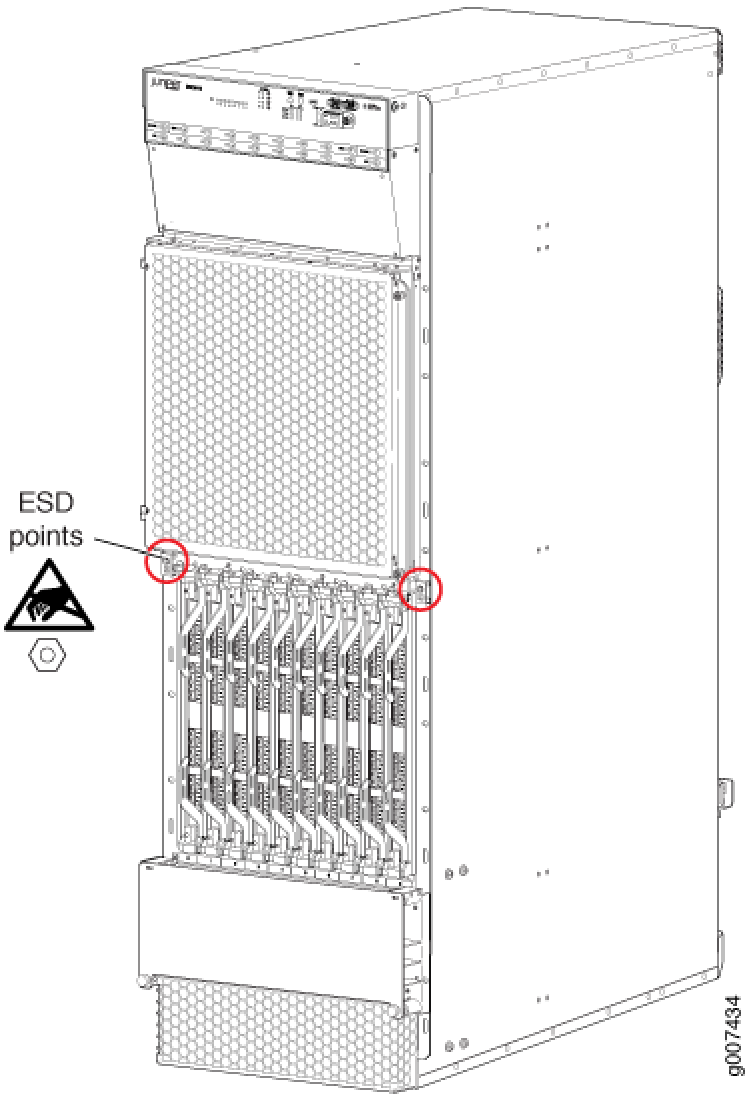
See Table 3 on page 12 for information about router components on the back of a DC-powered MX2010 router.

Table 3: Rear Components in a Fully Configured DC-Powered MX2010 Router

Component No.	Component Description	Slots	Number of FRUs
1	Upper fan trays (two).	Fan tray 2 and fan tray 3 (behind cage door)	2
2	DC PDM, DC PDM (240 V China), or a high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM1/Input1	1
3	DC PSM, DC PSM (240 V China), or a high-voltage second-generation universal (HVAC/HVDC) PSM.	0 through 8	9
4	PSM air filter	–	1
5	DC PDM, DC PDM (240 V China), or a high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM0/Input0	1
6	DC cable manager (standard or extended).	–	2
7	Fan tray air filter.	–	1
8	Lower fan trays (two).	Fan tray 0 and fan tray 1 (behind access door)	2

The MX2010 router has two electrostatic discharge (ESD) points. These are located on either side of the MPCs on the front of the chassis (see Figure 4 on page 13).

Figure 4: MX2010 Router ESD Points



RELATED DOCUMENTATION

MX2010 Physical Specifications | 168
Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet | 294
MX2010 Router Grounding Specifications
MX2010 Chassis Moving Guidelines | 167

MX2010 Backplane Description

The MX2010 router consist of a signal backplane and a power backplane that connects PSMs and PDMs to the chassis. The adapter cards (ADCs) are carrier cards used to house the MPCs. The MPCs install into the bottom card-cage backplanes from the front of the chassis and mate to the signal backplane to connect to the Switch Fabric Boards (SFBs) and the Control Board and Routing Engines (CB-REs). The backplane connects 10 line cards to 8 SFBs and 2 CB-REs. The SFBs and CB-REs install into the top from the front of the chassis. The PSMs install into the bottom power backplane, and the PDMs mate to the bottom power backplane. The cooling system components also connect to the top and bottom backplane.

The backplane performs the following major functions:

- Data path—Data packets are transferred across the backplane between the MPCs through the fabric ASICs on the SFBs.

- Power distribution—The router PDMs relay power from the feeds to the input of the PSMs through the power midplane. In addition, the output power from PSMs is distributed to the components of the chassis (MPCs, SFBs, and CB-REs), using the power backplane.

- Control/management path—The backplane provides management and control path connectivity among the various system components.

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MX2010 Router Overview | 2
MX2010 Chassis Description | 6
MX2010 Modular Port Concentrator Description | 92
MX2000 Switch Fabric Board (SFB) Overview | 72
MX2000 Host Subsystem CB-RE Description | 57
MX2010 Modular Interface Card Description | 102
MX2010 Power System Description | 121
MX2010 Power Midplane Description | 128

MX2010 Component Redundancy

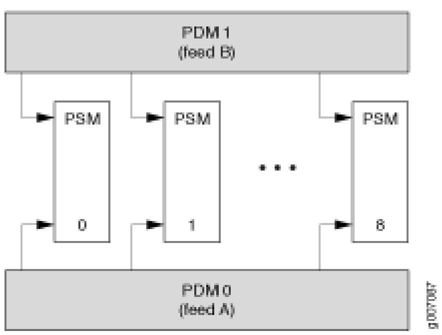
A fully configured router is designed so that no single point of failure can cause the entire system to fail. Only a fully configured router provides complete redundancy. All other configurations provide partial redundancy. The following major hardware components are redundant:

- Host subsystem—The host subsystem consists of a combined Control Board and Routing Engine (CB-RE) functioning together. The router 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.

- DC power system—The MX2010 DC power system (-48 V and 240 V China) is made up of three components: nine power supply modules (PSMs), two power distribution modules (PDMs), and a power midplane (PMP). For telecom (48 VDC) power supplies the power system distributes power from a pool of 22.5 KW (20 KW for PSM non-redundant and 2.5 KW reserved for PSM redundancy). This pool provides power to ten line-card slots, four fan trays and critical FRUs. These critical FRUs consist of two CB-REs and eight SFBs located in the top portion of the chassis.

- DC power feed redundancy—The MX2010 router power system is feed redundant. Each PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. There are two PDMs per power subsystem that carry nine feeds each. Users should connect feeds from one power source to one PDM and feeds from the other power source to the second PDM of the power subsystem (see Figure 5 on page 15).

  Figure 5: DC Power System Feed Redundancy

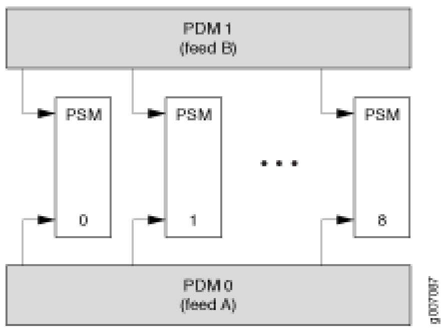
  

  Each PSM has a set of two DIP switches located on the faceplate. These DIP switches are used to indicate whether a user wants to connect one feed to the power system, two feeds, or none. These DIP switches provide critical information to the power management system to help generate alarms in case of a feed failure or a wrong connection. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly. See "MX2010 DC Power Supply Module (-48 V) Description" on page 147.

- High-Voltage Second-Generation Universal (HVAC/HVDC) PDMs—The universal PDM accepts either an HVAC or HVDC input. You can install a total of two PDMs into a router. Each universal PDM operates with nine feeds of a 30-A current limit. Each universal PSM is capable of delivering 3400 W of power with-dual feeds and 3000 W of power with a single-feed. In this configuration, each subsystem provides *N+1* output PSM redundancy along with *N+N* feed redundancy. The power feeds from different sources need to be connected to different PDMs. If feeds that connect to one PDM fail in a redundant configuration, the other feed provides full power. For the high-voltage second-generation universal (HVAC/HVDC) power system, both input power feeds are active, and share the load when they are present.

Figure 6 on page 16 illustrates the power distribution from the universal (HVAC/HVDC) PDMs to the universal (HVAC/HVDC) PSMs.

Figure 6: MX2010 Router Universal (HVAC/HVDC) Power Subsystem Feed Redundancy



- AC power system—The MX2010 supports connection of a three-phase AC power system. There are two types of three-phase power systems: the three-phase delta and three-phase wye. The AC power going to the PSMs is split into three individual phases—each PSM works on a single phase. This means the power system works independent of the kind of AC feed is connected. The user can connect one or two feeds, depending on the power system configuration (number of PSMs, redundancy, and so on). Each phase from each of the two feeds is distributed among one or two PSMs (one feed has each phase going to two PSMs, and the other feed has each phase going to a single PSM). See Figure 7 on page 17 and Figure 8 on page 17.

Figure 7: Power Distribution from Three-Phase Feed Delta PDM to the AC PSMs

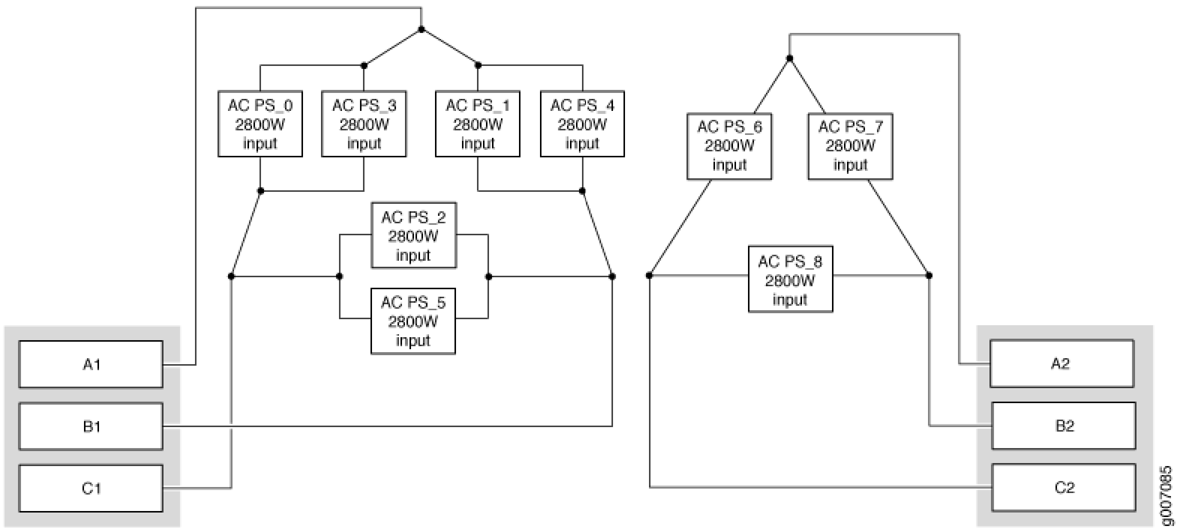
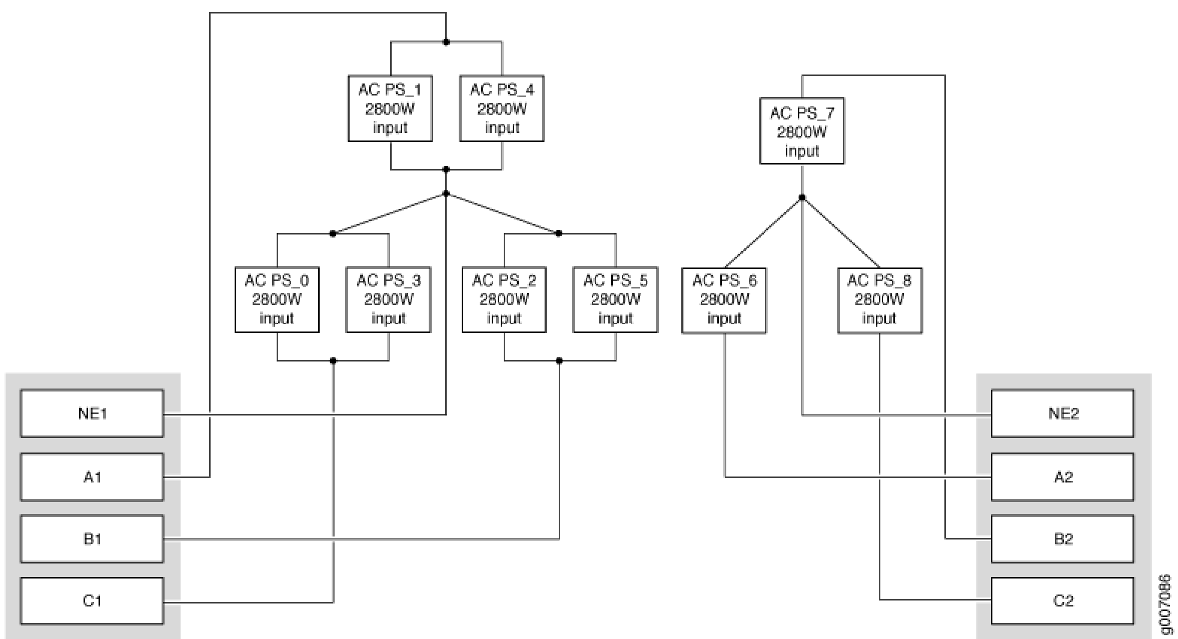


Figure 8: Power Distribution from Three-Phase Feed Wye PDM to the AC PSMs



The AC power system is feed redundant—each PSM takes in two AC feeds and uses one of the two. One AC feed is active at a time. If one feed fails, the PSM automatically switches over to the other feed without disrupting system function (see "MX2000 Three-Phase Delta AC Power Distribution Module Description" on page 129, "MX2000 Three-Phase Wye AC Power Distribution Module Description" on page 131, and "MX2000 AC Power Supply Module Description" on page 137).

- AC power requirements—Table 4 on page 18 shows the MX2010 current requirements for the three-phase delta and wye power feeds.

Table 4: AC PDM Delta and Wye Current Requirements

Three-Phase Voltage	Input Feed	Current Delta per Three-Phase PDM	Current Wye per Three-Phase PDM
200 V (minimum–nominal) (line-to-line) for delta (per phase)	1	50 A	–
	2	25 A	–
200 V (minimum–nominal) (line-to-neutral) for wye (per phase)	1	–	30 A
	2	–	15 A

> **NOTE**: This is the minimum required to provide 2.5 KW per PSM. Based on facilities guidelines, you should over-provision the MX2010 router. The two numbers listed in the current columns reflect the distribution of phases from the feed to PSM. For example, from one feed each phase goes to two PSMs and from other feed each phase goes to only one PSM.

- Power distribution modules (PDMs)—In the DC configuration, each system provides *N*+1 PSM redundancy along with *N*+*N* feed redundancy. The power feeds from different sources need to be connected to different PDMs. If feeds that connect to one PDM fail in a redundant configuration, the other feed starts to provide full power.

> **NOTE**: Depending on the voltage of the DC feeds (-48 VDC or 240 V China,) power can be drawn from both feeds. The feed with higher voltage provides more power. If the difference between the voltages is sufficient, then the higher voltage feed provides all the power. When the voltages are exactly the same, equal power is drawn from both feeds. For high-voltage second-generation universal (HVAC/HVDC) power system, both input power feeds are active, and share the load when they are present.

A total of two PDMs can be installed into a router. Each DC PDM (-48 V) operates with up to nine separate feeds of either 60-A or 80-A current limit. The capacity of these feeds is relayed to system software through a switch located on the DC PDM. Each DC PDM (240 V China) or DC PDM (-48 V)

—operates with nine feeds each. The MX2010 router supports two types of three-phase power system PDMs. The three-phase delta and three-phase wye. Individual phases are taken from three-phase feeds to individual PSMs. One AC feed provides power to six PSMs, while the second input feed provides power to the remaining three PSMs (supporting a total of nine PSMs).

- Power supply modules (PSMs)—All nine AC, DC, 240 V China, or universal HVAC/HVDC PSMs in a system share the load. For the high-voltage second-generation universal (HVAC/HVDC) power system, both input power feeds are active, and share the load when they are present. If one PSM fails in a redundant configuration, the remaining eight PSMs provide power to FRUs. Up to nine PSMs might be required to supply power to a fully configured router. Nine PSMs supply power to the two CB-REs (active and redundant), eight SFBs, ten MPCs, and four fan trays (active and redundant).

- Cooling system—The cooling system has a total of four fan trays— two per cooling zone (cooling zone 0 and cooling zone 1)—which are controlled and monitored by the host subsystem. Each cooling zone consists of two fan trays. The bottom fan trays are used to cool the bottom half of the CB-REs and SFBs, along with the ten line cards. The top fan trays are used to cool the top half of the CB-REs and SFBs. If a fan fails or the temperature rises above the temperature threshold, the speed of the remaining fans in the zone is automatically adjusted to keep the temperature within the acceptable range (see "MX2010 Cooling System Description" on page 51).

RELATED DOCUMENTATION

MX2010 Router Overview | **2**

Displaying MX2010 Router Components and Serial Numbers | **840**

Guidelines for Packing Hardware Components for Shipment

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

MX2010 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site (see Table 5 on page 21). Replacing most FRUs requires minimal router downtime. The router uses the following types of FRUs:

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

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

NOTE: Before you replace most host subsystem components, such as the Control Board and Routing Engine (CB-RE), you must take the host subsystem offline.

You must power off the Control Board and Routing Engine (CB-RE) before replacing a CompactFlash card or solid-state drive in a Routing Engine.

Table 5 on page 21 lists the FRUs for the MX2010 router.

Table 5: Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• PSM air filter • Air filter (lower) • Lower cable manager • Craft interface • Switch Fabric Board (SFB) (if redundant) • Backup CB-RE (if redundant) • Primary CB-RE (if *nonstop active routing* is configured) • Modular Port Concentrators (MPCs) • Adapter cards • Modular Interface Cards (MICs) • Fan trays • AC power supply modules (if redundant) • AC power distribution modules (if redundant) **NOTE**: A PDM can be replaced without impacting services. However, you must first disconnect it from power. See the PDM replacement procedures listed in Related Documentation. • DC (-48 V) power supply modules (if redundant) • DC (-48 V) power distribution modules (if redundant) • DC (240 VDC China) power supply modules (if redundant) • DC (240 VDC China) power distribution modules (if redundant) • Universal (HVAC/HVDC) power distribution modules (if redundant)	• Control Board and Routing Engine (CB-RE) (nonredundant) • Switch Fabric Board (SFB) (nonredundant)

Table 5: Field-Replaceable Units *(Continued)*

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• Universal (HVAC/HVDC) power supply modules (if redundant)	

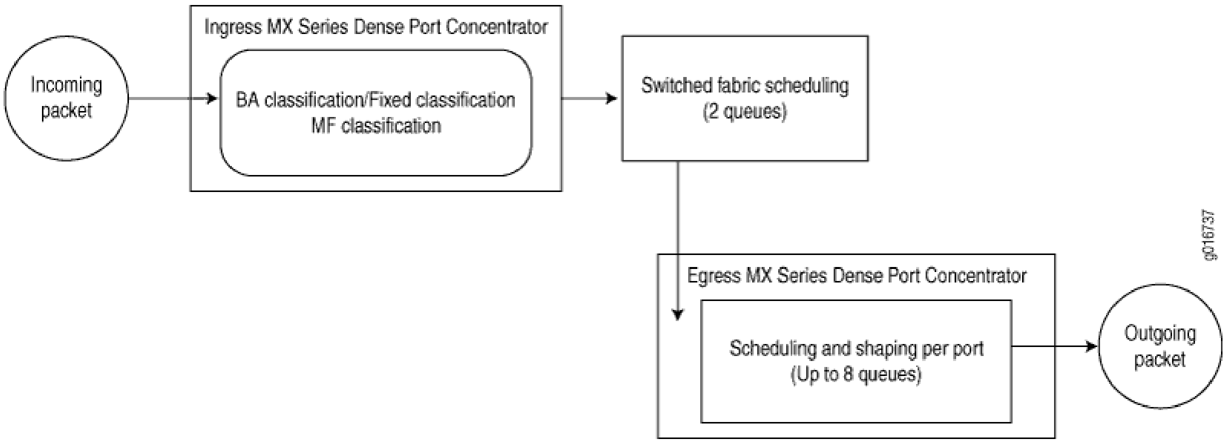
RELATED DOCUMENTATION

Replacing an MX2000 Three-Phase Delta AC Power Distribution Module
Replacing an MX2000 DC Power Distribution Module (-48 V) | **571**
Replacing an MX2010 Three-Phase Wye AC Power Distribution Module
Taking an MX2000 Host Subsystem Offline | **800**
Tools and Parts Required for Replacing MX2010 Hardware Components | **501**
MX2010 Router Hardware Components and CLI Terminology | **29**
Replacing the MX2010 Craft Interface | **547**
Replacing an MX2010 Fan Tray | **606**
Replacing the MX2010 Air Filters | **522**

MX Series Router Packet Forwarding Engine (PFE) Architecture

The general architecture for the MX Series router is shown in Figure 9 on page 23.

Figure 9: MX Series Router Packet Forwarding and Data Flow



Line Cards Supported on MX Series Routers

IN THIS SECTION

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- DPCs | 26
- MPCs and MICs | 26
- Switch Fabric Boards (SFB, SFB2, SFB3) | 27
- Switch Control Boards | 27
- MX2000 ADC | 27
- Routing Engines and CB-REs | 28

Juniper Networks MX Series 5G Universal Routing Platforms process incoming and outgoing packets using:

	Dense Port Concentrator (DPC)	Flexible PIC Concentrator (FPC) with Physical Interface Card (PIC)	Modular Port Concentrator (MPC) with a Modular Interface Card (MIC)	Switch Control Board (SCB, SCBE, SCBE2, SCBE3)
Description	Provides multiple physical interfaces and Packet Forwarding Engines (PFEs) on a single board that installs into a slot within the MX240, MX480, and MX960 routers.	Provides physical interfaces for MX240, MX480, and MX960 routers.	Provides physical interfaces for MX2000 series routers.	• House the routing engine • Control power to MPCs • Monitor and control system functions such as fan speed and the system front panel • Manage clocking, resets, and boots

(Continued)

	Dense Port Concentrator (DPC)	Flexible PIC Concentrator (FPC) with Physical Interface Card (PIC)	Modular Port Concentrator (MPC) with a Modular Interface Card (MIC)	Switch Control Board (SCB, SCBE, SCBE2, SCBE3)
Maximum Supported on MX2020	—	—	20	
Maximum Supported on MX2010	—	—	10	
Maximum Supported on MX960	12	12	12	
Maximum Supported on MX480	6	6	6	
Maximum Supported on MX240	3	2	3	
Configuration Syntax		*type-fpc/pic/port*	*type-fpc/pic/port*	

FPCs and PICs

A Flexible PIC Concentrator (FPC) occupies two Dense Port Concentrator (DPC) slots on an MX240, MX480, MX960 router. Each FPC supports up to two Physical Interface Cards (PICs). FPCs install vertically in the MX960 router chassis, and horizontally in the MX480 and MX240 router chassis. The maximum number of supported FPCs varies per router:

Physical Interface Cards (PICs) provide physical interfaces for MX240, MX480, MX960 routers. They install into the Flexible PIC Concentrators (FPCs). PICs and FPCs function similarly to MICs and MPCs. The maximum number of supported PICs varies per router:

DPCs

A Dense Port Concentrator (DPC) provides multiple physical interfaces and Packet Forwarding Engines (PFEs) on a single board that installs into a slot within the MX240, MX480, and MX960 routers. DPCs install vertically in the MX960 router chassis and horizontally in the MX480 and MX240 router chassis. The maximum number of supported DPCs varies per router:

- MX960 router— up to 12 DPCs
- MX480 router— up to 6 DPCs
- MX240 router— up to 3 DPCs

NOTE: In the Junos OS CLI, you use the FPC syntax to configure or display information about DPCs, and you use the PIC syntax to configure or display information about Packet Forwarding Engines on the DPCs.

In addition to Layer 3 routing capabilities, the DPCs also have many Layer 2 functions that allow MX Series routers to be used for many virtual LAN (VLAN) and other Layer 2 network applications.

MPCs and MICs

Modular Port Concentrators (MPCs) with Modular Interface Cards (MICs) provide packet forwarding services and physical interfaces for MX routers. MICs install into MPCs and function similarly to PICs and FPCs. MPCs install vertically in the MX2020, MX2010, MX2008, and MX960 router chassis, and horizontally in the MX480 and MX240 router chassis. On MX5, MX10, MX40, MX80, and MX104 routers, MICs install directly into the router chassis. There are also fixed-configuration MPCs, with built-in network ports and services functionality. The maximum number of supported MPCs varies per MX router and hardware configuration:

- MX2020 router— up to 20 MPCs
- MX2010 router— up to 10 MPCs
- MX960 router— up to 12 MPCs
- MX480 router— up to 6 MPCs
- MX240 router— up to 3 MPCs

- MX80 router— .

NOTE: The MX80 router is available in a modular configuration chassis (MX80) or fixed configuration chassis (MX80-48T). Both chassis have a fixed 10-Gigabit Ethernet MIC with four ports for uplink connections. The modular MX80 chassis has two dedicated slots for MICs. The fixed configuration MX80 router has an additional 48 10/100/1000Base-T Ethernet ports.

Switch Fabric Boards (SFB, SFB2, SFB3)

Switch Fabric Boards (SFBs) provide increased fabric bandwidth per slot. Up to eight SFBs, SFB2s, or SFB3s can be installed in an MX2020 or MX2010 router. The SFBs install vertically into the front of the chassis in the slots labeled 0 through 7.

NOTE: All switch fabric boards in the chassis must be the same type. Mixed mode is not supported.

Switch Control Boards

Switch Control Boards (MX-SCB, MX-SCBE, MX-SCBE2, and MX-SCBE3) provide full line-rate performance and redundancy without a loss of bandwidth. MX-series SCBs feature an integrated switch fabric that connects to all slots in the chassis in a nonblocking architecture. The SCBs house the routing engine, control power to MPCs, monitor and control system functions such as fan speed and the system front panel, and manage clocking, resets, and boots. The SCB is a single-slot card and has a carrier for the routing engine on the front.

SCBs install vertically in the MX2020, MX2010, and MX960 chassis, and horizontally in the MX480 and MX240 chassis. The number of supported SBCs varies per router:

- MX240 and MX480 routers— 2 SCBs for 1 + 1 MX SCB redundancy when used with the DPC line cards
- MX960 router— 3 SCBs for 2 + 1 redundancy when used with the DPC line cards
- MX2010 and MX2020 routers— 8 SCBs

MX2000 ADC

The MX2000 ADC is a special line card adapter (ADC) that enables MX2010 and MX2020 routers to use smaller form-factor MPCs (MPC1E, MPC2E, and MPC3E). The ADC is merely a shell that accepts line cards in the front and converts power and switch fabric in the rear. ADCs install vertically in the

MPC slot on the front of the router. For more information about the MX2000 ADC, see *MX2000 Adapter Card (ADC) Description*.

Routing Engines and CB-REs

Routing engines and Control Boards with Routing Engines (CB-REs) provide the software processes that run Junos OS. The routing engine maintains the routing tables, manages the routing protocols used on the router, controls the router interfaces, controls some chassis components, and provides the interface for system management and user access to the router. Each CB-RE is a combined Routing Engine and Switch Control Board in one unit.

Ethernet Frame Counts and Statistics on MX Series Routers

The following considerations apply to Ethernet frame counts and statistics on Juniper Networks MX Series 5G Universal Routing Platforms:

- Interface counters *do not* include the 7-byte Ethernet frame preamble and the frame delimiter byte.
- In Media Access Control (MAC) statistics. the frame size includes the MAC header and cyclical redundancy check (CRC) *before* any VLAN rewrite or other rules are applied.
- In traffic statistics, the frame size includes the Layer 2 header without the trailer CRC and *after* any VLAN rewrite or other rules are applied.

RELATED DOCUMENTATION

Layer 2 and Layer 3 Features on MX Series Routers

Understanding Trio Layer 2 Feature Parity

A variety of Layer 2 features are supported on M Series and MX Series routers. The features supported by the Trio family of line cards are listed in Table 6 on page 29.

Table 6: Trio Layer 2 Feature Parity

Feature	Feature Parity with Junos OS Release	Feature Supported in Junos OS Release
MX routers only: load balancing enhancements for Layer 2 Link Aggregation	9.1R1	10.4R1
Ethernet OAM IEEE 802.1ag MIP support	9.1R1	10.4R1
Link Layer Discovery Protocol (LLDP)	9.1R1	10.4R1
MX Series routers only: BPDU guard	9.1R1	10.4R1
MX Series routers only: BPDU loop guard	9.1R1	10.4R1
For next generation VPNs: IRB support with LDP-VLPS and BGP-VPLS interworking	9.1R1	10.4R1
MPLS: BGP multihoming for inter-AS VPLS	9.1R1	10.4R1
MX Series routers only: Ethernet as a core-facing interface in VPLS	9.1R1	10.4R1
Disables next-hop flood in connectivity fault management (CFM)	9.1R1	10.4R1

RELATED DOCUMENTATION

Protocols and Applications Supported on MPCs for MX Series Routers

MX2010 Router Hardware Components and CLI Terminology

The MX2010 router supports the components listed in Table 7 on page 30.

Table 7: MX2010 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	CHAS-BP-MX2010	**MX2010**	"MX2010 Physical Specifications" on page 168 "MX2010 Chassis Description" on page 6
AC Optimized Power Chassis	MX2010-PREMIUM2-AC		
DC Optimized Power Chassis	MX2010-PREMIUM2-DC		
Craft interface panel	MX2010-CRAFT	**Front Panel Display**	"MX2010 Craft Interface Description " on page 34
Cooling system, including air baffle, fan trays, and air filters			"MX2010 Cooling System Description" on page 51
Fan tray	MX2000-FANTRAY	**172mm FanTray - 6 Fans**	
Optimized Power Fan Tray	MX2K-FANTRAY	**Optimized Power fan tray**	
Air baffle	MX2000-UPR-BAFFLE	N/A	
Air filter kit	MX2010-FLTR-KIT-S	N/A	
Power System Components			"MX2010 Power System Description" on page 121
PDM blank cover	MX2000-PDM-BLANK	N/A	"MX2010 DC Power Distribution Module (-48 V) Description" on page 142

Table 7: MX2010 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
Power distribution module (PDM)	MX2000-PDM-DC	DC 52V Power Dist Module	
	MX2K-PDM-DC240V	MX2K 240V HVDC PDM	*MX2000 DC Power Distribution Module (240 V China) Description*
	MX2K-PDM-HV	MX2K UNIVERSAL HV PDM	"MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description" on page 153
	MX2000-PDM-AC-DELTA	AC Delta Power Dist Module	"MX2000 Three-Phase Delta AC Power Distribution Module Description" on page 129
	MX2000-PDM-AC-WYE	AC Y Power Dist Module	"MX2000 Three-Phase Wye AC Power Distribution Module Description" on page 131
	MX2K-PDM-AC-1PH	Single-phase AC PDM	
	MX2K-PDM-OP-AC	Single-phase AC PDM (6+1)	
	MX2K-PDM-OP-DC	Optimized Power DC PDM (6+1)	
PSM blank cover	MX2000-PSM-BLANK	N/A	"MX2010 Power System Description" on page 121
Power supply module (PSM)	MX2000-PSM-AC	AC 52V Power Supply Module	

Table 7: MX2010 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
	MX2000-PSM-DC	**DC 52V Power Supply Module**	
	MX2K-PSM-DC240V	MX2K 240V HVDC PSM	*MX2000 DC Power Supply Module (240 V China) Description*
	MX2K-PSM-HV	**MX2K UNIVERSAL HV PSM**	"MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description" on page 156
MIC	See *MX Series Interface Module Reference*		"MX2010 Modular Interface Card Description" on page 102
MPC blank cover	MX2000-LC-BLANK	N/A	"MX2010 Modular Port Concentrator Description" on page 92
MPC	See *MX Series Interface Module Reference*		
ADC	MX2000-LC-ADAPTER	**Adapter Card**	*MX2000 Adapter Card (ADC) Description*
SFB blank cover	MX2000-RE-SFB-BLANK	N/A	"MX2000 Switch Fabric Board (SFB) Overview" on page 72
SFB	MX2000-SFB	**Switch Fabric Board**	
CB-RE blank cover	MX2000-RE-SFB-BLANK	N/A	
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**Control Board**	

Table 7: MX2010 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
Routing Engine	RE-MX2000-1800X4	RE-S-1800x4	"RE-MX2000-1800x4 CB-RE Description" on page 58
Transceiver	See *MX Series Interface Module Reference*	Xcvr	"Installing an SFP or XFP into an MX2000 MPC or MIC" on page 499

RELATED DOCUMENTATION

MX2010 Router Overview | 2

MX Series Router Interface Names

MX2010 Port and Interface Numbering | 117

CHAPTER 3

Alarm and Display Components

IN THIS CHAPTER

- MX2010 Craft Interface Description | **34**
- MX2010 Component LEDs on the Craft Interface | **36**
- MX2010 Alarm Relay Contacts on the Craft Interface | **40**
- MX2010 Alarm LEDs and Alarm Cutoff/Lamp Test Button | **41**

MX2010 Craft Interface Description

The craft interface enables the user 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 on the front of the router above the upper fan tray and contains LEDs for the router components, the alarm relay contacts, and alarm cutoff button (see Figure 10 on page 34). Table 8 on page 35 describes the LEDs, buttons, and connectors.

Figure 10: Front Panel of the Craft Interface

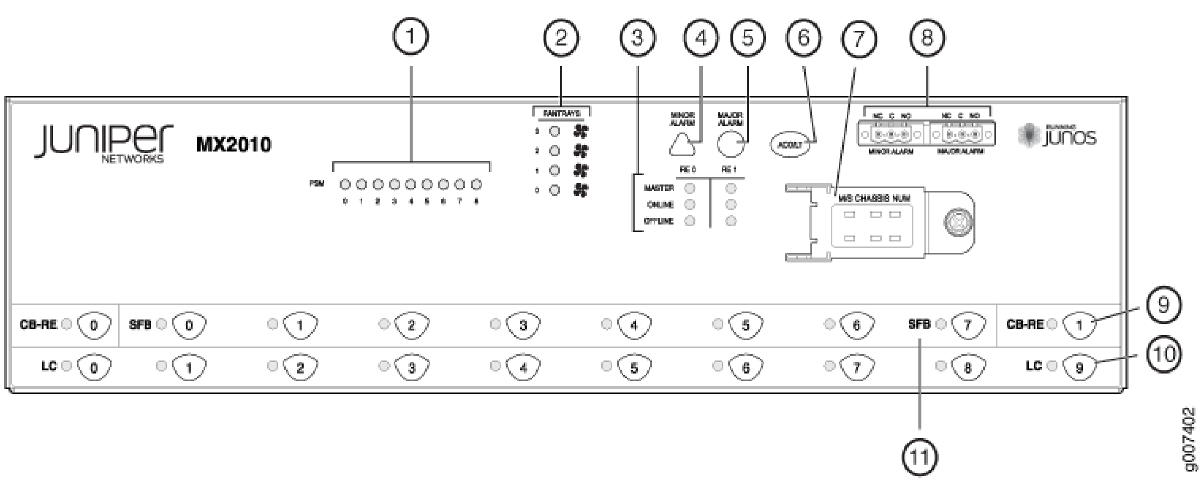


Table 8: Craft Interface LEDs, Buttons, and Connectors

Function No.	Label	Description
1	**PSM**	Status LEDs for PSMs **0** through **8**
2	**FANTRAYS**	Status LEDs for fan trays **0** through **3**
3	**RE0** (**MASTER**, **ONLINE**, and **OFFLINE**) **RE1** (**MASTER**, **ONLINE**, and **OFFLINE**)	Two sets of status LEDs per host subsystem. There are three LEDs per Routing Engine.
4	**MINOR ALARM**	Minor Alarm LED for monitoring or maintaining the MX2010
5	**MAJOR ALARM**	Major Alarm LED for critical conditions, which can result in system shutdown
6	**ACO/LT**	Alarm Cutoff/ Lamp Test Button. Turns off both minor and major alarms and deactivates the device attached to the corresponding alarm relay contact on the craft interface
7	**M/S CHASSIS NUM**	Chassis ID Dial and Standalone Dial. One dial is used to indicate the chassis number for multi-chassis configurations. The second dial is used to indicate whether the chassis is operating in standalone mode or as part of a multichassis system.
8	**MINOR ALARM–[NC C NO]** **MAJOR ALARM–[NC C NO]**	Two sets of alarm terminal contacts. Each consisting of normal open and normal closed relays that signal a minor or major alarm when broken.

Table 8: Craft Interface LEDs, Buttons, and Connectors *(Continued)*

Function No.	Label	Description
9	**CB-RE 0** and **CB-RE 1**	Online and Offline buttons located next to each Control Board and Routing Engine (CB-RE) enable you to take individual CB-REs offline or online. Status LEDs for the two CB-REs cards.
10	**LC 0** through **LC 9**	Online and Offline buttons located next to each line card enable you to take individual line cards offline or online. Status LEDs for the lower ten line cards.
11	**SFB 0** through **SFB 7**	Online and Offline buttons located next to each SFB enable you to take individual SFBs offline or online. Status LEDs for eight SFBs.

RELATED DOCUMENTATION

Replacing the MX2010 Craft Interface | 547
MX2010 Craft Interface Serial Number Label | 850

MX2010 Component LEDs on the Craft Interface

IN THIS SECTION

- MX2010 Host Subsystem LEDs and Buttons on the Craft Interface | 37
- MX2010 Power Supply Module LEDs on the Craft Interface | 37
- MX2010 Line-Card LEDs and Buttons on the Craft Interface | 38
- MX2010 SFB LED and Buttons on the Craft Interface | 38

- MX2010 Fan Tray LEDs on the Craft Interface | 39

MX2010 Host Subsystem LEDs and Buttons on the Craft Interface

Each host subsystem has three LEDs, located in the upper middle of the craft interface, that indicate its status. The LEDs labeled **RE0** show the status of the Routing Engine on the CB-RE in slot **0**. The LEDs labeled **RE1** show the status of the Routing Engine on the CB-RE in slot **1**. Table 9 on page 37 describes the functions of the host subsystem LEDs.

Table 9: Host Subsystem LEDs on the Craft Interface

Label	Color	State	Description
MASTER	Green	On steadily	Host is functioning as the primary.
ONLINE	Green	On steadily	Host is online and is functioning normally.
OFFLINE	Red	On steadily	Host is installed but the Routing Engine on the CB-RE is offline.
	–	Off	Host is not installed.

When placing the CB-RE offline, the Routing Engine goes offline. The Routing Engine gets powered by the Control Board.

MX2010 Power Supply Module LEDs on the Craft Interface

Each Power Supply Module (PSM) has one bicolor LED on the craft interface that indicates its status. The LEDs, labeled **0** through **8**, are located on the upper left of the craft interface next to the **PSM** label. Table 10 on page 37 describes the functions of the PSM LEDs on the craft interface.

Table 10: Power Supply Module LEDs on the Craft Interface

Label	Color	State	Description
PSM	Green	On steadily	PSM is functioning normally.

Table 10: Power Supply Module LEDs on the Craft Interface *(Continued)*

Label	Color	State	Description
	Red	On steadily	PSM module has failed or power input has failed.

MX2010 Line-Card LEDs and Buttons on the Craft Interface

Each line card (MPC) has one bicolor LED on the craft interface that indicates its status. The LEDs, labeled **0** through **9**, are located along the bottom of the craft interface. Table 11 on page 38 describes the functions of the LEDs.

Table 11: Line-Card LEDs on the Craft Interface

Label	Color	State	Description
OK	Green	On steadily	Line card functioning normally.
		Blinking	Line card is transitioning online or offline.
	–	Off	The slot is not online.
FAIL	Red	On steadily	Line card has failed.

There are ten push buttons located next to each of the line cards on the craft interface. These buttons are used to place the line cards online or offline. When a line card is inserted into an adapter card, and installed into the MX2010 router, the online/offline buttons can turn both cards on or off.

NOTE: When installing an adapter card without the line card, the online/offline buttons have no affect.

MX2010 SFB LED and Buttons on the Craft Interface

Each SFB has one tricolor LED on the craft interface that indicates its status. The SFB LED, labeled **0** through **7**, are located along the bottom of the craft interface. Table 12 on page 39 describes the functions of the SFB LED.

Table 12: SFB LED on the Craft Interface

Label	Color	State	Description
OK	Green	On steadily	SFB functioning normally.
		Blinking	SFB is transitioning online or offline.
	–	Off	The slot is not online.
FAIL	Red	On steadily	SFB has failed.

There are eight push buttons located next to each of the SFBs on the craft interface. These buttons are used to place the SFBs online or offline.

MX2010 Fan Tray LEDs on the Craft Interface

The fan tray LEDs, labeled **0** through **3**, are located on the top middle of the craft interface. Table 13 on page 39 describes the functions of the fan tray LEDs.

Table 13: Fan LEDs on the Craft Interface

Label	Color	State	Description
FAN TRAY	Green	On steadily	Fan is functioning normally.
	Red	On steadily	Fan in a fan tray has failed. Fan tray has failed.

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34
MX2010 Alarm Relay Contacts on the Craft Interface | 40

MX2010 Alarm Relay Contacts on the Craft Interface

The craft interface has two alarm relay contacts for connecting the router to external alarm devices (see Figure 11 on page 40). Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located on the upper right of the craft interface (see Table 14 on page 40).

Figure 11: Alarm Relay Contacts

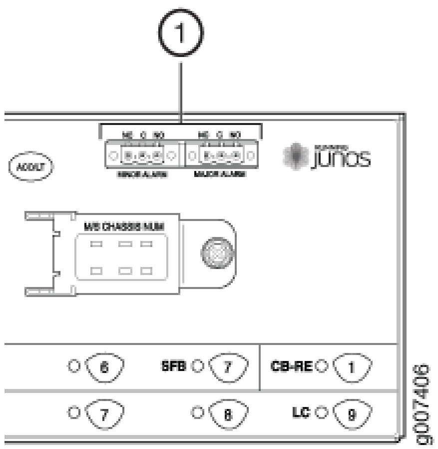


Table 14: Alarm Relay Contacts

Function No.	Label	Description
1	MINOR ALARM–[NC C NO] MAJOR ALARM–[NC C NO]	The alarm relays consist of three terminal contacts with a normal closed (NC), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

RELATED DOCUMENTATION

Disconnecting the Alarm Relay Wires from the MX2010 Craft Interface | 408
Connecting the Alarm Relay Wires to the MX2010 Craft Interface | 407

MX2010 Alarm LEDs and Alarm Cutoff/Lamp Test Button

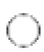
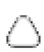
Two large alarm LEDs are located at the upper right of the craft interface. When lit, the circular red LED indicates a critical condition that can result in a system shutdown. A lit triangular yellow LED indicates a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously.

A condition that causes an LED to light also activates the corresponding alarm relay contact on the craft interface.

To deactivate red and yellow alarms, press the button labeled **ACO/LT** (for "alarm cutoff/lamp test"), which is located to the right of the alarm LEDs. Deactivating an alarm turns off both LEDs and deactivates the device attached to the corresponding alarm relay contact on the craft interface.

Table 15 on page 41 describes the alarm LEDs and alarm cutoff button in more detail.

Table 15: Alarm LEDs and Alarm Cutoff/Lamp Test Button

Shape	Color	State	LED Control Name	Description
	Red	On steadily	Critical alarm	Indicates a critical condition that can cause the router to stop functioning. Possible causes include component removal, failure, or overheating.
	Yellow	On steadily	Warning alarm	Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature.
	–	–	Alarm cutoff/lamp test button	Deactivates red and yellow alarms. Causes all LEDs on the craft interface to light (for testing) when pressed and held.

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34
MX2010 Alarm Relay Contacts on the Craft Interface | 40
MX2010 Router Overview | 2

CHAPTER 4

Cable and Rack Management

IN THIS CHAPTER

- MX2010 Cable Manager Description | 42
- MX2010 Rack-Mounting Hardware | 50

MX2010 Cable Manager Description

IN THIS SECTION

- Standard Cable Manager | 42
- Extended Cable Manager | 46

The MX2010 router supports the following cable managers:

Standard Cable Manager

The standard cable manager consists of the following components:

- Card-cage cable manager and air filter—MX2000-CBL-MID
- Lower cable manager—MX2000-CBL-BTM-S
- DC power cable manager—MX2010-DC-CBL-MGR-S
- Cable manager for the DC PDM (240 V China) and the universal (HVAC/HVDC PDM)—MX2K-HV-CBL-MGR

The lower cable manager (see Figure 12 on page 43) is located just below the bottom line-card cage, has a removable cover that is secured by two captive screws with access to rows used for routing and securing the cables away from the front of the Modular Port Concentrators (MPCs), and Modular Interface Cards (MICs) (see Figure 13 on page 44).

You can use cable strips or other ties to gently secure the cables in the lower cable manager. To secure the cables in place, loop the tie through the cable anchor and secure the tie.

Each DC PDM has one cable manager. The DC cable manager routes cables away from the rear of the PDMs, (see Figure 12 on page 43).

You can use cable strips or other ties to gently secure the cables in the DC cable manager. To secure the cables in place, loop the tie through the cable anchor and secure the tie. You can pull the DC cable manager up and outward to lock it into the maintenance position.

Figure 12: MX2010 Standard Cable Managers

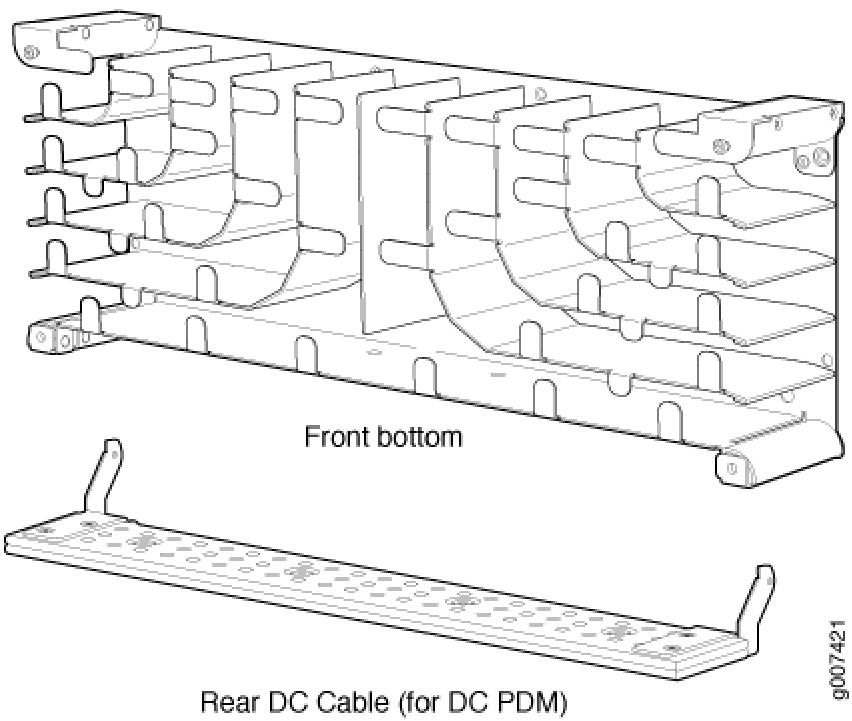
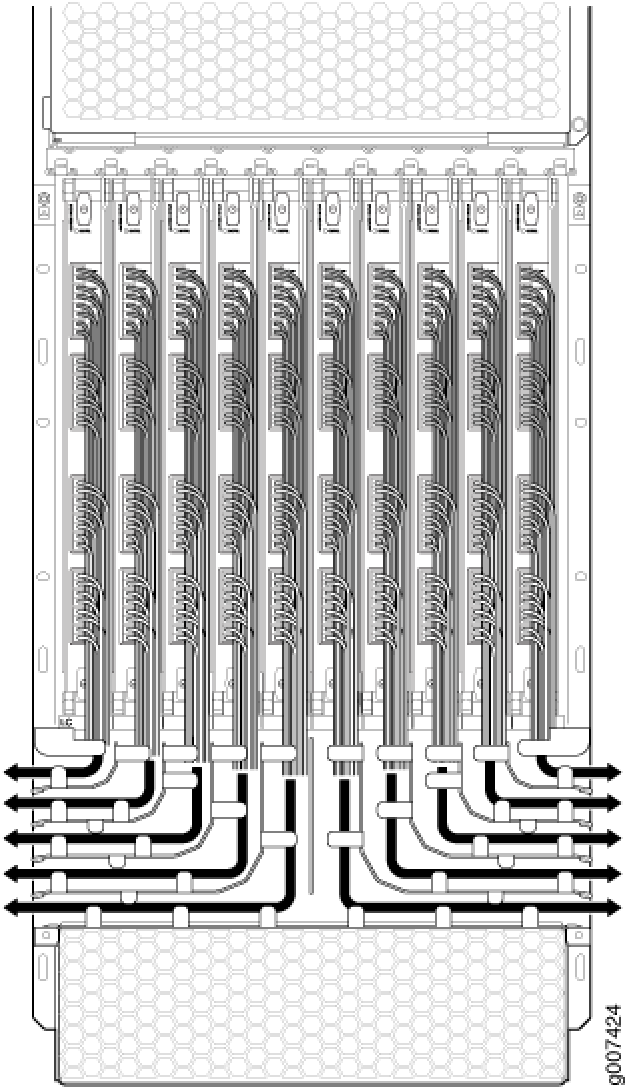


Figure 13: Lower Cable Manager



The card-cage cable manager (see Figure 14 on page 45 and Figure 15 on page 46) is a combination cable tray and air filter located in the upper card cage, which has rows for routing and securing the cables away from the front of the CB-REs, and SFBs.

You can use cable strips or other ties to gently secure the cables in the card-cage cable manager. To secure the cables in place, loop the tie through the cable anchor and secure the tie. To access the air filter, the cable manager needs to be opened.

Figure 14: Card-Cage Cable Manager

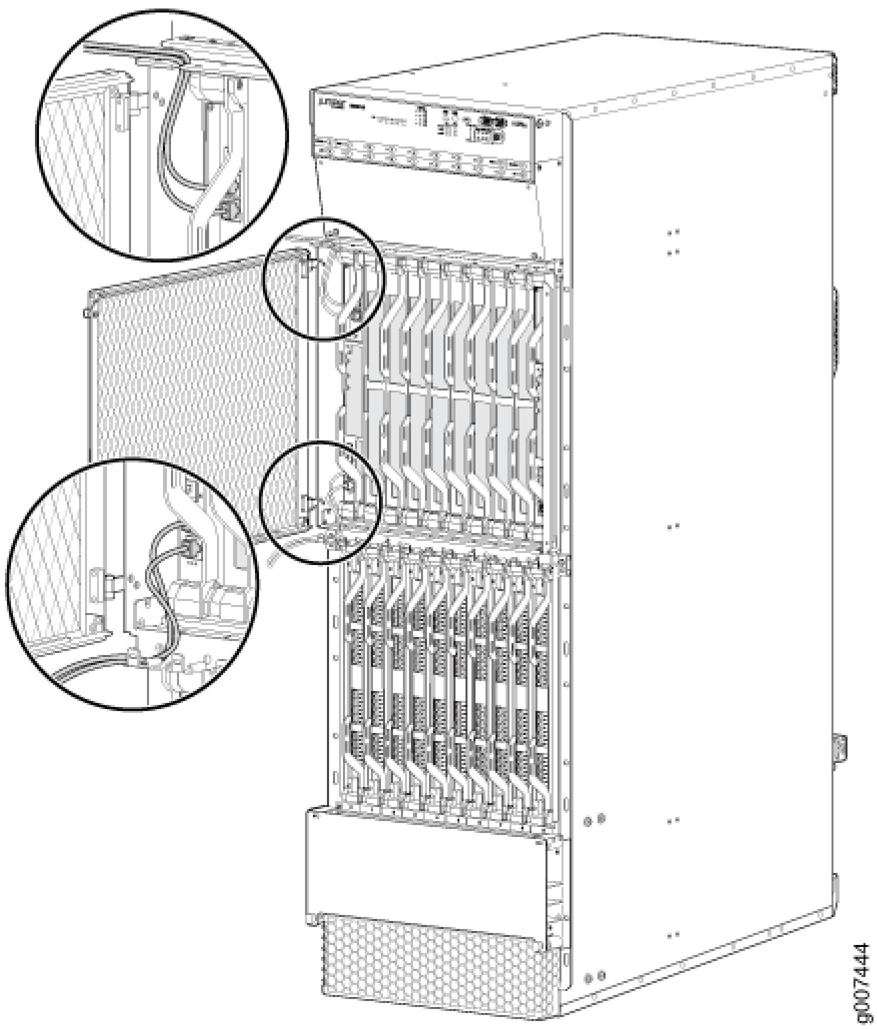
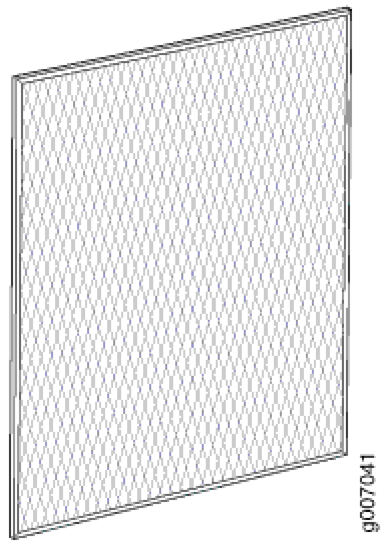


Figure 15: Card-Cage Air Filter



Extended Cable Manager

The extended cable manager consists of the following components:

- Extended lower cable manager—MX2000-CBL-BTM-XT-S
- Extended DC cable manager—MX2020-DC-CBL-MGR-XT-S
- Extended DC cable manager—MX2020-DC-CBL-MGR-XT-S

Figure 16: MX2010 Extended Cable Manager

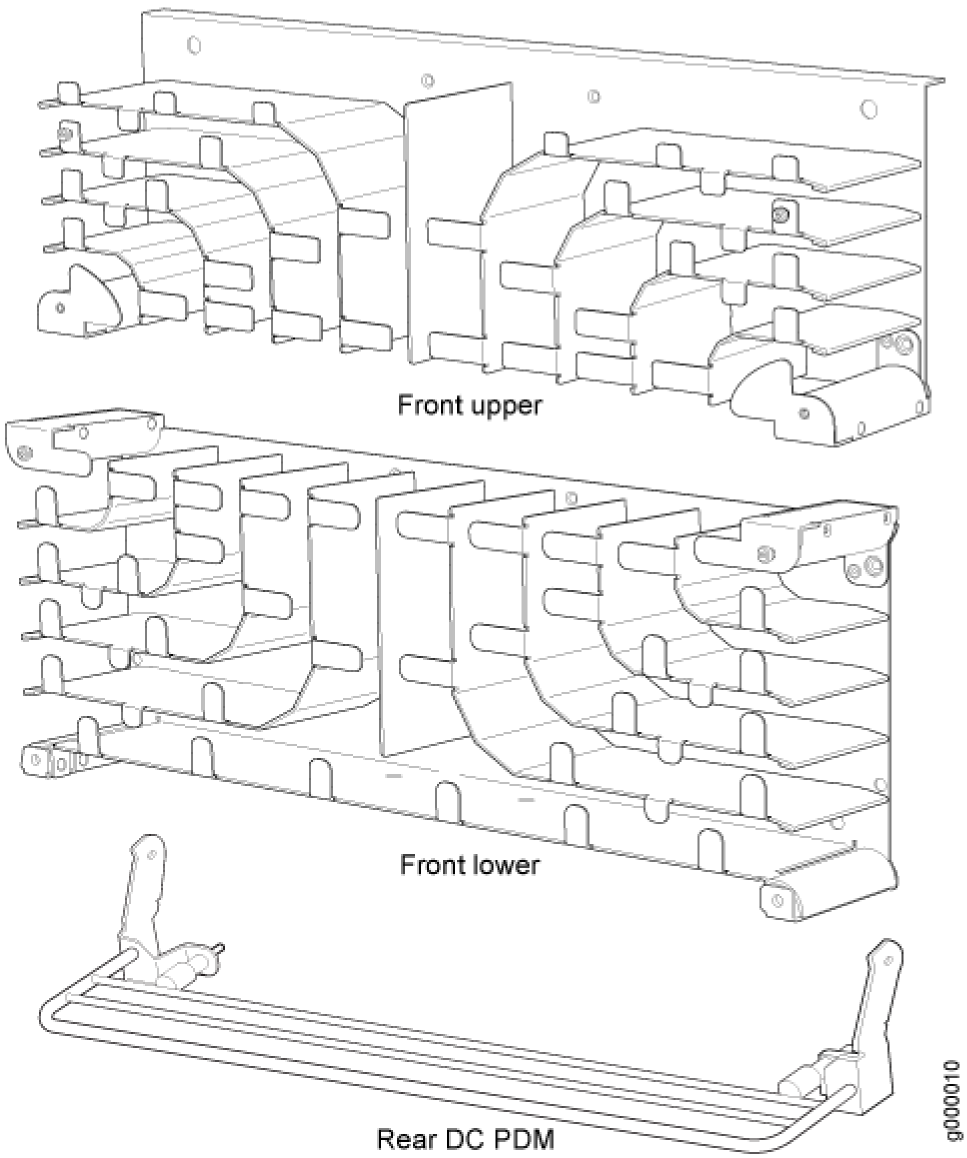
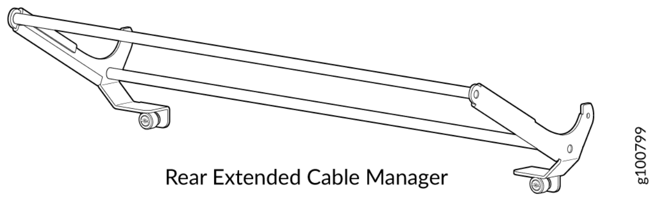
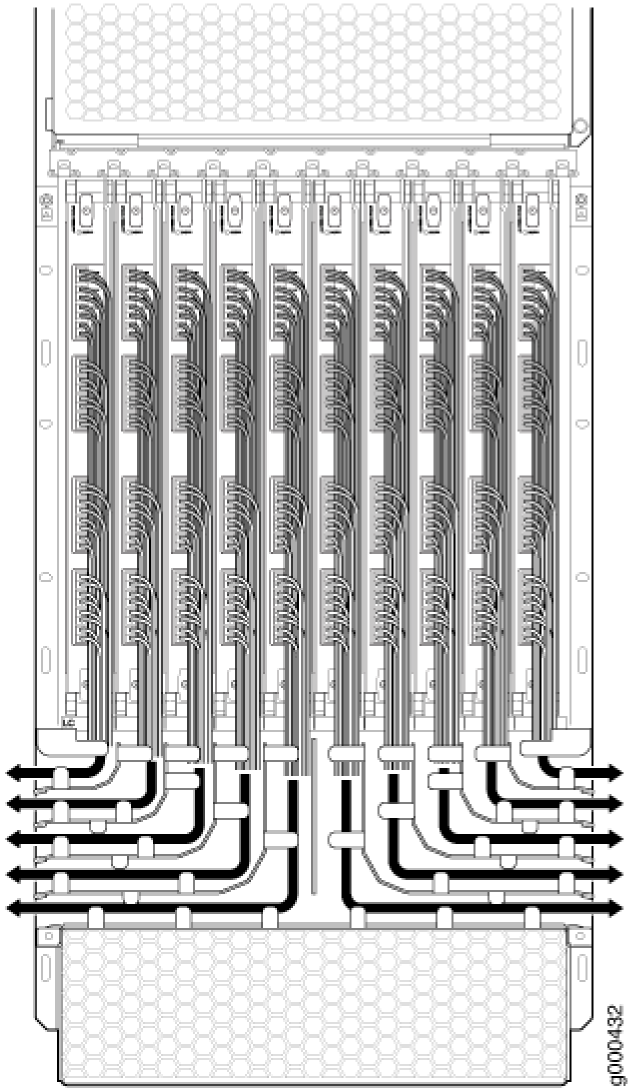


Figure 17: MX2000 Rear Extended Cable Manager for the DC PDM (240 V China) and the Universal (HVAC/HVDC) PDM



The extended cable manager provides additional support to route and secure a large number of cables away from the front of the MPCs and MICs (see Figure 18 on page 49).

Figure 18: MX2010 Lower Extended Cable Manager



The extended DC cable manager provides additional support to route and secure a large number of cables away from the rear of the PDMs.

You can use cable strips or other ties to gently secure the cables in the upper and lower extended cable managers. To secure the cables in place, loop the tie through the cable anchor and secure the tie.

RELATED DOCUMENTATION

Installing the MX2010 Standard Cable Manager | 455

Installing the MX2010 Standard DC Cable Manager | 430

Replacing the MX2010 Standard Cable Managers | 535

MX2010 Rack-Mounting Hardware

The rack-mounting hardware for the MX2010 router includes:

- One large adjustable mounting shelf for mounting in four-post racks or cabinets
- Built-in front-mounting flanges on the front of the chassis for front-mounting in a four-post rack or cabinet
- One open-frame mounting shelf for mounting in an open-frame rack (optional)
- Two center-mounting brackets for mounting the router in an open-frame rack (optional)
- Mounting screws
- Cage-nuts

NOTE: There must be a minimum or 34U of usable rack space when installing the MX2010 router into a 34-U rack.

RELATED DOCUMENTATION

MX2010 Chassis Description | 6
MX2010 Backplane Description | 14
MX2010 Power Midplane Description | 128
Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet | 294

CHAPTER 5

Cooling System

IN THIS CHAPTER

- MX2010 Cooling System Description | 51
- MX2010 Fan Tray LED | 55

MX2010 Cooling System Description

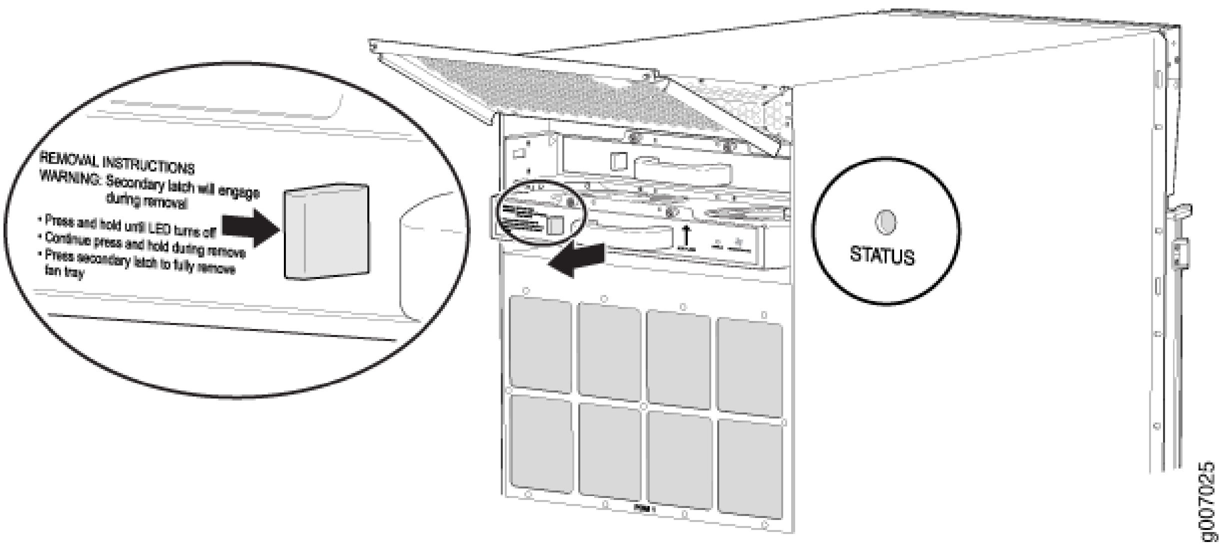
The cooling system consists of the following components:

- Fan tray—MX2000-FANTRAY
- Lower fan tray air filter—MX2010-FLTR-KIT-S
- Air baffle—MX2000-UPR-BAFFLE

The cooling system components work together to keep all router components within the acceptable temperature range. The router has four fan trays, two trays located at the top, and two trays located at the bottom of the router that install horizontally. Each fan tray contains six fans and are 172 mm in diameter. The fan trays are interchangeable and are hot-insertable and hot-removable.

Each fan tray has a double safety latch, so the fan tray cannot be removed in one swift motion (see Figure 19 on page 52). To remove the fan tray, press and hold the latch until LED turns off. The secondary latch will engage during removal. Press the secondary latch to fully remove the fan tray.

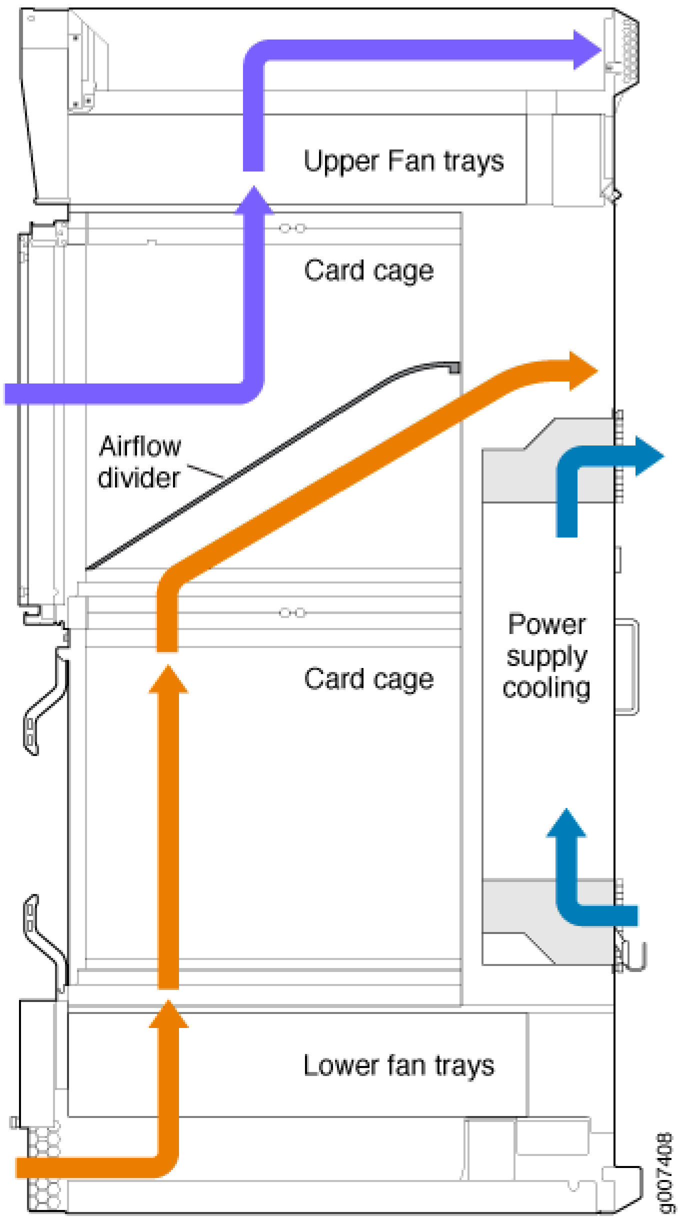
Figure 19: Removing Fan Tray



WARNING: Before removing a fan tray, make sure the fan blades have stopped completely.

The host subsystem monitors the temperature of the router components. When the router is operating normally, the fans function at lower than full speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range (see Figure 20 on page 53 and Figure 21 on page 54). The lower fan tray filter is shown in Figure 22 on page 54.

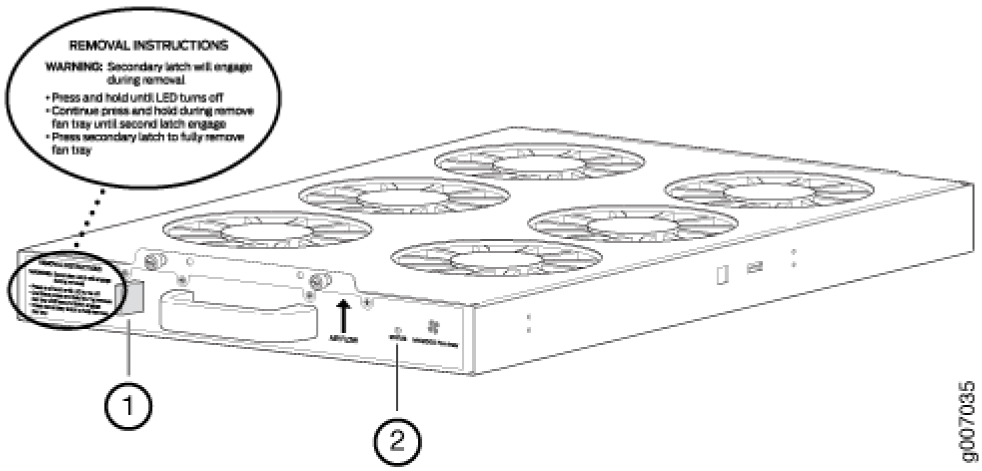
Figure 20: Airflow Through the Chassis



The MX2010 router provides a two-stage front-to-back cooling system. Air is pushed into the bottom inlet and up through the lower fan tray, and exits through the opening between the backplanes in the center of the chassis. This cools the bottom MPCs, and half of each SFB and CB-RE. Air is pulled through the SFBs and all the CB-REs in the center of the chassis and is exhausted out the upper rear of the system.

The CB-REs and SFBs are equipped with an air divider to deflect the exhaust air for the bottom half of the system out and direct the air for the top half of the system out.

Figure 21: Upper/Lower Fan Tray

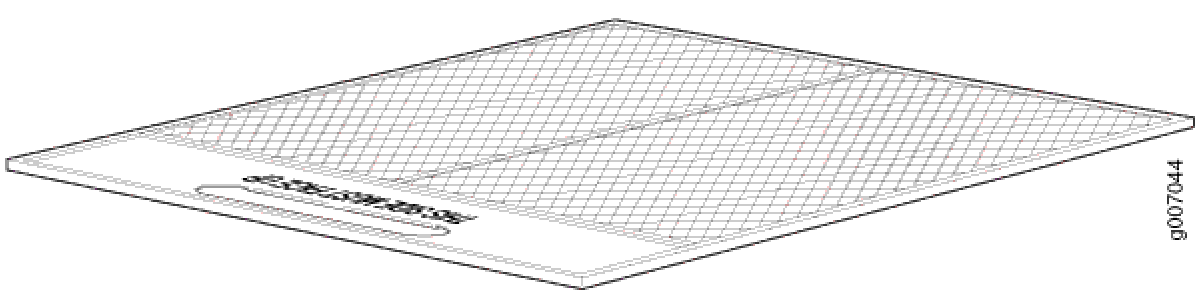


1– Safety double latch system	2– **STATUS** LED

> **WARNING**: Before removing a fan tray, make sure that the fan blades have stopped completely.

> **WARNING**: The fan trays use a double latch safety mechanism. Press and hold the latch until the **STATUS** LED turns off. Continue to press and hold the latch while removing the fan trays.

Figure 22: Lower Fan Tray Air Filter



The air baffle is an optional component that can be purchased from Juniper Networks.

When installed over the upper fan tray access door, the air baffle dissipates exhausted air away from the router.

RELATED DOCUMENTATION

Troubleshooting the MX2010 Cooling System | 820
Maintaining the MX2010 Air Filters | 716
Maintaining the MX2010 Fan Trays | 743
Maintaining the MX2010 Air Baffle | 754

MX2010 Fan Tray LED

Each fan tray (both the standard fan tray and optimized power fan tray) contains one bicolor LED located on the front faceplate (see Table 16 on page 55). A set of four bicolor fan tray LEDs is located on the top middle of the craft interface. For more information, see "MX2010 Component LEDs on the Craft Interface" on page 36.

Table 16: Fan Tray LEDs

Label	Color	State	Description
STATUS	Green	On	Fan tray is operating properly.
	Yellow	On	Fan tray is not receiving enough power to operate.
			Fan temperature may indicate warm threshold.
	Red	On	Fan tray is nonoperational.
			One or more fans are bad or not operating.
			Fan temperature may indicate high threshold.

RELATED DOCUMENTATION

MX2010 Cooling System Description | 51
Maintaining the MX2010 Fan Trays | 743
Troubleshooting the MX2010 Cooling System | 820

MX2010 Component LEDs on the Craft Interface | 36

CHAPTER 6

Host Subsystem Components

IN THIS CHAPTER

- MX2000 Host Subsystem CB-RE Description | 57
- RE-MX2000-1800x4 CB-RE Description | 58
- REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description | 62
- REMX2K-X8-128G CB-RE Description | 65
- CB-RE LEDs | 69
- MX2000 Switch Fabric Board (SFB) Overview | 72
- MX2000-SFB-S Switch Fabric Board Description | 73
- MX2000-SFB2-S Enhanced Switch Fabric Board Description | 77
- MX2000-SFB3 Switch Fabric Board Description | 81
- MX2000 Switch Fabric Board LED | 89

MX2000 Host Subsystem CB-RE Description

The CB-RE is a combined Routing Engine and Control Board in one unit. It performs the following functions:

- Maintains the routing tables
- Manages the routing protocols used on the router
- Controls the router interfaces
- Controls some chassis components
- Provides the interface for system management and user access to the route

The CB-RE is hot-pluggable and installs into the front of the MX2000 chassis in vertical slots labeled **0** and **1**. A USB port on the CB-RE accepts a USB memory device that allows you to load Junos OS. You can install one or two CB-REs in the router. If two CB-REs are installed, one functions as the primary and the other acts as the backup. If the primary CB-RE fails or is removed and the backup is configured appropriately, the backup takes over as the primary. If no CB-RE is installed in a slot, install a blank panel in the slot.

A minimum of one CB-RE must be installed in either slot **0** or slot **1** at all times.

CAUTION: If one CB-REs fails, do not remove the failed CB-RE until you have a replacement or blank panel to install.

The MX2000 line of routers supports the following CB-RE’s:

- RE-MX2000-1800x4 CB-RE
- REMX2K-X8-64G-LT CB-RE

NOTE: REMX2K-X8-64G-LT CB-RE has limited encryption support.

RELATED DOCUMENTATION

Maintaining the MX2020 Host Subsystem

RE-MX2000-1800x4 CB-RE Description

IN THIS SECTION

- RE-MX2000-1800x4 CB-RE Front Panel | 59
- RE-MX2000-1800x4 CB-RE Components | 60
- RE-MX2000-1800x4 CB-RE Software | 61
- RE-MX2000-1800x4 CB-RE Boot Sequence | 61

The RE-MX2000-1800x4 CB-RE runs Junos OS. Software processes that run on the CB-RE maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

RE-MX2000-1800x4 CB-RE Front Panel

Figure 23 on page 59 shows the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4.

Table 17 on page 59 describes the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4 ports.

Figure 23: RE-MX2000-1800x4 CB-RE Front View

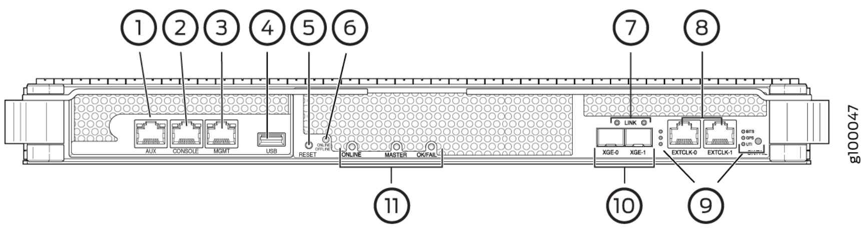


Table 17: Components on the RE-MX2000-1800x4

Function No.	Label	Description
1	**AUX**	This port is used to connect a laptop, modem, or other auxiliary unit.
2	**CONSOLE**	This port is used to configure the MX2000 router.
3	**MGMT**	This port is a dedicated management channel for device maintenance. It is also used for system administrators to monitor and manage the MX2000 router remotely.
4	**USB**	This port is used to install a USB flash drive that contains Junos OS.
5	**RESET**	Reboots the CB-RE.
6	**ONLINE/OFFLINE**	Takes the Routing Engine on the CB-RE online or offline.

Table 17: Components on the RE-MX2000-1800x4 *(Continued)*

Function No.	Label	Description
7	**LINK**	These LEDs are associated with each of the SFP+ ports (XGE-0 and XGE-1) and indicate the connection in use.
8	**ExtClk-1** and **ExtClk-2**	Connects the CB-RE to two external clock interfaces for BITS and GPS function through a serial cable with an RJ-45 connector.
9	**GPS**, and **BITS**	There is one bicolor LED for each external clock interface—BITS and GPS.
10	**XGE-0** and **XGE-1**	These ports are used for hardware diagnostics and are for Juniper-internal use only.
11	**ONLINE**, **MASTER**, and **OK/ FAIL**	There is one bicolor LED for each CB-RE control. The **ONLINE** LED indicates that the CB-RE is transitioning online and functioning properly. The **MASTER** LED indicates that this board is a primary Control Board and Routing Engine (CB-RE) , and the **OK/FAIL** LED indicates the CB-RE has failed.

RE-MX2000-1800x4 CB-RE Components

Each CB-RE consists of the following components:

- External clock interface—Allows BITS or GPS clock source input to the centralized timing circuit, or allows centralized timing to be output to BITS or GPS.
- 1000Base-T Ethernet controller
- Circuits for chassis management and control.
- Power circuits for the CB-RE.
- Control FPGA—Provides the Peripheral Component Interconnect (PCI) interface to the routing engine.

- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components.
- CPU—Runs Junos OS to maintain the router's routing tables and routing protocols.
- I2C bus logic, used for low-level communication with each component.
- DRAM—Provides storage for the routing and forwarding tables and for other routing engine processes.
- Component redundancy circuitry.
- USB port—Provides a removable media interface through which you can install the Junos OS manually. Junos OS supports USB version 1.0.
- CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The CompactFlash card is fixed and is inaccessible from outside the router.
- Solid State Disk (non-removable)—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.
- Interface ports—The **AUX**, **CONSOLE**, and **MGMT** ports provide access to management devices. Each CB-RE has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device. The two ports labeled **XGE-0** and **XGE-1** are used for hardware diagnostics and are for Juniper-internal use only. The **ExtClk** ports provide access to external timing distribution.
- EEPROM—Stores the serial number of the CB-RE.
- Reset button—Reboots the Routing Engine on the CB-RE when pressed.
- Online/Offline button—Takes the Routing Engine on the CB-RE online or offline when pressed.
- LEDs—Provide status of the Routing Engine on the CB-RE.

RE-MX2000-1800x4 CB-RE Software

The RE-MX2000-1800x4 CB-RE runs Junos OS. Software processes that run on the CB-RE maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

RE-MX2000-1800x4 CB-RE Boot Sequence

The router is shipped with the Junos OS pre-installed on the CB-RE. There are three copies of software:

- One copy on a USB flash drive that can be inserted into the slot on the CB-RE faceplate.

- One copy on the CompactFlash card in the Routing Engine.
- One copy on the Solid State Disk (SSD) in the CB-RE.

NOTE: The SSD is internal and cannot be removed.

The Routing Engine interface boots from the storage media in this order: the USB device (if present), then the CompactFlash card, then the SSD, and then the LAN. Normally, the router boots from the copy of the software on the CompactFlash card.

RELATED DOCUMENTATION

RJ-45 Connector Pinouts for MX Series CB-RE Auxiliary and Console Ports

RJ-45 Connector Pinouts for an MX Series CB-RE or RCB Management Port

Removing a CB-RE from an MX2000 Router | 504

MX2000 Host Subsystem CB-RE Description | 57

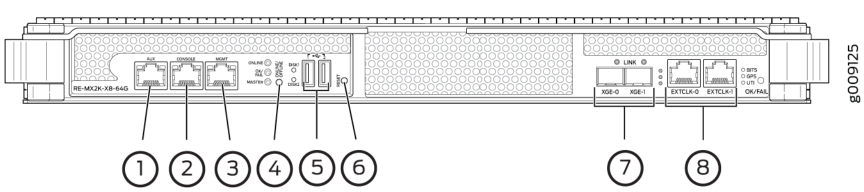
REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description

IN THIS SECTION

- REMX2K-X8-64G CB-RE Components | 62
- REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Boot Sequence | 64

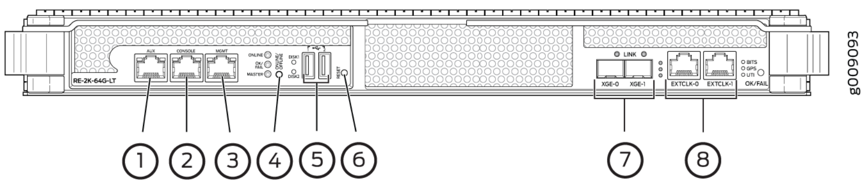
REMX2K-X8-64G CB-RE Components

Figure 24: REMX2K-X8-64G CB-RE Components



1– **AUX** port	5– USB ports
2– **CONSOLE** port	6– **RESET** button
3– **MGMT** port	7– **XGE-0** and **XGE-1** ports
4– **ONLINE/OFFLINE** button	8– **EXTCLK0** and **EXTCLK1** ports

Figure 25: REMX2K-X8-64G-LT CB-RE Components



1– **AUX** port	5– USB ports
2– **CONSOLE** port	6– **RESET** button
3– **MGMT** port	7– **XGE-0** and **XGE-1** ports
4– **ONLINE/OFFLINE** button	8– **EXTCLK0** and **EXTCLK1** ports

Each Control Board-Routing Engine (CB-RE) consists of the following components:

- External clock interface—Allows BITS or GPS clock source input to the centralized timing circuit, or allows centralized timing to be output to BITS or GPS.
- 1000Base-T Ethernet controller.
- Circuits for chassis management and control.
- Power circuits for the CB-RE.
- Control FPGA—Provides the Peripheral Component Interconnect (PCI) interface to the Routing Engine.
- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components.
- CPU—Runs Junos OS as a guest OS to maintain the router's routing tables and routing protocols.
- I2C bus logic, used for low-level communication with each component.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- Component redundancy circuitry.
- USB ports—Provides a removable media interface through which you can install Junos OS and Linux manually. Junos OS supports USB versions, 3.0, 2.0, and 1.1.

- Solid-state drives (nonremovable)—Provides secondary storage for log files, memory dumps, and system reboot.
- Interface ports—The **AUX**, **CONSOLE**, and **MGMT** ports provide access to management devices. Each CB-RE has one 10/100/1000-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device. The two SFP+ ports (**XGE-0** and **XGE-1**) provide support for hardware diagnostics and JCS port testing. The **EXTCLK1** and **EXTCLK2** ports provide access to external timing distribution.

> **NOTE**: Use sheilded CAT5e cable for connecting the **AUX**, **CONSOLE**, and **MGMT** ports.

- EEPROM in RE—Stores the field replacement unit (FRU) details of the RE.
- EEPROM in CB—Stores the field replacement unit (FRU) details of the CB.
- **RESET** button—Reboots the Routing Engine on the CB-RE when pressed.
- **ONLINE/OFFLINE** button—Makes the Routing Engine on the CB-RE online or offline when pressed.

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

- LEDs—Provide status of the Routing Engine on the CB-RE.

REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Boot Sequence

The router is shipped with Junos OS and Linux preinstalled on the CB-RE. There are two copies of software:

- One copy on a USB flash drive that can be inserted into the slot on the CB-RE faceplate.
- One copy each on the two SSDs in the CB-RE.

> **NOTE**: The SSD is internal and cannot be removed.

The Routing Engine interface boots from the storage media in this order: the USB device, SSD1, SSD2, and then the LAN.

RELATED DOCUMENTATION

Supported Routing Engines by Router

Routing Engine Specifications

REMX2K-X8-128G CB-RE Description

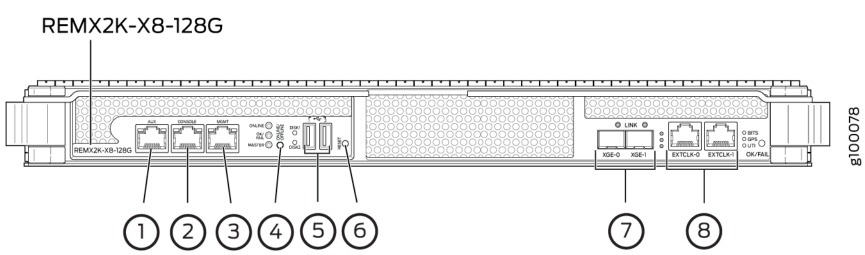
IN THIS SECTION

- REMX2K-X8-128G CB-RE Components | 65
- REMX2K-X8-128G CB-RE LEDs | 67
- REMX2K-X8-128G CB-RE Boot Sequence | 68

The Routing Engine is equipped with a 8-Core 2.3 GHz processor, 128 GB memory, and 200 GB SSDs and also supports Secure Boot for enhanced boot security.

REMX2K-X8-128G CB-RE Components

Figure 26: REMX2K-X8-128G CB-RE Components



1– **AUX** port	5– **USB** ports
2– **CONSOLE** port	6– **RESET** button
3– **MGMT** port	7– **XGE-0** and **XGE-1** ports
4– **ONLINE/OFFLINE** button	8– **EXTCLK0** and **EXTCLK1** ports

Each Control Board-Routing Engine (CB-RE) consists of the following components:

- External clock interface—Allows BITS or GPS clock source input to the centralized timing circuit, or allows centralized timing to be output to BITS or GPS.

- 1000Base-T Ethernet controller.
- Circuits for chassis management and control.
- Power circuits for the CB-RE.
- Control FPGA—Provides the Peripheral Component Interconnect (PCI) interface to the Routing Engine.
- Gigabit Ethernet switch that is connected to the embedded CPU complex on all components.
- CPU—Runs Junos OS as a guest OS to maintain the router's routing tables and routing protocols.
- I2C bus logic, used for low-level communication with each component.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- Component redundancy circuitry.
- USB ports—Provides a removable media interface through which you can install Junos OS and Linux manually. Junos OS supports USB versions, 3.0, 2.0, and 1.1.
- Solid-state drives (nonremovable)—Provides secondary storage for log files, memory dumps, and system reboot.
- Interface ports—The **AUX**, **CONSOLE**, and **MGMT** ports provide access to management devices. Each CB-RE has one 10/100/1000-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device. The two SFP+ ports (**XGE-0** and **XGE-1**) provide support for hardware diagnostics and JCS port testing. The **EXTCLK1** and **EXTCLK2** ports provide access to external timing distribution.

  NOTE: Use sheilded CAT5e cable for connecting the **AUX**, **CONSOLE**, and **MGMT** ports.

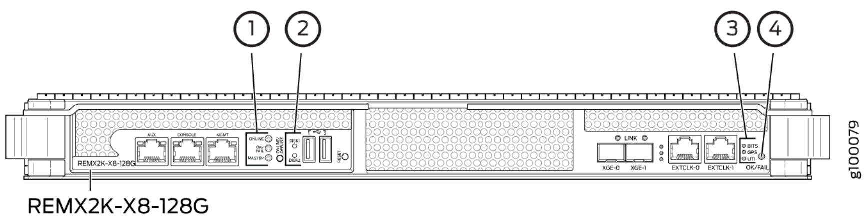
- EEPROM in RE—Stores the field replacement unit (FRU) details of the RE.
- EEPROM in CB—Stores the field replacement unit (FRU) details of the CB.
- **RESET** button—Reboots the Routing Engine on the CB-RE when pressed.
- **ONLINE/OFFLINE** button—Makes the Routing Engine on the CB-RE online or offline when pressed.

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

- LEDs—Provide status of the Routing Engine on the CB-RE.

REMX2K-X8-128G CB-RE LEDs

Figure 27: REMX2K-X8-128G CB-RE LEDs



1– **ONLINE** LED, **OK/FAIL** LED, and **MASTER** LED	3– **BITS, GPS,** and **UTI** LEDs
2– **DISK1** and **DISK2** LEDs	4– **ONLINE/OFFLINE** button

Table 18: REMX2K-X8-128G CB-RE LEDs

Label	Color	State	Description
ONLINE	Green	Blinking slowly	Routing Engine is in the process of booting BIOS, and the host OS.
		Blinking rapidly	Routing Engine is in the process of booting Junos OS.
	-	Off	Routing Engine is not online or not functioning normally.
DISK1 and **DISK2**	Green	Blinking	Indicates presence of disk activity.
	-	Off	There is no disk activity.
BITS, GPS, and **UTI** LEDs	Green	Blinking	A valid signal is detected on the BITS, GPS or UTI ports.

Table 18: REMX2K-X8-128G CB-RE LEDs *(Continued)*

Label	Color	State	Description
		Off	The link is down due to loss of signal (LOS). Check the cable and verify the external clock source is generating a valid signal.
OK/FAIL	Green	On steadily	Routing Engine is powering up.
	Yellow	On steadily	Routing Engine is not powering up, which indicates failure.
MASTER	Blue	On steadily	This Routing Engine is the Primary Routing Engine.

REMX2K-X8-128G CB-RE Boot Sequence

The router is shipped with Junos OS and Linux preinstalled on the CB-RE. There are two copies of software:

- One copy on a USB flash drive that can be inserted into the slot on the CB-RE faceplate.
- One copy each on the two SSDs in the CB-RE.

NOTE: The SSD is internal and cannot be removed.

The Routing Engine interface boots from the storage media in this order: the USB device, SSD1, SSD2, and then the LAN.

RELATED DOCUMENTATION

Supported Routing Engines by Router

Routing Engine Specifications

CB-RE LEDs

Each Routing Engine on the CB-RE (model numbers RE-MX2000-1800X4 and REMX2K-X8-64G) has three LEDs that indicate its status. The LEDs, labeled **ONLINE**, **MASTER**, **OK/FAIL**, are located directly on the faceplate of the CB-RE. Table 19 on page 69 describes the functions of the Routing Engine interface of the CB-RE. There are three LEDs on the craft interface for each Routing Engine (**RE0** and **RE1**). These LEDs are labeled **MASTER**, **ONLINE**, and **OFFLINE**.

NOTE: The GPS LED will display when connecting to an external clocking interface.

The Control Board, part of the host subsystem, has a set of bicolor LEDs that display its status. The LEDs, labeled **LINK**, **GPS**, **BITS**, and **UTI** are located directly on the faceplate of the CB-RE. Table 19 on page 69 describes the functions of the Control Board interface of the CB-RE. There are two LEDs on the craft interface for each Control Board–one labeled **CB-RE0** (far left) and one labeled **CB-RE1** (far right). For more information about the CB-RE and Routing Engine LEDs on the craft interface, see "CB-RE LEDs" on page 69.

Table 19: CB-RE LEDs

Label	Color	State	Description
ONLINE	Green	Blinking	CB-RE is transitioning online.
		On steadily	CB-RE is functioning normally.
	–	Off	CB-RE is offline.
MASTER	Blue	On steadily	CB-RE is the primary.
OK/FAIL	Red	On steadily	CB-RE has failed.
LINK	Green	On steadily	SFP+ ports (XGE-0 and XGE-1) link connection.
		Blinking steadily	Activity on SFP+ ports (XGE-0 and XGE-1).

Table 19: CB-RE LEDs *(Continued)*

Label	Color	State	Description
	Yellow	On	No link.
BITS	Green	On steadily	BITS external clocking interface is active.
	Yellow	On steadily	BITS external clocking interface has failed.
	–	Off	BITS external clocking interface is offline.
GPS	Green	On steadily	GPS external clocking interface is active.
	Yellow	On steadily	GPS external clocking interface has failed.
	–	Off	GPS external clocking interface is offline.

Figure 28: REMX2K-X8-64G CB-RE LEDs

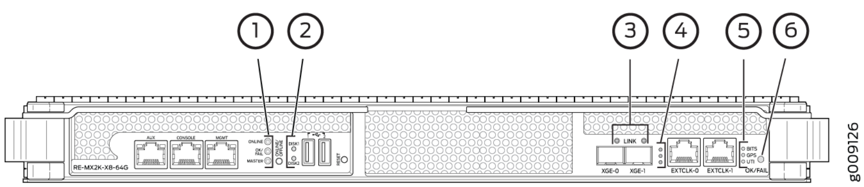


Table 20: REMX2K-X8-64G CB-RE LEDs

Callout from Figure 28 on page 70	Label	Color	State	Description
1	**ONLINE**	Green	Blinking	CB-RE is transitioning online.
			On steadily	CB-RE is functioning normally.

Table 20: REMX2K-X8-64G CB-RE LEDs *(Continued)*

Callout from Figure 28 on page 70	Label	Color	State	Description
		–	Off	CB-RE is offline.
1	**MASTER**	Blue	On steadily	CB-RE is the primary.
10	**OK/FAIL**	Yellow	Off	RE is functioning normally.
			On steadily	RE has failed.
2	**DISK1**	Green	Blinking	Indicates presence of disk activity.
		-	Off	There is no disk activity.
2	**DISK2**	Green	Blinking	Indicates presence of disk activity.
		-	Off	There is no disk activity.
3	**LINK**	Green	On steadily	SFP+ ports (**XGE0** and **XGE1**) links are active.
			Blinking steadily	Activity on the SFP+ ports (**XGE0** and **XGE1**).
		Yellow	On	No link.
5	**BITS**	Green	On steadily	BITS external clocking interface is active.
		Yellow	On steadily	BITS external clocking interface has failed.
		–	Off	BITS external clocking interface is offline.

Table 20: REMX2K-X8-64G CB-RE LEDs *(Continued)*

Callout from Figure 28 on page 70	Label	Color	State	Description
5	**GPS**	Green	On steadily	GPS external clocking interface is active.
		Yellow	On steadily	GPS external clocking interface has failed.
		–	Off	GPS external clocking interface is offline.
5	**UTI**	Green	On steadily	UTI external clocking interface is active.
		Yellow	On steadily	UTI external clocking interface has failed.
		–	Off	UTI external clocking interface is offline.
6	**OK/FAIL**	Red	On steadily	CB has failed.

RELATED DOCUMENTATION

Maintaining the MX2020 Host Subsystem

MX2000 Switch Fabric Board (SFB) Overview

Switch Fabric Boards (SFBs) are the data plane for the subsystems in the MX router chassis. SFBs create a highly scalable and resilient “all-active” centralized switch fabric that delivers up to 4 Tbps of full-duplex switching capacity to each MPC slot in an MX2000 router.

There are three models of MX SFBs:

- MX2000-SFB-S Switch Fabric Board Description
- MX2000-SFB2-S Enhanced Switch Fabric Board Description

- MX2000-SFB3 Switch Fabric Board Description

The SFB and SFB2 switch fabric board models are the same except that the SFB model has three XF fabric chips per card whereas the SFB2 model has two PF fabric chips per card.

RELATED DOCUMENTATION

MX2000 Switch Fabric Board LED

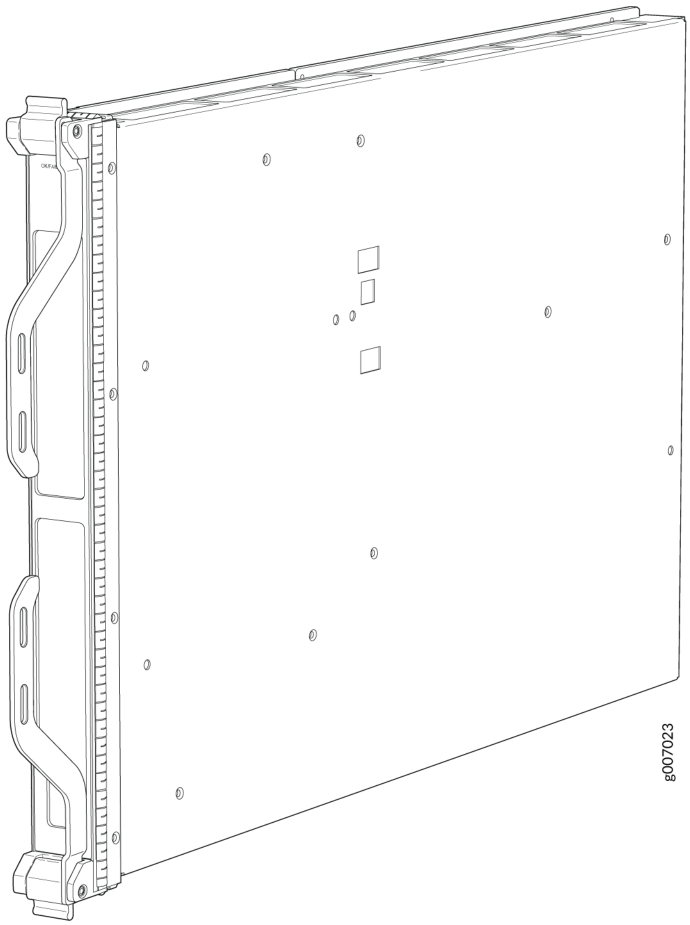
MX2000-SFB-S Switch Fabric Board Description

MX2000-SFB-S switch fabric boards (SFB) create a highly scalable and resilient “all-active” centralized switch fabric that delivers up to 860 Gbps per slot of full-duplex switching capacity to each Modular Port Concentrator (MPC) in an MX2000 series router. Each SFB hosts one switch fabric plane made of two fabric chipsets. You can install up to eight SFB2s in an MX2000 series router. Only seven SFB2s are required for line rate operation

Note that you can’t mix switch fabric board models (SFB, SFB2, SFB3) in a single MX2000 series router chassis. If you upgrade from one model to another, the MX2000 series router will support both models at the same time but only for the duration of the upgrade.

Figure 29 on page 74 shows the MX2000 Switch Fabric Board (SFB).

Figure 29: MX2000-SFB-S Switch Fabric Board



Name in CLI	`Switch Fabric Board`
Features and Components	The MX2000-SFB-S provides: • I2C bus logic interface for managing component managements and monitoring temperature and voltage • PCIe control of three XF ASICs • Switching functions for MPCs • Throughput of 6Tbps, with a minimum of 7 SFBs installed. An additional SFB is recommended for N+1 redundancy.

Switch Fabric Board Slots	You can install up to eight SFBs in an MX2000 router. The SFBs install vertically into the front of the router chassis in the slots labeled 0 through 7. Slot 0 must always have a functioning SFB. If the SFB in slot 0 fails, replace it with a functioning SFB from another slot, and then install a blank panel in the other slot. If slots 1 through 7 are empty, install a blank panel in them. You cannot install a blank panel in slot 0. **CAUTION**: If an SFB fails, don't remove it until you have a replacement SFB or blank panel ready to install.
Switch Fabric Board Redundancy	For line rate operation, the MX2000 series router must have at least seven SFBs installed. Although MX2000 routers can operate with fewer than seven SFBs, packet forwarding performance is impacted.
Weight and Dimensions	• Weight: 12 lb (5.44 kg) • Width: 1.7 in. (4.31 cm) • Depth: 23.6 in. (59.94 cm). With ejector handle: 26.14 in. (66.39 cm) • Height: 16.225 in. (41.21 cm)
Maximum Power Requirements (without MICs)	MX2020: • Typical: 250 W • At different temperatures: 295 W at 55° C 280 W at 40° C 270 W at 25° C MX2010: • Typical: 220 W • At different temperatures: 265 W at 55° C 250 W at 40° C 240 W at 25° C

LEDs	See MX2000 Switch Fabric Board LED.
Upgrades	During an upgrade from SFB to SFB2, MX2000 series routers support both SFB and SFB2 at the same time for the duration of the upgrade.
Interoperabilitly with MPC Line Cards	The MX2000-SFB-S interoperates with these MPCs: • MPC2E • MPC2E NG (with ethernet MICs only) • MPC3E • MPC3E NG (with ethernet MICs only) • MPC4E • MPC5E • MPC6E • MPC7E • MPC8E • MPC9E • MS-MPC

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

Replacing an MX2000 SFB | 637

Performing a Smooth Upgrade to Enhanced Switch Fabric Board (SFB2) with Minimal Impact on Traffic

MX2000-SFB2-S Enhanced Switch Fabric Board Description

MX2000-SFB2-S Enhanced Switch Fabric Board Description

MX2000-SFB2-S enhanced switch fabric boards (SFB2) create a highly scalable and resilient "all-active" centralized switch fabric that delivers up to 2 Tbps of full-duplex switching capacity to each Modular Port Concentrator (MPC) in an MX2000 series router. Each SFB2 hosts one switch fabric plane made of three fabric chipsets. You can install up to eight SFB2s in an MX2000 series router. Only seven SFB2s are required for line rate operation.

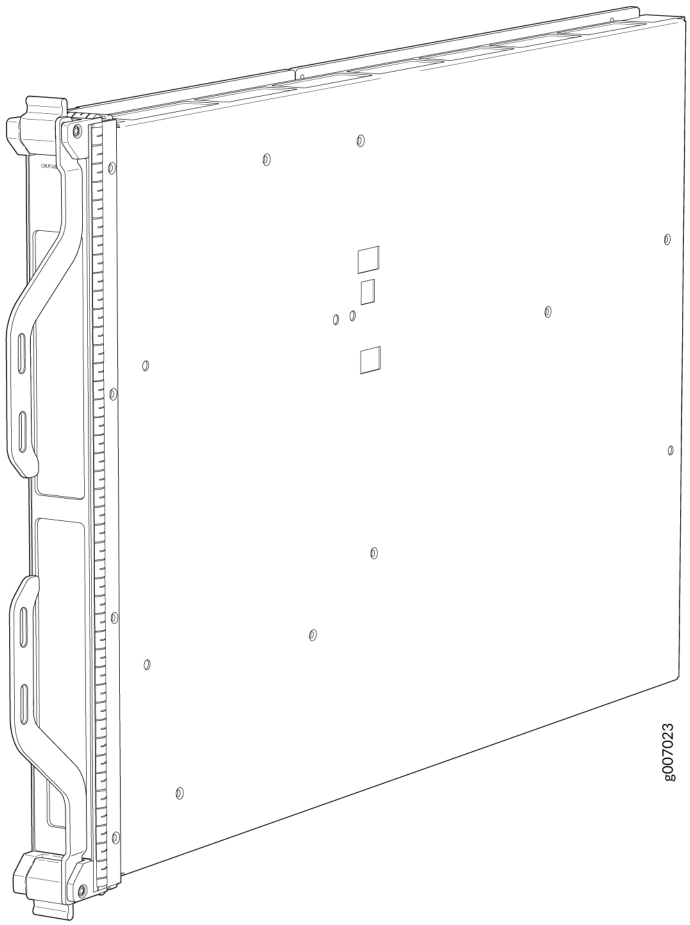
Note that you can't mix switch fabric board models (SFB, SFB2, SFB3) in a single MX2000 series router chassis. If you upgrade from an SFB to an SFB2, the MX2000 routers will support both the SFB and SFB2 at the same time but only for the duration of the upgrade.

The MX2000-SFB2-S switch fabric board straddles the two backplanes. It has connectors connecting to both backplanes.

> **NOTE**: The MX2000 SFB and the MX2000 SFB2 Enhanced Switch Fabric Board are the same except that the SFB has two PF fabric chips per card whereas the SFB2 has three XF fabric chips per card.

Figure 30 on page 78 shows the MX2000 Enhanced Switch Fabric Board (SFB).

Figure 30: MX2000-SFB2-S Enhanced Switch Fabric Board



Software release	• Junos OS Release 11.4 and later • Name in CLI: `Switch Fabric Board`
Features and Components	The MX2000-SFB2-S provides: • PCIe control of three XF fabric chips per card. • I2C bus logic interface for managing component managements and monitoring temperature and voltage • Switching functions for MPCs • 2 Tbps per slot with eight SFB2s and 1.7 Tbps per slot with seven SFB2s

SFB2 Slots	You can install up to eight SFB2s in an MX2000 router. The SFB2s install vertically into the front of the chassis in the slots labeled 0 through 7. If any slots are empty, you must install a blank panel. Slot 0 must always have a functioning SFB2. If the SFB2 in slot 0 fails, replace it with a functioning SFB2 from another slot, and then install a blank panel in the other slot. If slots 1 through 7 are empty, install a blank panel in them. You cannot install a blank panel in slot 0. **CAUTION**: If an SFB2 fails, don't remove it until you have a replacement SFB2 or blank panel ready to install.
SFB2 Redundancy	For line rate operation, the MX2000 series router must have at least seven SFB2s installed. Although MX2000 routers can operate with fewer than seven SFB2s, packet forwarding performance is impacted.
Weight and Dimensions	• Weight: 16 lb (7.2 kg) • Width: 1.7 in. (4.31 cm) • Depth: 23.6 in. (59.94 cm). With ejector handle: 26.14 in. (66.39 cm) • Height: 16.225 in. (41.21 cm)

Maximum Power Requirements (without MICs)	MX2020: • Typical: 250 W • At different temperatures: 295 W at 55° C 280 W at 40° C 270 W at 25° C MX2010: • Typical: 220 W • At different temperatures: 265 W at 55° C 250 W at 40° C 240 W at 25° C
LEDs	See MX2000 Switch Fabric Board LED for a description of the SFB2 LED functions. Each SFB2 also has a set of bicolor LEDs on the craft interface that indicate its status. The SFB2 LEDs, labeled **0** through **7**, are located along the bottom center of the craft interface.
Upgrades	During an upgrade from SFB to SFB2, MX2000 series routers support both SFB and SFB2 at the same time for the duration of the upgrade.

Interoperabilitly with MPC Line Cards	The MX2000-SFB2 interoperates with these MPCs: • MPC2E • MPC2E NG (with ethernet MICs only) • MPC3E • MPC3E NG (with ethernet MICs only) • MPC4E • MPC5E • MPC6E • MPC7E • MPC8E • MPC9E • MS-MPC

RELATED DOCUMENTATION

MX2000 Switch Fabric Board LED
MX2000 Host Subsystem CB-RE Description
Replacing an MX2000 SFB
Understanding Fabric Fault Handling on Enhanced Switch Fabric Board (SFB2)
Performing a Smooth Upgrade to Enhanced Switch Fabric Board (SFB2) with Minimal Impact on Traffic

MX2000-SFB3 Switch Fabric Board Description

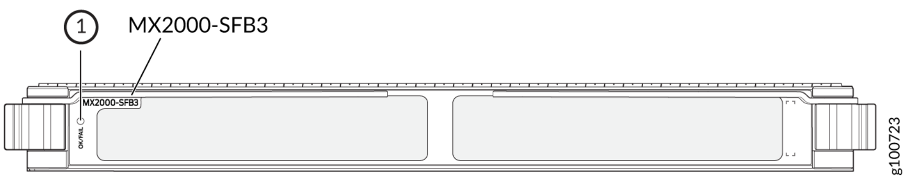
IN THIS SECTION

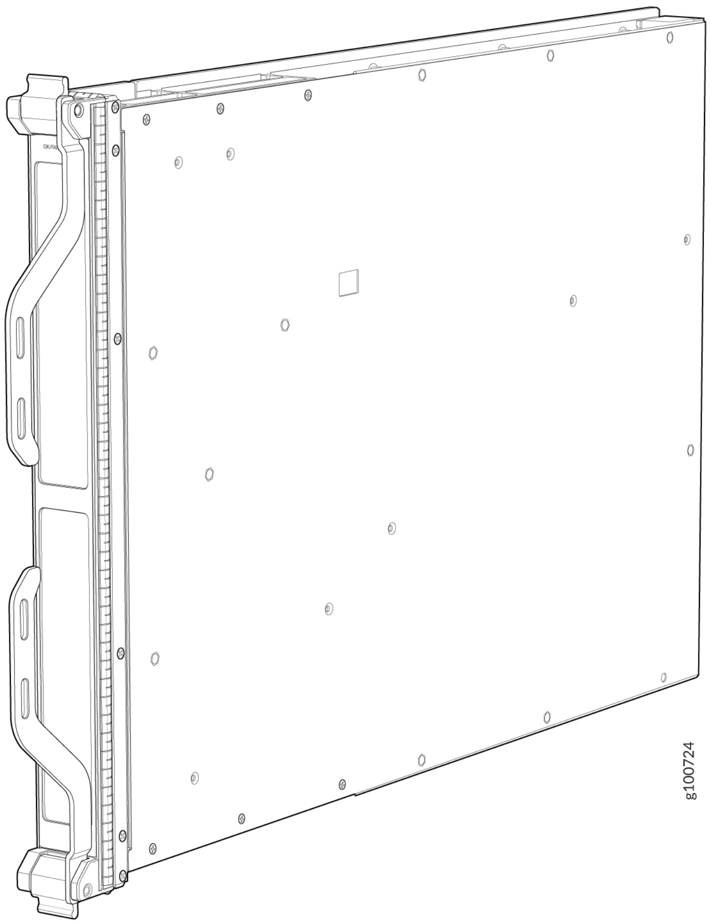
MX2K-MPC11E Support | 87

- MX2000-SFB3 Switch Fabric Board Bandwidth Per MPC Line Card | 88
- MX2000-SFB3 Fabric Planes | 88

The MX2000-SFB3 Switch Fabric Board creates a highly scalable and resilient “all-active” centralized switch fabric that delivers up to 4 Tbps of full-duplex switching capacity per line card slot for MX2010 and MX2020 routers. The MX2000-SFB3 along with the MX2K-MPC11E Modular Port Concentrator provides industry-leading 100-Gigabit Ethernet and 400-Gigabit Ethernet-ready port density. Figure 31 on page 82 shows the MX2000-SFB3.

Figure 31: MX2000-SFB3 Switch Fabric Board





1– **OK/FAIL** status LED	
Software release	• Junos OS Release 19.3R2 and later 19.3 releases • Junos OS Release 20.1R1 and later releases **NOTE**: The MX2K-MPC11E is not supported in any Junos OS 19.4 releases.
Physical Description	• Weight: 22.6 lb (10.3 kg) • Width: 1.7 in. (4.3 cm) • Depth: 23.7 in. (60.1 cm) (not including the ejector handle); 26.2 in. (64.4 cm) (with the ejector handle) • Height: 16.2 in. (41.2 cm) • Name in CLI: `Switch Fabric Board 3`

MX Series Router Platform Support	• The MX2000-SFB3 supports MX2010 and MX2020 router platforms.

Prerequisites	• Requires at least one MX2000-SFB3 switch fabric board.
	• Requires one of the following routing engines:
	  • RE-MX2000-1800X4
	  • REMX2K-1800-32G
	  • REMX2K-X8-128G
	  • REMX2K-X8-64G

Hardware Features	The MX2000-SFB3: • Delivers up to 4 Tbps of full-duplex switching capacity to each MPC in an MX2010 or MX2020 router. • Provides up to three fabric planes per Packet Forwarding Engine.
LED	The MX2000-SFB3 has one **OK/FAIL** LED that indicates status as follows: • Green—MX2000-SFB3 is online and functioning normally (OK status). • Red—MX2000-SFB3 has an error or failure (FAIL status). • Off—MX2000-SFB3 is offline. The port LEDs under each SFB slot on the front panel of the device chassis indicate the online/offline status. These LEDs are labeled **0** through **7**.
Safety, Environmental, and Security Features	• The MX2000-SFB3 uses 48—V power systems and meets all safety requirements for 48—V isolated spacing. • MX2000-SFB3 is certified as an EMI emissions Class A device.
Upgrades	• The memory storage devices in the MX2000-SFB3 are field-upgradable (I2CS, CPLD and the Super Controller FPGA). • The MX2000-SFB3 does not support smooth upgrades or downgrades for SFB or SFB2 fabric cards.

MX2020 and MX2010 SFB Slots	You can install up to eight MX2000-SFB3's in MX2020 routers and MX2010 routers. The MX2000-SFB3's install vertically into a fabric board slot on the front of the chassis in the slots labeled **0** through **7**. If any slots are empty, you must install a slot cover. **CAUTION**: If one of the MX2000-SFB3's fails, do not remove it until you have a replacement MX2000-SFB3 or slot cover ready to install.
MX2000-SFB3 Power Zones	MX2020 routers support two power zones. Power is provisioned for an MX2000-SFB3 fabric card from one of the two power zones, based on the SFB3 slot number. The power is provisioned from the lower power zone for the MX2000-SFB3 fabric cards in slots 0-3. Similarly, the power is provisioned from the upper power zone for the MX2000-SFB3 fabric cards in the slots 4-7. MX2010 routers support a single power zone; Therefore, power is provisioned from the same power zone for all the MX2000-SFB3 fabric cards, regardless of the SFB3 slot number.
System Power Requirements	• DC Input Operating Range: -72 to -40 VDC • Maximum Power at 40 C° (72° F) + 6000 ft. (1829 m): 540 W (MX2020); 385W (MX2010)
Supported Routing Engines	The MX2000-SFB3 supports these routing engines: • RE-MX2000-1800X4 • REMX2K-1800-32G • REMX2K-X8-128G • REMX2K-X8-64G

Supported Power Distribution Modules	The MX2000-SFB3 supports these power distribution modules: • MX2000-PDM-AC-WYE • MX2000-PDM-AC-DELTA • MX2000-PDM-DC • MX2K-PDM-AC-1PH • MX2K-PDM-OP-AC • MX2K-PDM-OP-DC
Supported Power Supply Modules	The MX2000-SFB3 supports these power supply modules: • MX2000-PSM-AC • MX2000-PSM-DC **NOTE**: With the existing power supplies, an MX2020 can support a maximum of 14 MX2K-MPC11Es (seven in the top MPC slots and seven in the bottom MPC slots) while maintaining PSM redundancy in each zone. Likewise, the MX2010 with existing power supplies can support a maximum of six MX2K-MPC11Es and maintain PSM redundancy.
Interoperabilitly with MPC Line Cards	The MX2000-SFB3 interoperates with these MPCs: • MX2K-MPC11E • MPC6E • MPC8E • MPC9E • MS-MPC Starting in Junos OS Release 22.2R1 MX2000-SFB3 interoperates with these MPCs: • MPC7E • MPC5E • MPC2E-NG (with ethernet MICs only) • MPC3E-NG (with ethernet MICs only)

Interoperabilitily With Other Switch Fabric Boards	All fabric board types must be MX2000-SFB3. MX2010 routers and MX2020 routers don’t support a mixed fabric board type.

MX2K-MPC11E Support

The number of MX2K-MPC11E line cards that the MX2020 and MX2010 router chassis can support varies, depending upon the ambient temperature of the chassis and the PSM redundancy. Table 21 on page 87 shows the number of MX2K-MPC11E line cards that are supported on the MX2020 router with fully populated, existing PDMs and PSMs (in redundant and non-redundant modes) at 40 C° (72° F) + 6000 ft. (1829 m).

Table 21: MX2K-MPC11E Line Card Maximums Per PSM Redundancy, Temperature, and Elevation for MX2020 Routers

	With PSM Redundancy	Without PSM Redundancy	Temperature and Elevation
Upper Zone	7	8	40 C° (72° F) + 6000 ft. (1829 m)
Lower Zone	7	8	40 C° (72° F) + 6000 ft. (1829 m)
Total	14	16	40 C° (72° F) + 6000 ft. (1829 m)

Table 22 on page 87 shows the number of MX2K-MPC11E line cards that are supported on the MX2010 router with fully populated, existing PDMs and PSMs (in redundant and non-redundant modes) at 40 C° (72° F) + 6000 ft. (1829 m).

Table 22: MX2K-MPC11E Line Card Maximums Per PSM Redundancy, Temperature, and Elevation for MX2010 Routers

MX2010 Line Card Type	Maximum Supported With PSM Redundancy	Maximum Supported Without PSM Redundancy	Temperature and Elevation
MX2K-MPC11E	6	7	40 C° (72° F) + 6000 ft. (1829 m)

MX2000-SFB3 Switch Fabric Board Bandwidth Per MPC Line Card

Table 23 on page 88 lists the fabric bandwidth for supported MPC line cards when used with the MX2000-SFB3.

Table 23: Switch Fabric Board Bandwidth Per Supported MPC Line Card

MPC Line Card	MPC Line Card Bandwidth	Fabric Bandwidth per Packet Forwarding Engine
MPC6E	520 G	130 G
MPC8E	960 G	240 G
MPC9E	1.6 T	400 G
MX2K-MPC11E	4 T	500 G
MPC2E-NG (with ethernet MICs only)	80 G	20 G
MPC3E-NG (with ethernet MICs only)	130 G	32.5 G
MPC5E	240 G	60 G
MPC7E-MRATE	430 G	107.5 G
MPC7E-10G	400 G	100 G

MX2000-SFB3 Fabric Planes

- There are 24 fabric planes when eight MX2000-SFB3's are installed.
- All eight MX2000-SFB3's are required to support line rate traffic on the MX2K-MPC11E line card.
- There is 7+1 MX2000-SFB3 redundancy with MPCE6, MPCE8, and MPCE9 line cards.

RELATED DOCUMENTATION

MX2000 Switch Fabric Board LED | 89
MX2000 Host Subsystem CB-RE Description | 57
Replacing an MX2000 SFB | 637

MX2000 Switch Fabric Board LED

One bicolor LED on the Switch Fabric Board (SFB) indicates the status of the SFB. The LED, labeled **OK/FAIL**, is located directly on the SFB. Table 24 on page 89 describes the functions of the SFB LED.

Table 24: Switch Fabric Board LED

Label	Color	State	Description
OK/FAIL	Green	Slow blinking when being initialized. Fast blinking when SFB is being identified by software. **NOTE**: This is used to guide the operator to correct any action needed on the SFB.	SFB is online.
	Red	On steadily	SFB has failed.
	–	Off	SFB is offline.

Each SFB also has a set of bicolor LEDs on the craft interface that indicate its status. The SFB LED, labeled **0** through **7**, are located along the bottom center of the craft interface. For more information about the SFB LED on the craft interface, see "MX2010 Component LEDs on the Craft Interface" on page 36.

RELATED DOCUMENTATION

MX2000 Switch Fabric Board (SFB) Overview | 72
MX2000-SFB2-S Enhanced Switch Fabric Board Description
MX2000-SFB3 Switch Fabric Board Description
MX2000 Host Subsystem CB-RE Description | 57

CHAPTER 7

Interface Modules— ADCs, MPCs, and MICs

IN THIS CHAPTER

- MX2000 Adapter Card (ADC) Description | 90
- MX2010 Modular Port Concentrator Description | 92
- MPCs Supported by MX Series Routers | 94
- MX2010 Modular Port Concentrator LEDs | 101
- MX2010 MPC Terminology | 101
- MX2010 Modular Interface Card Description | 102
- MICs Supported by MX Series Routers | 103
- MX2010 Modular Interface Card LEDs | 117
- MX2010 Port and Interface Numbering | 117

MX2000 Adapter Card (ADC) Description

The MX2000 routers are compatible with all Trio-based MPC line cards; However, because the MX2000 routers use a newer-generation Switch Fabric Board (SFB) with faster bandwidth, smaller form-factor MPCs must use a special Line Card Adapter (ADC). The ADC is merely a shell that accepts line cards in the front and converts power and switch fabric in the rear. ADCs install vertically in the front of the router.

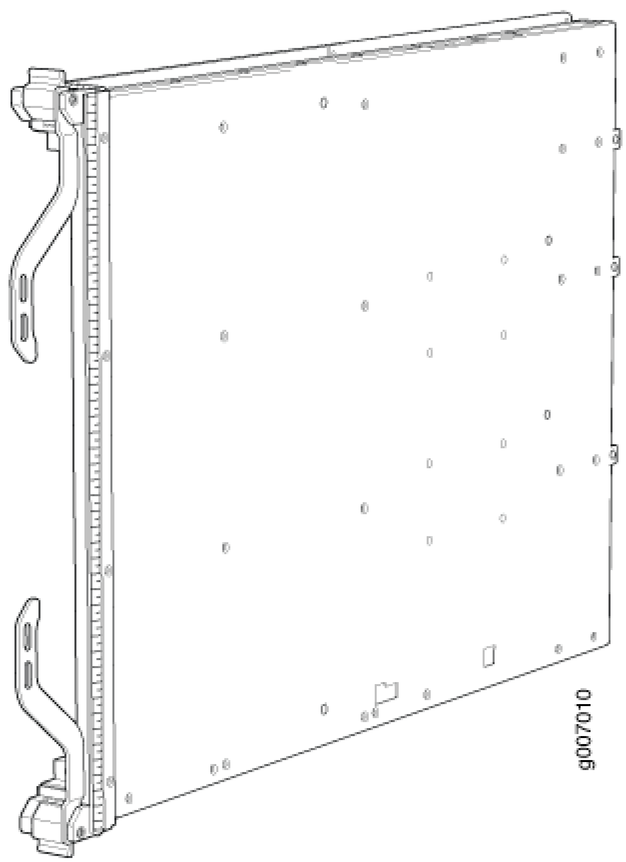
The following MPCs require an ADC:

- MPC1E
- MPC2E
- MPC3E
- MPC5E
- MPC7E

NOTE: When a slot is not occupied by a combined ADC and MPC, you must insert a blank panel to fill the empty slot and ensure proper cooling of the system.

ADCs are hot-removable and hot-insertable. Figure 32 on page 91 shows the ADC supported on MX2000 routers.

Figure 32: ADC for the MX2000 Routers



RELATED DOCUMENTATION

Maintaining MX2020 Adapter Cards

MX2010 Modular Port Concentrator Description

IN THIS SECTION

- MPC Components | **93**

The Modular Port Concentrators (MPCs) provides packet forwarding services. The MPCs install into an adapter card, which in turn connects to the backplane. Modular Interface Cards (MICs) provide the physical interfaces and install into the MPCs. The user can install up to two MICs of different media types on the same MPC as long as the MPC supports those MICs.

NOTE: The MX2010 router also supports fixed-port MPCs.

MICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each MIC performs framing and high-speed signaling for its media type. Each MPC is equipped with up to four Junos Trio chipsets, which perform control functions tailored to the MPC's media type.

The MX2010 router supports up to 10 MPCs. For power requirements, see "Calculating DC Power Requirements for MX2010 Routers" on page 250 and "Calculating AC Power Requirements for MX2010 Routers" on page 225.

The router has 10 dedicated line-card slots for MPCs. MPCs install vertically in the front of the router. The dedicated slots are numbered **0** though **9** (left to right). An MPC can be installed in any line-card slot. The user can install any combination of MPC types in the router.

When an MPC slot is not occupied by an MX2000 MPC or an adapter card with MPC, a blank MX2000 panel needs to be installed.

MPCs are hot-removable and hot-insertable. When the user installs an MPC in an operating router, the CB-RE downloads the MPC software, the MPC runs its diagnostics, and enables the Packet Forwarding Engines housed on the MPC. Forwarding on other MPCs continues uninterrupted during this process.

Figure 33 on page 93 shows a typical MPC supported on the MX2010 router. Figure 34 on page 93 shows an MPC installed vertically in the MX2010 router. For more information about MPCs, see the *MX Series Interface Module Reference*.

Figure 33: Typical MPC Supported on the MX2010 Router

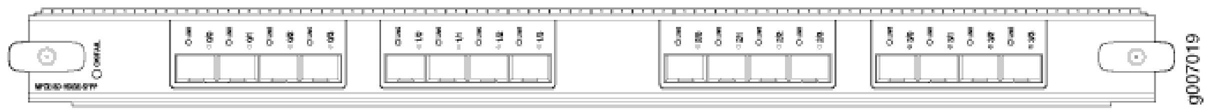
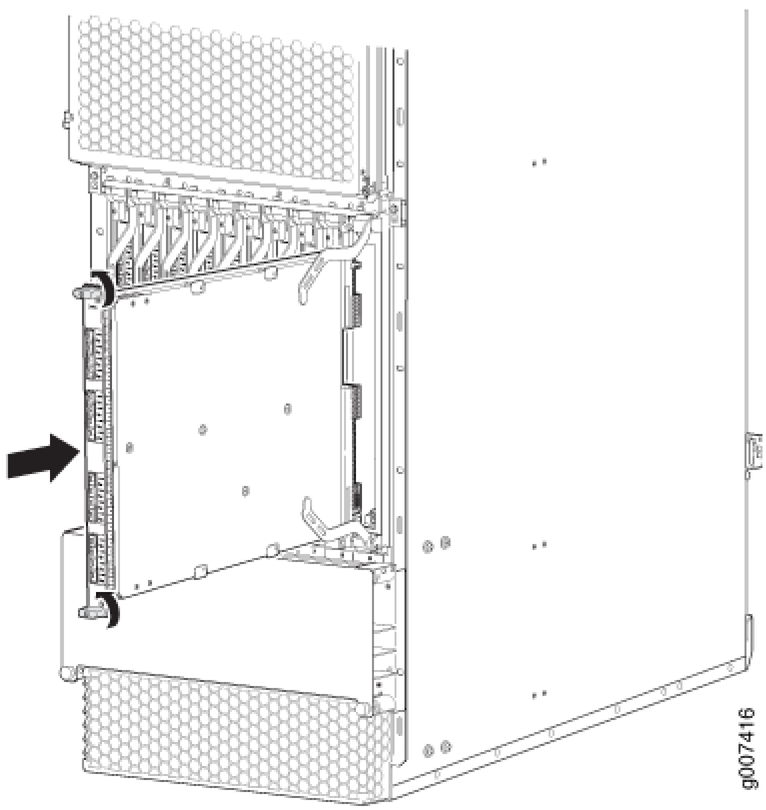


Figure 34: MPC Installed in the MX2010 Router



MPC Components

Each MPC consists of the following components:

- MIC card carrier, which includes two MIC slots (excludes the fixed configuration MPC).
- Fabric interfaces.
- Two Gigabit Ethernet interfaces that allow control information, route information, and statistics to be sent between the Routing Engine and the CPU on the MPCs.

- Up to four Junos Trio chipsets, which perform control functions tailored to the MPC's media type.
- Backplane connectors and power circuitry.
- Online button located on the craft interface, which takes the MPC online or offline when pressed.
- **OK/FAIL** LED on the MPC faceplate. For more information about LEDs on the MPC faceplate, see the *MX Series Interface Module Reference*.

RELATED DOCUMENTATION

MX2010 Modular Port Concentrator LEDs | **101**

MX2010 Field-Replaceable Units | **19**

Maintaining MX2010 MPCs | **763**

Troubleshooting the MX2010 MPCs | **833**

Replacing an MX2010 MPC and Adapter Card | **625**

MX2000 Adapter Card (ADC) Description | **90**

MPCs Supported by MX Series Routers

Table 25 on page 94 lists the MPCs and their first supported Junos OS release on MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 routers.

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
Fixed Configuration MPCs							

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MPC-3D-16XGE-SFPP	MPC-3D-16XGE-SFP	10.0R2	15.1F7	12.3	12.3	–	–
Multiservices MPC	MS-MPC	13.2R4	15.1F7	15.1	15.1	–	–
32x10GE MPC4E	MPC4E-3D-32XGE-SFPP	12.3R2	15.1F7	12.3R2	12.3R2	–	–
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	12.3R2	15.1F7	12.3R2	12.3R2	–	–
6x40GE + 24x10GE MPC5E	MPC5E-40G10G	13.3R2	15.1F7	13.3R2	13.3R2	–	–
6x40GE + 24x10GE MPC5EQ	MPC5EQ-40G10G	13.3R2	15.1F7	13.3R2	13.3R2	–	–
2x100GE + 4x10GE MPC5E	MPC5E-100G10G	13.3R3	15.1F7	13.3R3	13.3R3	–	–
2x100GE + 4x10GE MPC5EQ	MPC5EQ-100G10G	13.3R3	15.1F7	13.3R3	13.3R3	–	–

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MPC7E-MRATE	MPC7E-MRATE	• 15.1F4 with Junos Continuity • 16.1R1 and later	15.1F7	• 15.1F4 with Junos Continuity • 16.1R1 and later	• 15.1F4 with Junos Continuity • 16.1R1 and later	–	–
MPC7E-10G	MPC7E-10G	• 15.1F5 with Junos Continuity • 16.1R1 and later	15.1F7	• 15.1F5 with Junos Continuity • 16.1R1 and later	• 15.1F5 with Junos Continuity • 16.1R1 and later	–	–
MPC10E-10C-MRATE	MPC10E-10C-MRATE	19.2R1	–	–	–	–	–
MPC10E-15C-MRATE	MPC10E-15C-MRATE	19.1R1	–	–	–	–	–

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MX2K-MPC11E Modular Port Concentrator	MX2K-MPC11E	-	-	• 19.3R2 and later 19.3 releases • 20.1R1 **NOTE**: The MX2K-MPC11E MPC is not supported in any 19.4 releases.	• 19.3R2 and later 19.3 releases • 20.1R1 **NOTE**: The MX2K-MPC11E MPC is not supported in any 19.4 releases.	-	-
MPCs							
MPC1	MX-MPC1-3D	10.2	15.1F7	12.3	12.3	–	–
MPC1E	MX-MPC1E-3D	11.2R4	15.1F7	12.3	12.3	–	–
MPC1 Q	MX-MPC1-3D-Q	10.2	15.1F7	12.3	12.3	–	–

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MPC1E Q	MX-MPC1E-3D-Q	11.2R4	15.1F7	12.3	12.3	–	–
MPC2	MX-MPC2-3D	10.1	15.1F7	12.3	12.3	–	–
MPC2E	MX-MPC2E-3D	11.2R4	15.1F7	12.3	12.3	–	
MPC2 Q	MX-MPC2-3D-Q	10.1	15.1F7	12.3	12.3	–	–
MPC2E Q	MX-MPC2E-3D-Q	11.2R4	15.1F7	12.3	12.3	–	–
MPC2 EQ	MX-MPC2-3D-EQ	10.1	15.1F7	12.3	12.3	–	–
MPC2E EQ	MX-MPC2E-3D-EQ	11.2R4	15.1F7	12.3	12.3	–	–
MPC2E P	MX-MPC2E-3D-P	12.2	15.1F7	12.3	12.3	–	–

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MPC2E NG	MX-MPC2E-3D-NG	14.1R4, 14.2R3 and Junos Continuity 15.1	15.1F7	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	–	–
MPC2E NG Q	MX-MPC2E-3D-NG-Q	14.1R4, 14.2R3 and Junos Continuity 15.1	15.1F7	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	–	–
MPC3E	MX-MPC3E-3D	12.1	15.1F7	12.3	12.3	–	–
MPC3E-3D-NG	MX-MPC3E-3D-NG	14.1R4, 14.2R3 and Junos Continuity 15.1	15.1F7	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	–	–
MPC3E-3D-NG-Q	MX-MPC3E-3D-NG-Q	14.1R4, 14.2R3 and Junos Continuity 15.1	15.1F7	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	–	–

Table 25: MPCs Supported by MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 Routers *(Continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2008 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers	First Junos OS Release on MX10003 Routers	First Junos OS Release on MX10008 Routers
MPC6E	MX2K-MPC6E	–	15.1F7	13.3R2	13.3R2	–	–
MPC8E	MX2K-MPC8E	–	15.1F7	• 15.1F5 with Junos Continuity • 16.1R1 and later	• 15.1F5 with Junos Continuity • 16.1R1 and later	–	–
MPC9E	MX2K-MPC9E	–	15.1F7	• 15.1F5 with Junos Continuity • 16.1R1 and later	• 15.1F5 with Junos Continuity • 16.1R1 and later	–	–
MX10003 MPC (Multi-Rate)	MX10003-LC2103	–	–	–	–	17.3	
MX10003 MPC (Multi-Rate)	MX10003-LC2103-V2	–	–	–	–	21.3R1	

RELATED DOCUMENTATION

MX Series MPC Overview

MX Series MPC Overview

MX Series MIC Overview

MICs Supported by MX Series Routers

MIC/MPC Compatibility

Pathfinder: Hardware Supported by Junos Continuity Software

MX2010 Modular Port Concentrator LEDs

One bicolor LED located on the craft interface above the MPC, displays the status of the MPC. For more information about the MPC LEDs on the craft interface, see "MX2010 Component LEDs on the Craft Interface" on page 36.

Each MPC also has LEDs located on the faceplate. For more information about LEDs on the MPC faceplate, see the “LEDs” section for each MPC in the *MX Series Interface Module Reference*.

RELATED DOCUMENTATION

MX2010 Modular Port Concentrator Description | **92**

Maintaining MX2010 MPCs | **763**

Troubleshooting the MX2010 MPCs | **833**

Replacing an MX2010 MPC and Adapter Card | **625**

MICs Supported by MX Series Routers | **103**

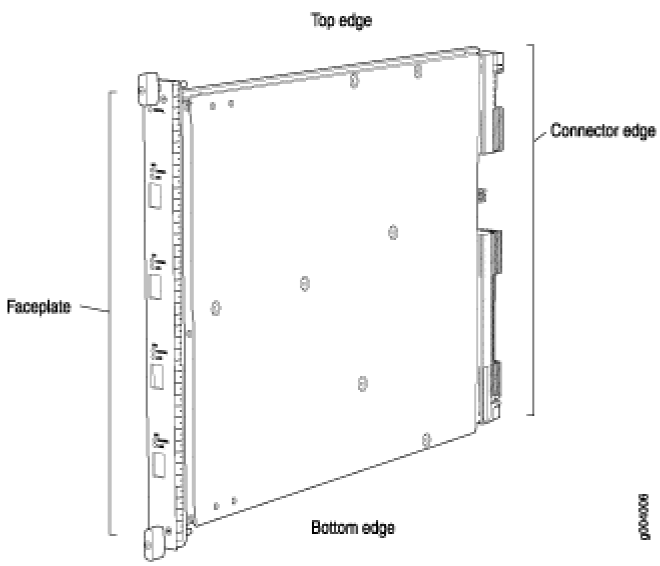
MX2010 MPC Terminology

Regardless of whether you are holding an MPC vertically or horizontally, this information uses the same terms for all four edges of the MPC (see Figure 35 on page 102):

- Faceplate—Edge of the MPC that has connectors into which you insert the SFP or XFP transceivers
- Connector edge—Edge opposite the faceplate; this edge has the connectors that attach to the midplane
- Top edge—Edge at the top of the MPC when it is vertical

- Bottom edge—Edge at the bottom of the MPC when it is vertical

Figure 35: MPC Edges



RELATED DOCUMENTATION

MX2010 Modular Port Concentrator Description | 92
MX2010 Component LEDs on the Craft Interface | 36
Holding an MX2010 MPC | 803
Troubleshooting the MX2010 MPCs | 833
Replacing an MX2010 MPC and Adapter Card | 625

MX2010 Modular Interface Card Description

The Modular Interface Cards (MICs) install into the Modular Port Concentrators (MPCs) and provide the physical connections to various network media types. MICs allow different physical interfaces to be supported on a single MPC. The user can install MICs of different media types on the same MPC as long as the MPC supports those MICs.

MICs receive incoming packets from the network and transmit outgoing packets to the network. During this process, each MIC performs framing and high-speed signaling for its media type.

MICs are hot-removable and hot-insertable. The user can install up to two MICs in each MPC.

RELATED DOCUMENTATION

MX2010 Modular Interface Card LEDs | **117**

Maintaining MX2010 MICs | **760**

Troubleshooting the MX2010 MICs | **832**

Replacing an MX2010 MIC | **613**

MICs Supported by MX Series Routers | **103**

MICs Supported by MX Series Routers

The following tables list the first supported Junos OS release for the MX Series.

- Table 26 on page 103 lists the first supported Junos OS release for MICs on MX240, MX480, MX960, and MX2008 routers.
- Table 27 on page 107 lists the first supported Junos OS release for MICs on MX2010 and MX2020 routers.
- Table 28 on page 111 list the first supported Junos OS release for MICs on MX5, MX10, and MX40 routers.
- Table 29 on page 113 lists the first supported Junos OS release for MICs on MX80 and MX104 routers.
- Table 30 on page 116 lists the first supported Junos OS release for MICs on MX10003 router.

Table 26: MICs Supported by MX240, MX480, MX960 and MX2008 Routers

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
ATM				
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	8	12.1	15.1F7
DS3/E3				

Table 26: MICs Supported by MX240, MX480, MX960 and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	15.1F7
Circuit Emulation				
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	12.3	15.1F7
Gigabit Ethernet				
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	10.1	15.1F7
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.3	15.1F7
Gigabit Ethernet MIC with 256b-AES MACsec	MIC-MACSEC-20GE	20	18.3	-
10-Gigabit Ethernet				
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	10.2	15.1F7
10-Gigabit Ethernet MICs with XFP	MIC-3D-4XGE-XFP	4	10.1	15.1F7
10-Gigabit Ethernet MIC with SFP+ (10 Ports)	MIC3-3D-10XGE-SFPP	10	12.3	15.1F7

Table 26: MICs Supported by MX240, MX480, MX960 and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
10-Gigabit Ethernet MIC with SFP+ (24 Ports)	MIC6-10G	24	-	15.1F7
10-Gigabit Ethernet OTN MIC with SFP+ (24 Ports)	MIC6-10G-OTN	24	-	15.1F7
40-Gigabit Ethernet				
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	2	12.2	15.1F7
100-Gigabit Ethernet				
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	1	12.1	15.1F7
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	1	12.2	15.1F7
100-Gigabit Ethernet MIC with CXP (4 Ports)	MIC6-100G-CXP	4	-	15.1F7
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	2	-	15.1F7
100-Gigabit DWDM OTN				

Table 26: MICs Supported by MX240, MX480, MX960 and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
100-Gigabit DWDM OTN MIC with CFP2-ACO	MIC3-100G-DWDM	1	15.1F5 15.1F6 17.1R1	15.1F7
Multi-Rate				
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	11.2	15.1F7
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	11.2	15.1F7
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	11.4	15.1F7
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	11.4	15.1F7
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	4	12.2	15.1F7
MIC MRATE (12-Port Multi-Rate MIC with QSFP+)	MIC-MRATE	12	-	15.1F7

Table 26: MICs Supported by MX240, MX480, MX960 and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)	MIC-MACSEC-MRATE	12		17.4
Tri-Rate				
Tri-Rate MIC	MIC-3D-40GE-TX	40	10.2	15.1F7
Services				
Multiservices MIC	MS-MIC-16G	0	13.2	15.1F7
SONET/SDH				
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	1	12.2	15.1F7

Table 27: MICs Supported by MX2010 and MX2020 Routers

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
ATM				
ATM MIC with SFP	MIC-3D-8OC3-2 OC12-ATM	8	12.3	12.3
DS3/E3				
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3 -E3-B	8	12.3	12.3

Table 27: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
Circuit Emulation				
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	–	–
Gigabit Ethernet				
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	12.3	12.3
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.3	13.3
10-Gigabit Ethernet				
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	12.3	12.3
10-Gigabit Ethernet MICs with XFP	MIC-3D-4XGE-XFP	4	12.3	12.3
10-Gigabit Ethernet MIC with SFP+ (10 Ports)	MIC3-3D-10XGE-SFPP	10	12.3	12.3
10-Gigabit Ethernet MIC with SFP+ (24 Ports)	MIC6-10G	24	13.3R2	13.3R2
10-Gigabit Ethernet OTN MIC with SFP+ (24 Ports)	MIC6-10G-OTN	24	13.3R3	13.3R3
40-Gigabit Ethernet				

Table 27: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	2	12.3	12.3
100-Gigabit Ethernet				
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	1	12.3	12.3
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	1	12.3	12.3
100-Gigabit Ethernet MIC with CXP (4 Ports)	MIC6-100G-CXP	4	13.3R2	13.3R2
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	2	13.3R3	13.3R3
100-Gigabit DWDM OTN				
100-Gigabit DWDM OTN MIC with CFP2-ACO	MIC3-100G-DWDM	1	15.1F5 15.1F6 17.1R1	15.1F5 15.1F6 17.1R1
Multi-Rate				
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	12.3	12.3
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	12.3	12.3
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	12.3	12.3

Table 27: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	12.3	12.3
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	4	12.3	12.3
MIC MRATE (12-Port Multi-Rate MIC with QSFP+)	MIC-MRATE	12	• 15.1F5 with Junos Continuity • 16.1R1 and later	• 15.1F5 with Junos Continuity • 16.1R1 and later
Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)	MIC-MACSEC-MRATE	12	17.4	17.4
Tri-Rate				
Tri-Rate MIC	MIC-3D-40GE-TX	40	12.3	12.3
Services				
Multiservices MIC	MS-MIC-16G	0	13.2	13.2
SONET/SDH				
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	1	12.3	12.3

Table 28: MICs Supported by MX5, MX10, and MX40 Routers

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
ATM					
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	8	12.1	12.1	12.1
DS3/E3					
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	11.4	11.4
Circuit Emulation					
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	13.2R2	13.2R2	13.2R2
Channelized E1/T1 Circuit Emulation MIC (H)	MIC-3D-16CHE1-T1-CE-H	16	–	–	–
Gigabit Ethernet					
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	11.2R4	11.2R4	11.2R4
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.2R2	13.2R2	13.2R2

Table 28: MICs Supported by MX5, MX10, and MX40 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
Gigabit Ethernet MIC with SFP (EH)	MIC-3D-20GE-SFP-EH	20	–	–	–
10-Gigabit Ethernet					
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	11.2R4	11.2R4	11.2R4
Multi-Rate					
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3 OC12-1OC48	4	11.2R4	11.2R4	11.2R4
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3 OC12-4OC48	8	11.2R4	11.2R4	11.2R4
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHO C3-2CHOC12	4	11.4	11.4	11.4
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHO C3-4CHOC12	8	11.4	11.4	11.4

Table 28: MICs Supported by MX5, MX10, and MX40 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3 -1COC12-CE	4	12.2	12.2	12.2
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H)	MIC-4COC3-1C OC12-CE-H	-	-	-	-
Tri-Rate					
Tri-Rate MIC	MIC-3D-40GE-TX	40	–	11.2R4	11.2R4
Services					
Multiservices MIC	MS-MIC-16G	0	13.2 Rear slot only.	13.2 Rear slot only.	13.2 Rear slot only.
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC19 2-XFP	1	12.2	12.2	12.2

Table 29: MICs Supported by MX80 and MX104 Routers

MIC Name	MIC Model Number	Ports	MX80	MX104
ATM				

Table 29: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
ATM MIC with SFP	MIC-3D-8OC3-2OC 12-ATM	8	12.1	13.3
DS3/E3				
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	13.3
Circuit Emulation				
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	13.2R2	13.2R2
Channelized E1/T1 Circuit Emulation MIC (H)	MIC-3D-16CHE1-T1-CE-H	16	–	13.2R2
Gigabit Ethernet				
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	10.2	13.2R2
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.2R2	13.2R2
Gigabit Ethernet MIC with SFP (EH)	MIC-3D-20GE-SFP-EH	20	–	13.2R2
Gigabit Ethernet MIC with 256b-AES MACsec	MIC-MACSEC-20GE	20	18.3	18.3

Table 29: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	10.2	13.2R2
Multi-Rate				
SONET/SDH OC3/ STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	11.2	13.3
SONET/SDH OC3/ STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	11.2	13.3
Channelized SONET/SDH OC3/ STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	11.4	13.3
Channelized SONET/SDH OC3/ STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	11.4	13.3
Channelized OC3/ STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	4	12.2	13.2R2
Channelized OC3/ STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H)	MIC-4COC3-1COC12-CE-H	-	-	13.2R2
Tri-Rate				

Table 29: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
Tri-Rate MIC	MIC-3D-40GE-TX	40	10.2	13.2R2
Services				
Multiservices MIC	MS-MIC-16G	0	13.2 Rear slot only. Supported on the modular MX80 and fixed MX80-48T	13.3R2 **NOTE**: Starting From Junos OS 13.3R3, 14.1R2, and 14.2R1, MX104 supports only two Multiservices MICs.
SONET/SDH				
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	1	12.2	13.3

Table 30: MICs Supported by MX10003 Router

MIC Name	MIC Model Number	Ports	MX10003
Multi-Rate			
Multi-Rate Ethernet MIC (12-Port Multi-Rate MIC with QSFP+)	JNP-MIC1	12	17.3
Multi-Rate Ethernet MIC (12-Port Multi-Rate MACsec MIC with QSFP+)	JNP-MIC1-MACSEC	12	17.3R2

RELATED DOCUMENTATION

MX Series MIC Overview

MIC/MPC Compatibility

MX2010 Modular Interface Card LEDs

Each MIC has LEDs located on the faceplate. For more information about LEDs on the MIC faceplate, see the “LEDs” section for each MIC in the *MX Series Interface Module Reference*.

RELATED DOCUMENTATION

Maintaining MX2010 MICs | **760**

Troubleshooting the MX2010 MICs | **832**

Replacing an MX2010 MIC | **613**

MX2010 Port and Interface Numbering

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

type-fpc/pic/port

- *type*—Media type, which identifies the network device. For example:
  - ge—Gigabit Ethernet interface
  - so—SONET/SDH interface
  - xe—10-Gigabit Ethernet interface

  For a complete list of media types, see *Interface Naming Overview*.
- *fpc*—Slot in which the MPC is installed. On the MX2010 router, the MPCs are represented in the CLI as `FPC 0` through `FPC 9`.
- *pic*—Logical PIC on the *MIC*. The number of logical PICs varies depending on the type of MIC.
- *port*—Port number.

NOTE: The MIC number is not included in the interface name.

The MX2010 supports up to ten MPCs that install vertically and are numbered from left to right.

The following sample CLI output displays an MPC (**MPCE Type 2 3D**) installed in MPC slot **9**.

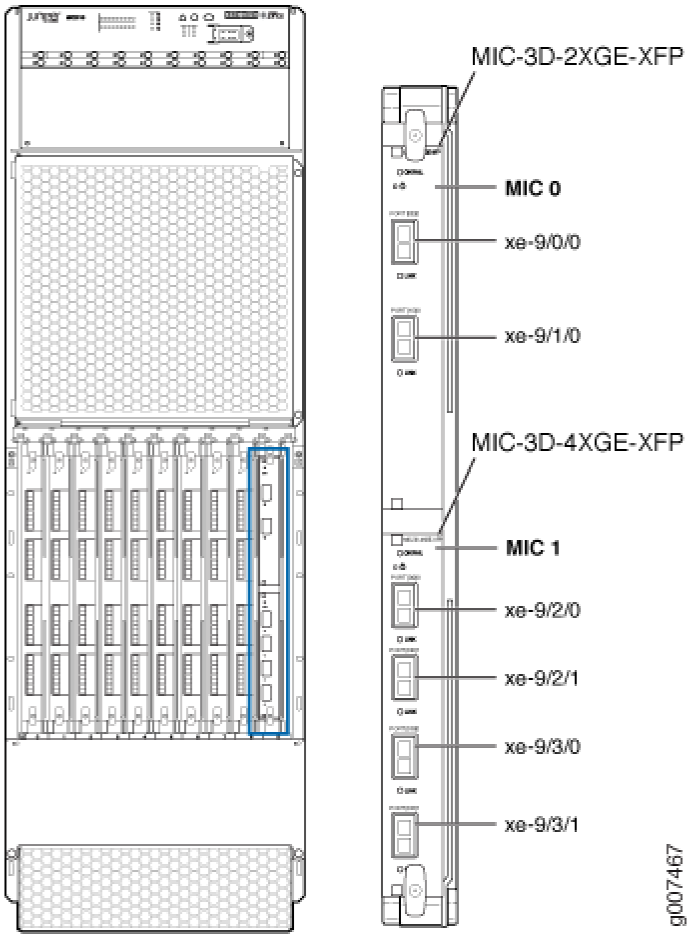
```
user@host> show chassis hardware

...
FPC 9            REV 07   750-038491   ZV7947           MPCE Type 2 3D
  CPU            REV 04   711-038484   ZV1360           MPCE PMB 2G
  MIC 0          REV 27   750-028387   CAAB4862         3D 4x 10GE XFP
    PIC 0                 BUILTIN      BUILTIN          2x 10GE XFP
      Xcvr 0     REV 01   740-014289   T07M71204        XFP-10G-SR
    PIC 1                 BUILTIN      BUILTIN          2x 10GE XFP
      Xcvr 0     REV 01   740-014289   AD0932M004Y      XFP-10G-SR
  MIC 1          REV 20   750-028380   ABBT7121         3D 2x 10GE XFP
    PIC 2                 BUILTIN      BUILTIN          1x 10GE XFP
      Xcvr 0     REV 01   740-014289   AD0932M0092      XFP-10G-SR
    PIC 3                 BUILTIN      BUILTIN          1x 10GE XFP
      Xcvr 0     REV 01   740-014289   AD0932M000J      XFP-10G-SR
...
```

There is one 10-Gigabit Ethernet MIC (**MIC-3D-2XGE-XFP**) installed into the MPC, **MIC 0** (top slot), and one 10-Gigabit Ethernet MIC (**MIC-3D-4XGE-XFP**) installed into the MPC, **MIC 1** (bottom slot). Each MIC is logically divided into two PICs in the CLI.

The port numbers on the MICs correspond to the port number in the interface. See the *MX Series Interface Module Reference* for more information about specific MICs.

Figure 36 on page 119 shows how the interfaces correspond to the ports on the MIC.

Figure 36: MX2010 Interface Port Mapping



NOTE: The slot number will be different depending on which slot the MPC and MIC is installed.

The `show interfaces terse` command displays the two 10-Gigabit Ethernet interfaces, `xe-9/0/0` and `xe-9/1/0` that correspond to the two ports on the MIC card that is installed in slot **0** of the MPC, and four 10-Gigabit Ethernet interfaces, `xe-9/2/0`, `xe-9/2/1`, `xe-9/3/0`, and `xe-9/3/1` that correspond to the four ports on the MIC card that is installed in slot **1** of the MPC.

```
user@host>show interfaces terse
...
lc-9/0/0                up     up
lc-9/0/0.32769          up     up    vpls
pfe-9/0/0               up     up
pfe-9/0/0.16383         up     up    inet
                                     inet6
```

```
pfh-9/0/0               up    up
pfh-9/0/0.16383         up    up   inet
xe-9/0/0                up    up
xe-9/1/0                up    up
lc-9/2/0                up    up
lc-9/2/0.32769          up    up   vpls
pfe-9/2/0               up    up
pfe-9/2/0.16383         up    up   inet
                                   inet6
xe-9/2/1                up    up
xe-9/2/0.0              up    up   inet     223,1,3,1/30
                                   iso
                                   inet6    3ffe::df01:301/30
                                            fe80::6687:88ff:fe04:8928/64
                                   mpls
                                   multiservice
xe-9/3/0                up    up
xe-9/3/1                up    up
...
```

RELATED DOCUMENTATION

MX2010 Router Hardware Components and CLI Terminology | 29

CHAPTER 8

Power System

IN THIS CHAPTER

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MX2010 Power System Description

The MX2000 routers are available in -48 V and 240 V China DC power configurations, three-phase (delta and wye) AC power configurations, single-phase power configurations, and high voltage AC

(HVAC) or high voltage DC (HVDC) configurations. You can add additional power to the rack as needed. The MX2010 router is configurable with up to two AC, DC, 240 V China, or high-voltage second-generation universal (HVAC/HVDC) power distribution modules (PDMs), and up to nine AC, DC, or universal (HVAC/HVDC power supply modules (PSMs). The PSMs connect to the top and bottom power backplanes that distribute the output voltages produced by the PSMs to the router components. Table 31 on page 122 describes the MX2010 DC power components and Table 33 on page 125 describes the MX2010 AC power components.

CAUTION: Do not mix AC, DC, 240 V China, or universal (HVAC/HVDC) PSMs or different PDM types within a single system. The MX2010 systems configured for three-phase wye AC input power must use only three-phase wye AC PDMs and three-phase wye AC PSMs. The systems configured for DC (-48 V) input power must use DC (-48 V) PDMs and PSMs. The systems configured for DC (240 V China) input power must use DC (240 V China) PDMs and PSMs. The systems configured for three-phase delta AC input power must use only three-phase delta AC PDMs and three-phase delta AC PSMs. The systems configured for single-phase AC input power must use only single phase AC PDMS and single-phase AC PSMs. The systems configured for universal (HVAC/HVDC) input power must use universal (HVAC/HVDC) PDMs and universal PSMs.

Table 31: MX2010 DC Power Components

Component	Description
DC power system	The MX2010 DC power system comprises three components: nine PSMs, two PDMs,, and a power midplane (PMP). The power system distributes power from a pool of 22.5K W (20K W for PSM nonredundant and 2.5 KW reserved for PSM redundancy). This pool provides power to 10 line-card slots, four fan trays, two CB-REs and eight SFBs.

Table 31: MX2010 DC Power Components ***(Continued)***

Component	Description
DC Power Distribution Modules (-48 V)	In the DC (-48 V) power configuration, the router contains up to two DC PDMs located at the rear of the chassis in slots **PDM0/ Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system. Two PDMs provide full redundancy. The DC PDM provides a power interface to nine PSMs. Each DC PDM operates with seven feeds or nine feeds of either a 60-A or 80-A amp current limit. You can select the input feed capacity (60-A or 80-A) by setting the DIP switch on the PDM to the rated amperage of the DC power input feeds. Each DC PDM has seven or nine DC inputs (–48 VDC and return terminals for each input). **NOTE**: The selected input capacity applies to all inputs of this PDM. Selecting 60 A reduces the available power output capacity of the PSMs supplied by this PDM. In a redundant configuration, the 7-feed DC PDMs support a total of fourteen 60-A or 80-A feeds, and the 9-feed DC PDMs support a total of eighteen 60-A or 80-A feeds.
DC Power Distribution Modules (240 V China)	In the DC PDM (240 V China) power configuration, the router contains up to two DC PDMs located at the rear of the chassis in slots **PDM0/Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system. Two PDMs provide full redundancy. The DC PDM provides a power interface to nine PSMs. If feeds that connect to one PDM fail in a redundant configuration, the other feed will provide full power. You can install a total of two PDMs into a router. Each DC PDM (240 V China) operates with nine feeds.

Table 31: MX2010 DC Power Components *(Continued)*

Component	Description
DC Power Supply Modules (PSMs)	The MX2010 DC PSMs (-48 V and 240 V China) are hot-removable and hot-insertable. The DC PSMs are a dual redundant feed (**INP0** and **INP1**). To provide feed redundancy, you can connect each DC PSM to two separate feeds from different sources. When both input feeds are present, power is drawn from the feed supplying higher DC voltage. You can set these feeds by using the input mode DIP switch located on the DC PSM (see "MX2010 DC Power Supply Module (-48 V) Description" on page 147). There are two PDMs per power system capable of carrying seven feeds or nine feeds each. The 240 V China PDM has nine feeds. Each DC PSM is capable of delivering 2500 W of power if -48 V/80 A is applied to the -48 V PSM, and 240 V/16 A is applied to the China 240 VDC PSM.

Table 32: MX2010 High-Voltage Universal (HVAC/HVDC) Power Components

Component	Description
HVAC/HVDC power subsystem	The MX2010 HVAC/HVDC power system comprises three components: nine PSMs, two PDMs, and a power midplane (PMP). The power system distributes power from a pool of 30.6 KW (27.2 KW non redundant and 3.4 KW reserved for redundancy) if dual inputs are used. If single inputs are used, the pool is 27 KW (24 KW non redundant and 3 KW reserved for redundancy). This pool provides power to 10 line-card slots, four fan trays, two CB-REs and eight SFBs.
Universal HVAC/HVDC Power Distribution Modules	In the universal HVAC/HVDC PDM power configuration, the router contains up to two HVAC/HVDC PDMs located at the rear of the chassis in slots **PDM0/Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system. Two PDMs provide full redundancy. The HVAC/HVDC PDM provides a power interface to nine PSMs. If feeds that connect to one PDM fail in a redundant configuration, the other feed provides full power. You can install a total of two PDMs into a router. Each HVAC/HVDC PDM operates with nine feeds.

Table 32: MX2010 High-Voltage Universal (HVAC/HVDC) Power Components *(Continued)*

Component	Description
Universal HVAC/HVDC Power Supply Modules (PSMs)	The MX2010 universal HVAC/HVDC PSMs are hot-removable and hot-insertable. The universal PSMs are a dual-redundant feed (**INP0** and **INP1**). To provide feed redundancy, you can connect each PSM to two separate feeds from different sources. When both input feeds are present, power is drawn from both feeds equally. You can set these feeds by using the input mode DIP switch located on the HVAC/HVDC PSM (see *MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description*). There are two PDMs per system capable of carrying nine feeds each. Each HVAC/HVDC PSM is capable of delivering 3400 W if both feeds are present, and 3000 W if one feed is present.

Table 33: MX2010 AC Power Components

Component	Description
AC power system	The MX2010 supports connection of a single-phase or three-phase (delta or wye) AC power system. In the three-phase power systems, the AC power going to the PSMs is split into three individual phases (wye) or a pair of phases (delta). Each PSM works on a single phase; therefore, the power system works independent of the type of AC feed connected. You can connect one or two AC feeds, depending on the power system configuration (number of PSMs, redundancy, and so on). Each phase from each of the two feeds is distributed among one or two PSMs. One feed has each phase going to two PSMs, and the other feed has each phase going to a single PSM. The single-phase AC PDM provides an AC input connection from the single-phase AC power source, and also provides an input power interface to the PSM through a system power midplane.

Table 33: MX2010 AC Power Components *(Continued)*

Component	Description

AC Power Distribution Modules (PDMs)	The MX2010 supports connection of a single-phase or three-phase (delta or wye) AC PDM. Four AC PDM models are available: three-phase delta, three-phase wye, seven-feed single-phase, and nine-feed single-phase.
	• Each three-phase AC PDM requires two three-phase feeds to be connected. Each phase from each of the two feeds is distributed among one or two PSMs (one feed has each phase going to two PSMs, and the other feed has each phase going to a single PSM).
	  • The single-phase AC PDM provides an AC input connection from the single-phase AC power source, and also provides an input power interface to the PSM through a system power midplane. The single-phase AC PDMs accept seven or nine AC power cords from a single-phase AC source.
	  • Each AC input is independent and feeds one PSM. Up to nine PSMs can be connected through the AC PDM.

AC Power Supply Modules (PSMs)	The MX2010 AC PSMs are hot-removable and hot-insertable. The AC PSMs have a dual redundant feed (**INP0** and **INP1**). One input feed is active during operation. These feeds are set by the input mode DIP switch located on the AC PSM (see "MX2000 AC Power Supply Module Description" on page 137). Each AC PSM works with a single phase derived from either three-phase delta 200–240 VAC (line-to-line) or three-phase wye 200–240 VAC (line-to-neutral). Each AC PSM is capable of delivering 2500 W of power.

The MX2010 router supports the power systems models and Junos OS releases in Table 34 on page 126.

Table 34: Supported MX2010 Power System Components

Name	Model Number	Junos OS Release
DC PSM	MX2000-PSM-DC	12.3R2 and later
DC PSM (240-V China)	MX2K-PSM-DC-240V	18.2R1 and later

Table 34: Supported MX2010 Power System Components *(Continued)*

Name	Model Number	Junos OS Release
Universal HVAC/HVDC PSM	MX2K-PSM-HV	19.4R1 and later
Nine-feed DC PDM (240-V China)	MX2K-PDM-DC-240V	18.2R1 and later
Nine-feed DC PDM	MX2000-PDM-DC	12.3R2 and later
Seven-feed DC PDM	MX2K-PDM-OP-DC	15.1R1
Nine-feed Universal HVAC/HVDC PDM	MX2K-PDM-HV	19.4R1 and later
AC PSM	MX2000-PSM-AC	12.3R2 and later
Three-phase delta AC PDM	MX2000-PDM-AC-DELTA	12.3R2 and later
Three-phase wye AC PDM	MX2000-PDM-AC-WYE	12.3R2 and later
Nine-feed single-phase AC PDM	MX2K-PDM-AC-1PH	15.1R1 and later
Seven-feed single-phase AC PDM	MX2K-PDM-OP-AC	15.1R1 and later

NOTE: Routers configured with AC, DC, 240 V China, or universal (HVAC/HVDC) PDMs and PSMs are shipped with blank panels installed.

NOTE: To avoid triggering any PSM-related or power-related alarms for the PSMs that are not used but still plugged into the MX2010 router, make sure that you:

- Do not connect external power feeds to the PSM through the PDM.
- Move the DIP switch on the PSMs to the off position.

- Turn off the PSM by using its **ON/OFF** switch.

RELATED DOCUMENTATION

MX2000 AC Power Supply Module Description | 137
MX2000 Three-Phase Delta AC Power Distribution Module Description | 129
MX2000 Three-Phase Wye AC Power Distribution Module Description | 131
MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description | 134
MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description | 135
MX2010 DC Power Distribution Module (-48 V) Description | 142
MX2010 DC Power Supply Module (-48 V) Description | 147
MX2000 DC Power Distribution Module (240 V China) Description | 143
MX2000 DC Power Supply Module (240 V China) Description | 149
MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | 153
MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs | 159
MX2010 AC Power Requirements | 203
MX2010 DC Power Requirements | 233
Maintaining the Power Supply Modules on the MX2000 Line of Routers | 779
Troubleshooting the MX2000 Router Power System

MX2010 Power Midplane Description

The MX2010 power system consists of a power midplane (PMP). This midplane is used to connect power from the PDM feeds (AC, DC, 240 V China, or HVAC/HVDC universal) to the input of the PSMs (AC, DC, 240 V China, or HVAC/HVDC universal) as well as the output from the PSMs to the FRUs (MPCs, CB-REs, SFBs, and fan trays). The power midplane plugs into the signal backplane. The PSMs and PDMs get plugged into the power midplane.

RELATED DOCUMENTATION

MX2010 Router Overview | 2
MX2010 Chassis Description | 6

MX2010 Modular Port Concentrator Description | 92
MX2000 Switch Fabric Board (SFB) Overview | 72
MX2000 Host Subsystem CB-RE Description | 57
MX2010 Modular Interface Card Description | 102
MX2010 Power System Description | 121
MX2010 Backplane Description | 14

MX2000 Three-Phase Delta AC Power Distribution Module Description

Each three-phase delta AC power distribution module (PDM) weighs approximately 12 lb (5.44 kg). A metal wiring compartment contains two AC terminal blocks and ground labeled **GND**. One AC terminal block consists of three input terminals that serves six power supply modules (PSMs) and the second terminal block serves three PSMs. The terminal block on the left is labeled **A1**, **B1**, and **C1** (bottom to top). The second terminal block on the right is labeled **A2**, **B2**, and **C2** (bottom to top). The PDMs are located at the rear of the chassis in slots **PDM0/Input0** through **PDM1/Input1**, (bottom to top). LEDs provide the status of the PDM. Figure 37 on page 129 shows the three-phase delta AC PDM.

NOTE: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

Figure 37: Three-Phase Delta AC Power Distribution Module

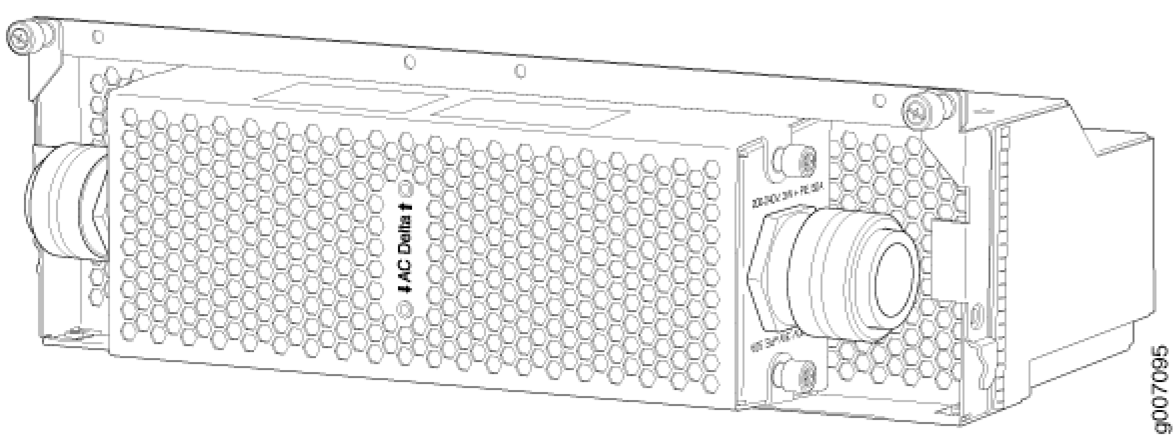


Figure 38 on page 130 shows the three-phase delta AC PDM connections.

> **CAUTION**: The three-phase delta AC PDM must be installed and secured in the chassis before connecting the power input cables. If the PDM must be removed, both input power cables must be uninstalled and removed from the PDM before the PDM can be removed from the chassis. The MX series chassis is not sensitive to phase rotation sequence—either clockwise or counter-clockwise will operate correctly.

Figure 38: Three-Phase Delta AC Power Distribution Module Connections

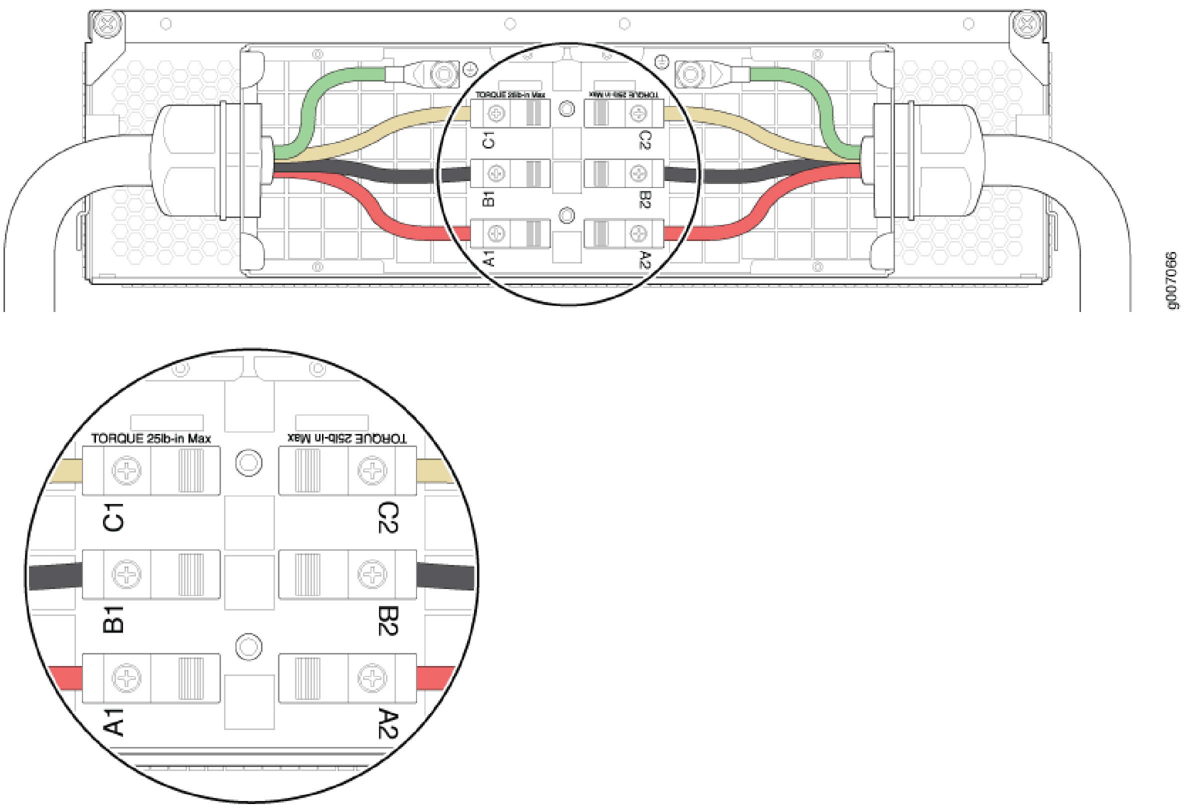
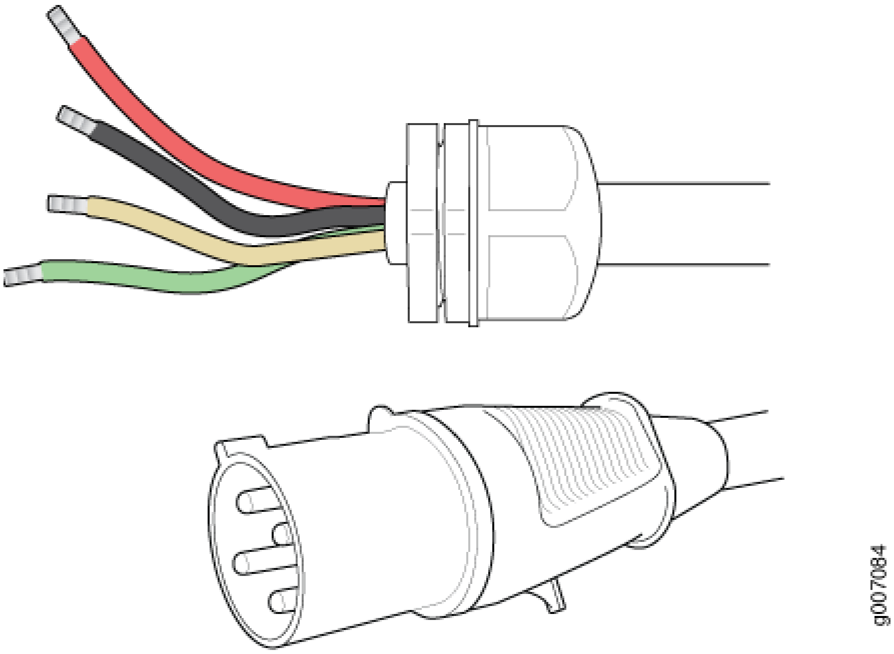


Figure 39 on page 131 shows the three-phase delta AC power cord.

Figure 39: Three-Phase Delta AC Power Cord



RELATED DOCUMENTATION

MX2020 Power Subsystem Description

MX2020 AC Power Requirements

MX2000 Three-Phase Wye AC Power Distribution Module Description

Each three-phase wye AC PDM weighs approximately 12 lb (5.44 kg). A metal wiring compartment contains two AC terminal blocks and ground labeled **GND**. One AC terminal block consists of three input terminals that serve six PSMs and the second terminal block serves three PSMs. The terminal block on the far left is labeled **A1**, **B1**, **C1**, and **N1** (bottom to top). The second terminal block is labeled **A2**, **B2**, **C2**, and **N2** (bottom to top). The PDMs are located at the rear of the chassis in slots **PDM0/ Input0** through **PDM1/Input1**, (bottom to top). LEDs provide the status of the PDM. Figure 40 on page 132 shows the three-phase wye AC PDM.

NOTE: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

Figure 40: Three-Phase Wye AC Power Distribution Module

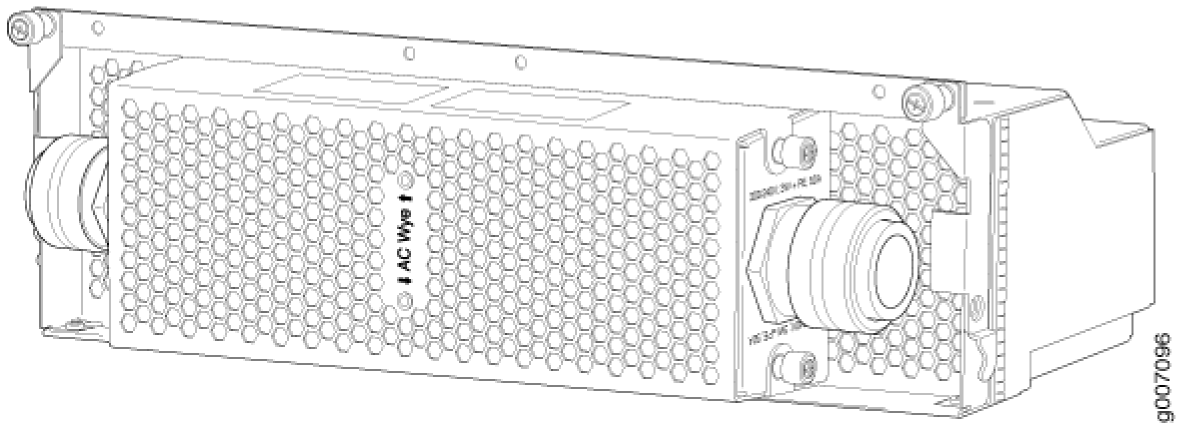


Figure 41 on page 133 shows the three-phase wye AC PDM connections.

CAUTION: The three-phase wye AC PDM must be installed and secured in the chassis before connecting the power input cables. If the PDM must be removed, both input power cables must be uninstalled and removed from the PDM before the PDM can be removed from the chassis. The MX Series chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

Figure 41: Three-Phase Wye AC Power Distribution Module Connections

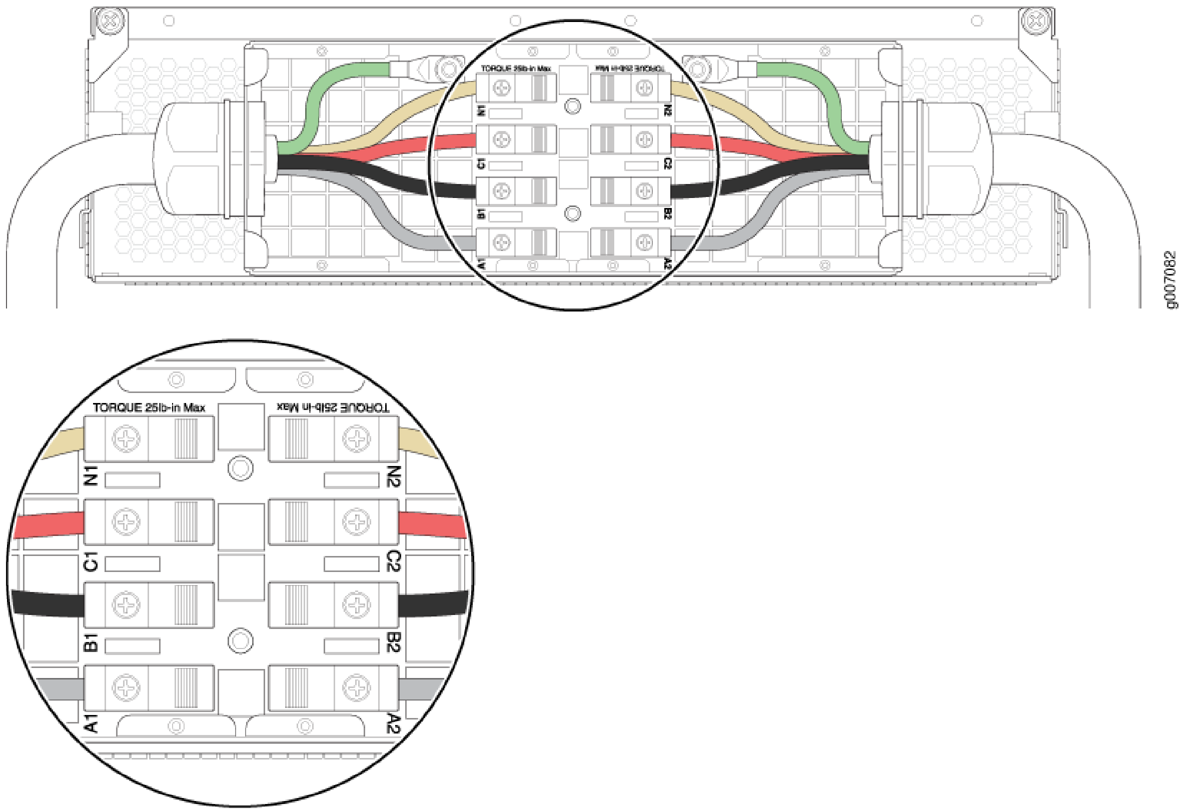
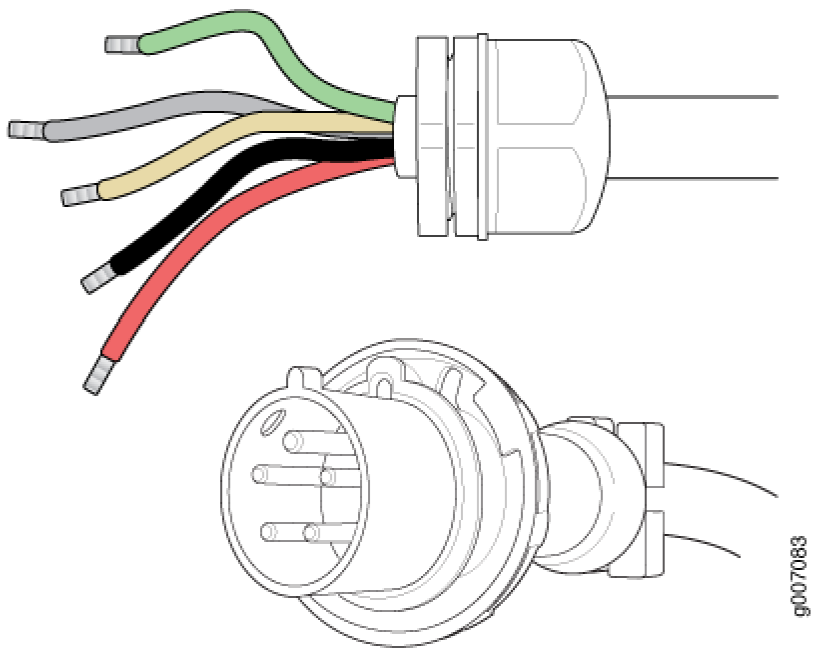


Figure 42 on page 134 shows the three-phase wye AC power cord.

Figure 42: Three-Phase Wye AC Power Cord



RELATED DOCUMENTATION

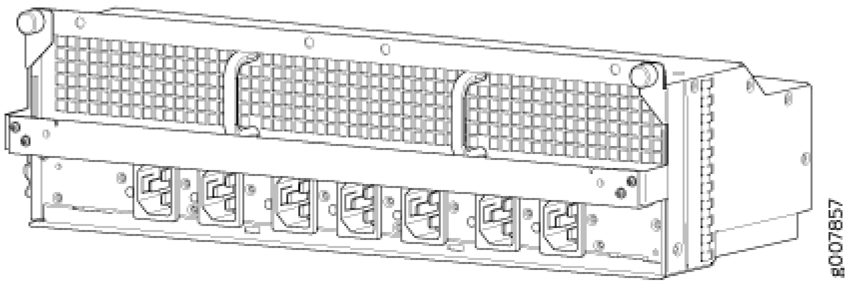
MX2020 Power Subsystem Description

MX2020 AC Power Requirements

MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description

Each seven-feed single-phase AC power distribution module (PDM) weighs approximately 8 lb (3.6 kg). The front of the PDM has seven type C21 power cord connections for connecting to single-phase AC power. Figure 43 on page 135 shows the seven-feed single-phase AC PDM.

Figure 43: Seven-Feed Single-Phase AC Power Distribution Module



CAUTION: The single-phase AC PDM must be installed and secured in the chassis before connecting the input power cables. If the PDM must be removed, all input power cables must be removed from the PDM before the PDM can be removed from the chassis.

RELATED DOCUMENTATION

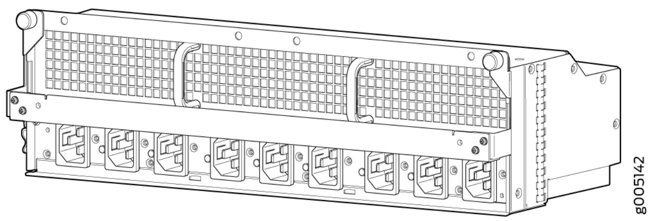
MX2020 AC Power Requirements

MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description

The MX2000 nine-feed single-phase AC power distribution module (PDM) provides AC input connection from a single-phase AC source, and also provides an input power interface to the power supply module (PSM) through a system power midplane. Up to nine PSMs can be connected to the single-phase AC PDM. Each AC input is independent and feeds one PSM.

The nine-feed single-phase AC PDM weighs approximately 9 lb (4.1 kg). The front of the PDM has nine type C21 power cord connections for connecting to single-phase AC power. Figure 44 on page 136 shows the nine-feed single-phase AC PDM.

Figure 44: Nine-Feed Single-Phase AC Power Distribution Module



CAUTION: The single-phase AC PDM must be installed and secured in the chassis before connecting the input power cables. If the PDM must be removed, all input power cables must be removed from the PDM before the PDM can be removed from the chassis.

RELATED DOCUMENTATION

MX2020 AC Power Requirements

MX2020 Power Subsystem Description

MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs

Figure 45 on page 137 shows the LEDs on the three-phase delta AC PDM faceplate. The three-phase wye AC PDM has the same LEDs. The LEDs in Table 35 on page 137 indicate the status of the AC PDM. In addition, a PDM failure triggers the red alarm LED on the craft interface.

Figure 45: Three-Phase Delta AC PDM LEDs

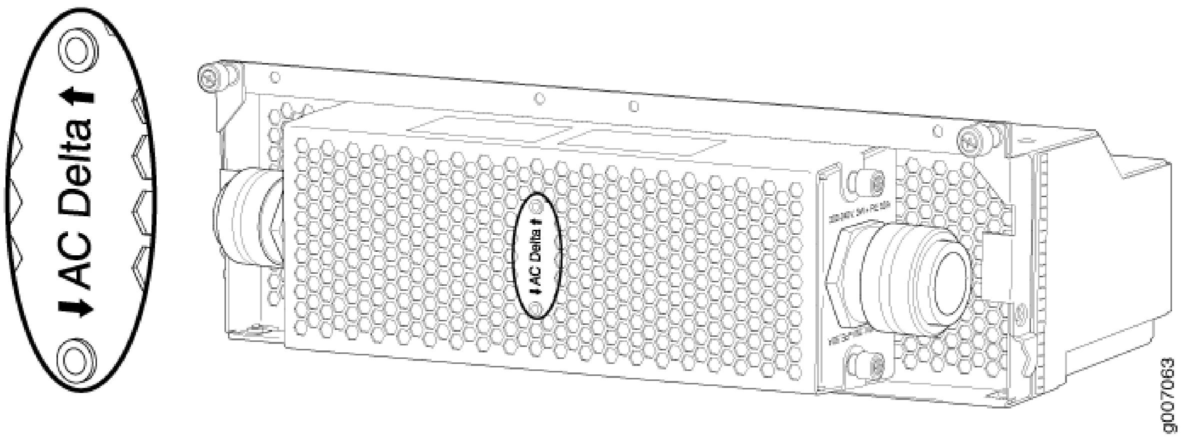


Table 35: Three-Phase Delta AC PDM LEDs

Label	Color	State	Description
←	Green	On	The left AC terminal block is receiving voltage.
	–	Off	The left AC terminal block is not receiving voltage.
→	Green	On	The right AC terminal block is receiving voltage.
	–	Off	The right AC terminal block is not receiving voltage.

MX2000 AC Power Supply Module Description

There are a total of nine AC power supply modules (PSMs) located at the rear of the chassis in slots **PSM0** through **PSM8** (left to right). The AC PSMs in slots **PSM0** through **PSM8** provide power to:

- fan trays (**0**, **1**, **2**, and **3**; **0** and **1** for MX2008)
- MPCs in slot **0** through **9**
- CB-REs in slot **0** and **1**
- SFBs in slot **0** through **7**

The MX2000 line of routers supports a three-phase delta AC power system, three-phase wye AC power system, or a single-phase AC power system.

CAUTION: Do not mix AC and DC PSMs or different PDM types within a single system. The MX2000 line of routers configured for three-phase wye AC input power must use only three-phase wye AC PDMs and three-phase AC PSMs. The systems configured for three-phase delta AC input power must use only three-phase delta AC PDMs and AC PSMs. The systems configured for single-phase AC input power must use only single phase AC PDMS and AC PSMs.

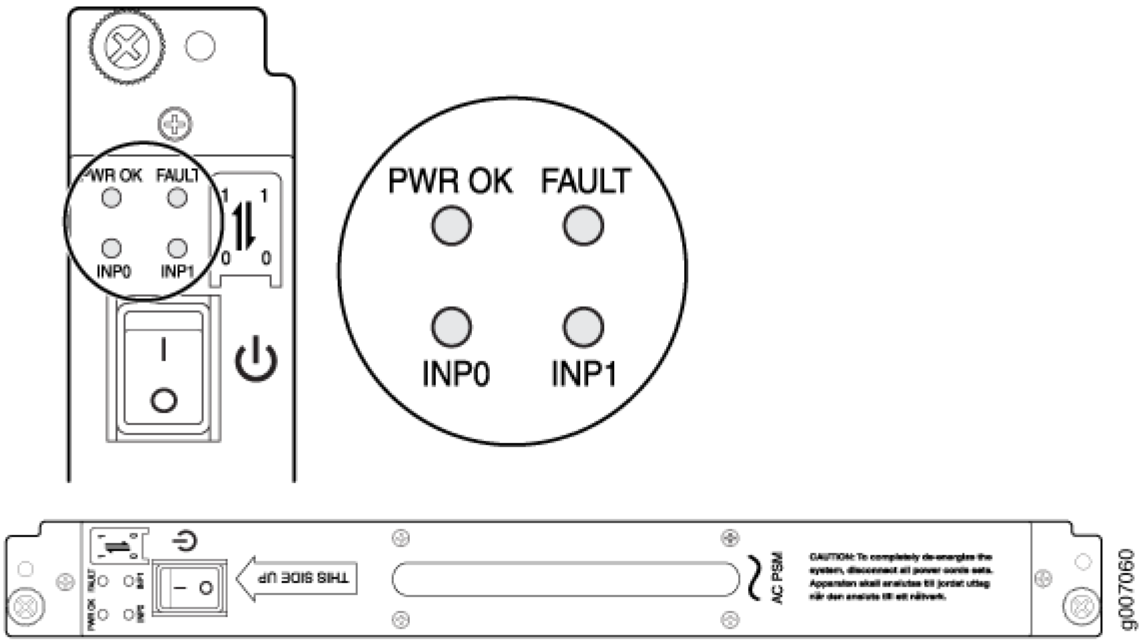
In a three-phase AC power system, the AC power going to the PSMs is split into a pair of phases. Each PSM works on a single phase. This means the power system works independent of the kind of AC feed connected. You can connect one or two feeds, depending on the power system configuration, number of PSMs, redundancy, and so on. Each phase from each of the two feeds is distributed among one or two PSMs. One feed has each phase going to two PSMs and the other feed has each phase going to a single PSM.

The single-phase AC power distribution module (PDM) provides an AC input power interface to the PSM through the system power midplane. Up to nine PSMs can be connected to a single-phase AC PDM. Each single-phase AC PDM accepts seven or nine AC power cords from a single-phase AC source. Each AC input is independent and feeds one PSM.

The AC PSMs are hot-removable and hot-insertable.

Up to nine PSMs may be connected in parallel per power subsystem to increase available power for MPCs, as needed and to provide redundancy. Figure 46 on page 139 shows the AC PSM.

Figure 46: AC Power Supply Module

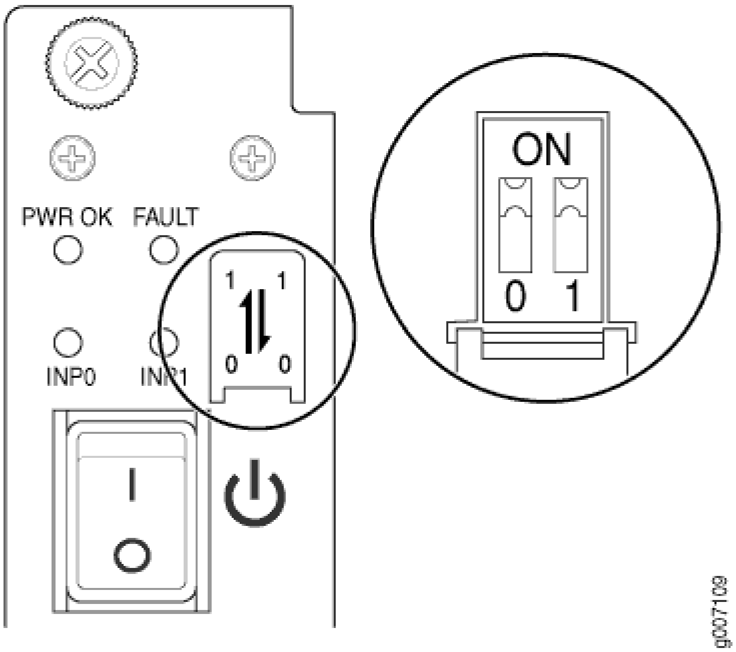


The AC power system provides dual redundant feeds (**INP0** and **INP1**). Each PSM takes in two AC feeds and uses one of the two. One input feed is active during operation. Each feed is a single-phase AC system 200–240 VAC derived from a three-phase delta or wye AC input system. These feeds are set by the input mode DIP switch located on the AC PSM. Move the input mode DIP switch to the on or off position to determine the power supply feeds (see Table 36 on page 139 and Figure 47 on page 140).

Table 36: DIP Switch Positions on the AC PSM

Left Switch Position	Right Switch Position	Input Source
Off	Off	None
On	Off	Input 0 (**INP0**)
Off	On	Input 1 (**INP1**)
On	On	Both Input 0 and Input 1

Figure 47: Selecting the Input Feed on the AC Power Supply Module



A PSM failure triggers the alarm LED on the craft interface. For information about connecting to AC power sources, see "MX2000 AC Power System Electrical Specifications" on page 218.

RELATED DOCUMENTATION

MX2020 AC Power Supply Module LEDs

MX2010 AC Power Supply Module LEDs

Each AC PSM faceplate contains four LEDs. These LEDs are described in Table 37 on page 140. There are a total of nine bicolor LEDs located in the craft interface, and are labeled **0** through **8** for the nine PSMs. Both feeds are alive during operation, but only one feed provides current. In addition, a PSM failure triggers the red alarm LED on the craft interface.

Table 37: MX2010 AC Power Supply Module LEDs

Label	Color	State	Description
PWR OK	Green	On	Power is functioning normally with no alarms.

Table 37: MX2010 AC Power Supply Module LEDs *(Continued)*

Label	Color	State	Description
	Yellow	On	PSM controller is functioning normally.
	–	Off	PSM is not functioning normally or the AC input voltage is out of range.
FAULT	Red	On	PSM is not functioning normally or the AC input voltage is out of range.
	–	Off	PSM is functioning normally.
INP0	Green	On	AC input is within the required voltage range and the DIP switch is set to on.
	Yellow	On	AC input is out of the required voltage range.
	–	Off	AC input to the PSM is not present.
INP1	Green	On	AC input is within the required voltage range and the DIP switch is set to on.
	Yellow	On	AC input is out of the required voltage range.
	–	Off	AC input to the PSM is not present.

RELATED DOCUMENTATION

MX2010 Component LEDs on the Craft Interface | **36**
MX2010 Power System Description | **121**
MX2000 AC Power Supply Module Description | **137**
MX2000 AC Power System Electrical Specifications | **218**

MX2010 DC Power Distribution Module (-48 V) Description

In the DC power configuration, the router contains up to two DC power distribution modules (PDMs) located at the rear of the chassis in slots **PDM0/Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system (two PDMs per MX2010 chassis) for nonredundant power. The DC PDM provides a power interface to nine power supply modules (PSMs).

Two PDMs provide full redundancy. In a redundant configuration, a total of fourteen 60-A or 80-A input feeds (7-feed DC PDMs), and a total of eighteen 60-A or 80-A input feeds (9-feed DC PDMs) are supported.

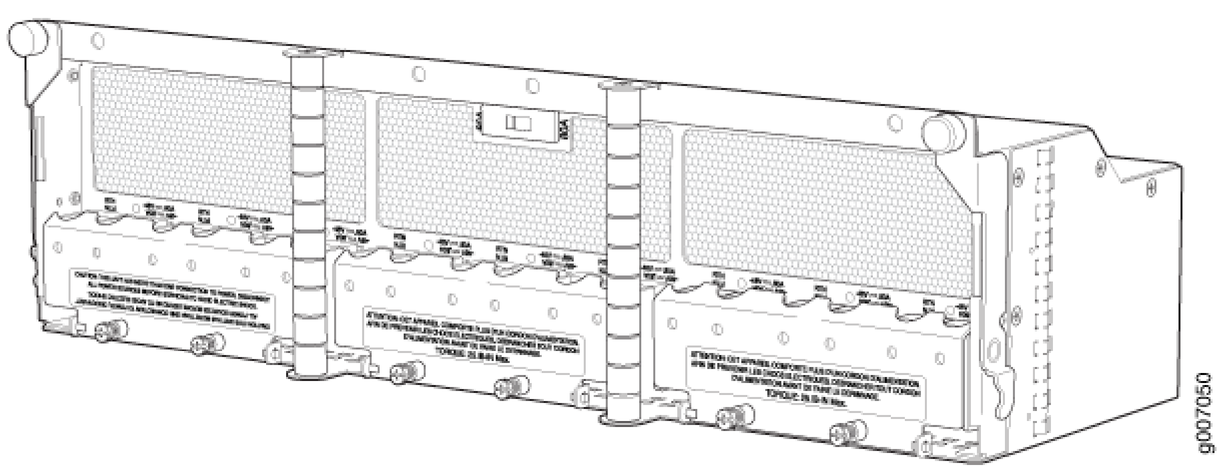
> **NOTE**: The power backplane for a subsystem distributes regulated 52 VDC to all boards supplied by that subsystem.

Each DC PDM has seven or nine DC inputs (–48 VDC and return terminals for each input). You can select 60-A or 80-A input feed capacity on the DC PDM by setting the DIP switch on the PDM to the rated amperage of the DC power input feeds.

> **NOTE**: The selected input capacity applies to all inputs of this PDM. Selecting 60 A reduces the available power output capacity of the PSMs supplied by this PDM.

Figure 48 on page 142 shows the MX2010 DC PDM.

Figure 48: MX2010 DC PDM



NOTE: The type of feed that you use on the DC PDM (60-A or 80-A) depends on the distribution scheme and distribution equipment. With a 60-A feed, the maximum power supply output power is limited to 2100 W while the maximum power supply input power is limited to 2400 W. With an 80-A feed, the maximum power supply output is limited to 2500 W while the maximum power supply input power is limited to 2800 W. The system power management software calculates the available and used power based on DIP switch positions in the PDM.

RELATED DOCUMENTATION

MX2010 DC Power Distribution Module (-48 V) LEDs | 144

MX2010 Router Grounding Specifications

Calculating DC Power Requirements for MX2010 Routers | 250

DC Power (-48 V) Circuit Breaker Requirements for the MX2010 Router | 254

DC Power Cable Specifications for the MX2010 Router | 255

Site Electrical Wiring Guidelines for MX Series Routers

MX2000 DC Power Distribution Module (240 V China) Description

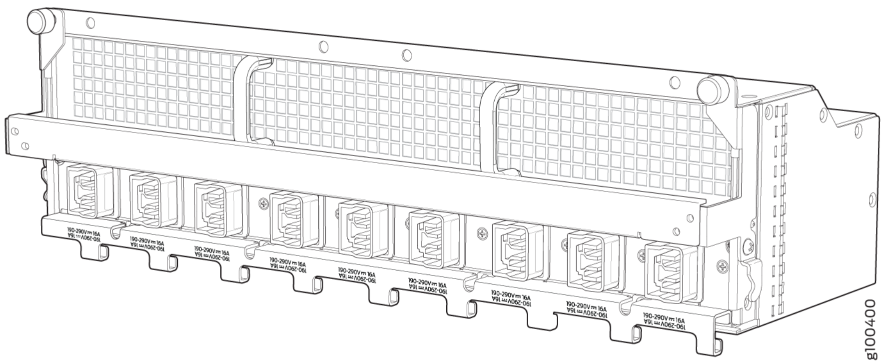
In the DC power configuration, the router contains up to two DC power distribution modules (PDMs) located at the rear of the chassis in slots **PDM0/Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system (two PDMs per chassis) for nonredundant power. The DC PDM provides a power interface to nine power supply modules (PSMs).

Two PDMs provide full redundancy for the router. In a redundant configuration, a total of a total of eighteen (9-feed DC PDMs) are supported.

NOTE: The power backplane for a subsystem distributes regulated 52 VDC to all boards supplied by that subsystem.

Each DC PDM (240 V China) has nine DC inputs, (see Figure 49 on page 144).

Figure 49: MX2000 DC PDM (240 V China)



RELATED DOCUMENTATION

MX2000 DC Power Distribution Module (240 V China) LEDs

MX2000 Router Grounding Specifications | **183**

DC Power (240 V China) Circuit Breaker Requirements for the MX2000 Router | **255**

MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications

Calculating DC Power Requirements for MX2010 Routers | **250**

DC Power (-48 V) Circuit Breaker Requirements for the MX2010 Router | **254**

DC Power Cable Specifications for the MX2010 Router | **255**

Site Electrical Wiring Guidelines for MX Series Routers

MX2010 DC Power Distribution Module (-48 V) LEDs

Each DC PDM faceplate contains one bicolor LED for each of the nine –48 V input power feeds, indicating the correct or incorrect polarity connection of each feed. See Table 38 on page 145. See Figure 50 on page 145.

Figure 50: DC Power Distribution Module LEDs

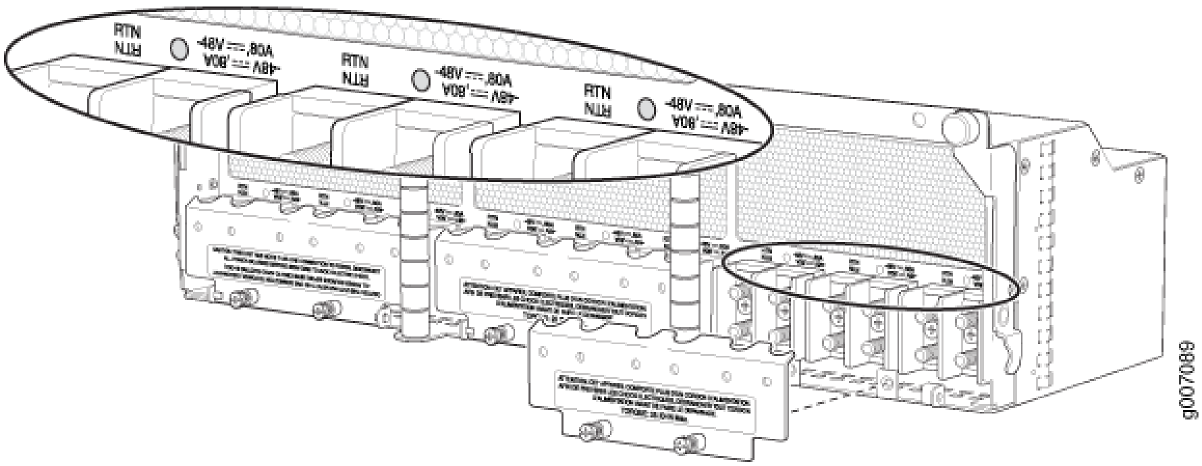


Table 38: DC Power Distribution Module LEDs

Label	Color	State	Description
–48V=80A	Green	On	RTN and –48V input feeds are connected. PDM is functioning normally.
	–	Off	RTN input feed is not connected or present.
			–48V input feed is not connected or present.
			RTN and –48V input feeds are not connected.
	Red	On	RTN or –48V input feeds may be reversed, feed live.

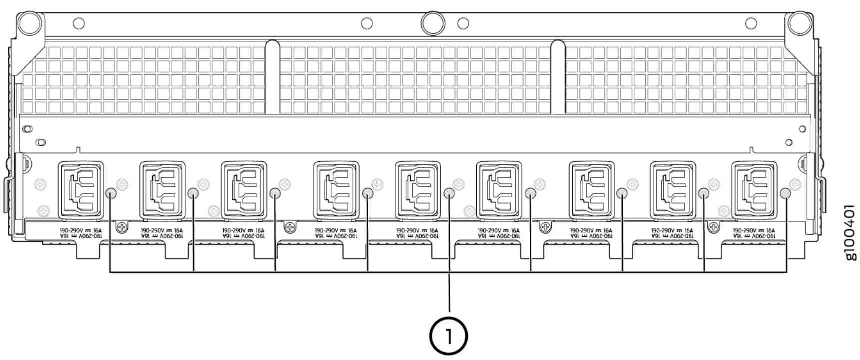
RELATED DOCUMENTATION

MX2010 Component LEDs on the Craft Interface | 36
MX2010 Power System Description | 121
MX2010 DC Power Distribution Module (-48 V) Description | 142
MX2010 DC Power (-48 V) System Electrical Specifications | 246

MX2000 DC Power Distribution Module (240 V China) LEDs

Each DC PDM (240 V China) faceplate contains one LED for each of the nine input power feeds, indicating the correct or incorrect polarity connection of each feed. See Figure 51 on page 146 and Table 39 on page 146 DC PDM (240 V China) LEDs.

Figure 51: DC Power Distribution Module (240 V China) LEDs



1– LED

Table 39: DC Power Distribution Module (240 V China) LEDs

Color	State	Description
Green	On	Positive and negative input feeds are connected. PDM is functioning normally.
–	Off	Positive input feed is not connected or present.
		Negative input feed is not connected or present.

RELATED DOCUMENTATION

MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications

MX2010 Component LEDs on the Craft Interface | **36**

MX2010 Power System Description | **121**

MX2010 DC Power (-48 V) System Electrical Specifications | **246**

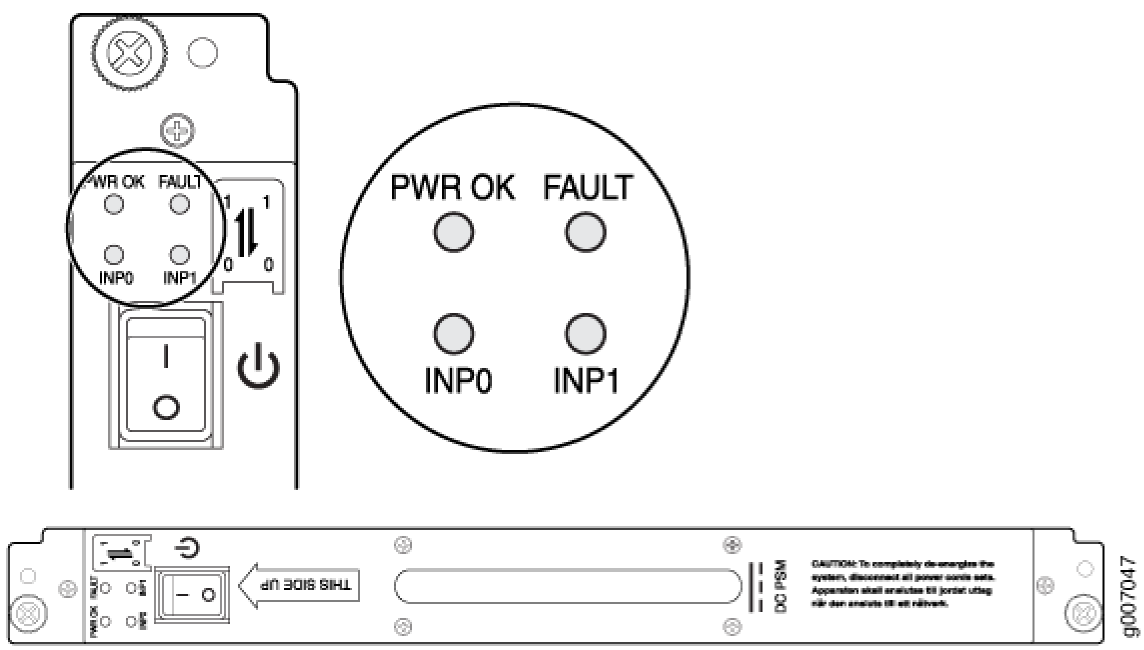
MX2010 DC Power Supply Module (-48 V) Description

The MX2010 supports a DC power system. The DC power system operates with feeds of 60 A or 80 A current limited. A total of nine feeds are required to fully power the MX2010. Another nine feeds are required to provide feed redundancy (a total of 18 60-A or 80-A feeds). In the DC power configuration, the router contains up to nine DC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8**, (left to right). The DC PSMs in slots **PSM0** through **PSM8** provide power to the all router components including MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and fan trays **0**, **1**, **2**, and **3**.

NOTE: The MX2010 systems configured for DC input power must use only DC PDMs and DC PSMs. You cannot mix AC and DC PSMs or PDMs within a single system.

Up to nine PSMs may be connected in parallel to increase available system power across MPCs as needed and provide redundancy. Figure 52 on page 147 shows the DC PSM.

Figure 52: DC (-48 V) Power Supply Module

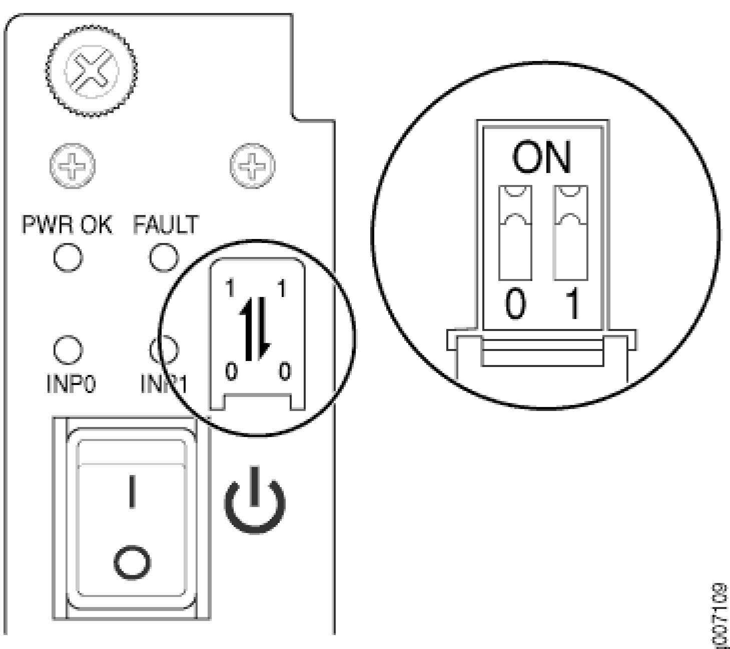


The DC power system is feed redundant. Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. If two feeds are connected, PSM input power is drawn from the feed with the higher voltage present. There are two PDMs per power system capable of carrying nine feeds each. Connect feeds from one source to one PDM and feeds from the other source to the second PDM of the power system. The primary input of the PSM is a dual redundant feed, **INP0** and **INP1**. Both feeds are active during operation, but both feeds might or might not be providing current. Move the input mode DIP switch to the on or off position to determine the power supply feeds (see Table 40 on page 148 and Figure 53 on page 148). In addition, a PSM failure triggers the alarm LED on the craft interface. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly, see "MX2010 DC Power (-48 V) System Electrical Specifications" on page 246.

Table 40: DIP Switch Positions on the DC (-48 V) PSM

Left Switch Position	Right Switch Position	Input Source
Off	Off	None
On	Off	Input 0 (**INP0**)
Off	On	Input 1 (**INP1**)
On	On	Both Input 0 and Input 1

Figure 53: Selecting Input Feed on the DC (-48 V) Power Supply Module



RELATED DOCUMENTATION

MX2010 DC Power Supply Module LEDs | 152
MX2010 Router Grounding Specifications
DC Power (-48 V) Circuit Breaker Requirements for the MX2010 Router | 254
MX2010 DC Power Distribution Description (-48 V) | 242
DC Power Cable Specifications for the MX2010 Router | 255
Site Electrical Wiring Guidelines for MX Series Routers
Installing the MX2010 Air Filter | 422
Removing the MX2010 Air Filter | 522

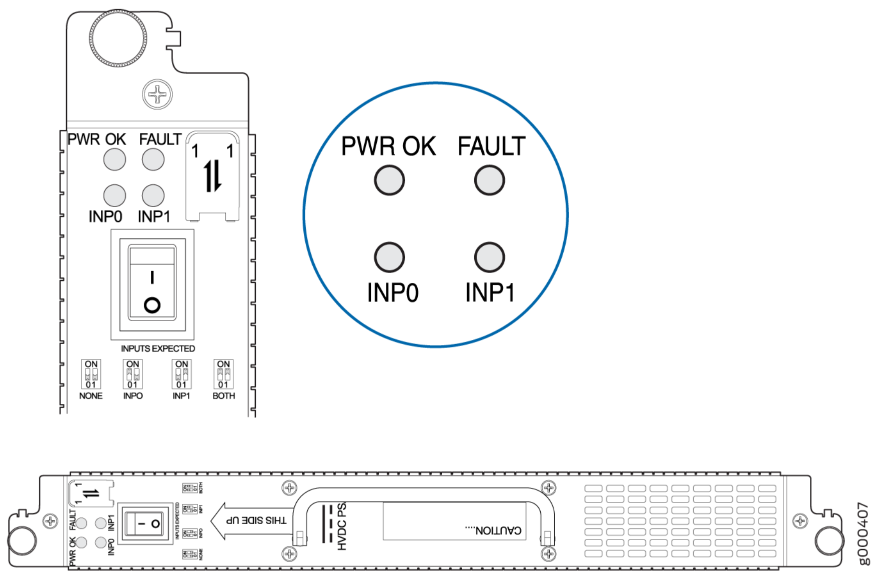
MX2000 DC Power Supply Module (240 V China) Description

The MX2010 supports a DC power system. The 240 V China DC power system operates with nine feeds. A total of nine feeds are required to fully power the MX2010. Another nine feeds are required to provide feed redundancy (a total of 18 feeds In the DC power configuration, the router contains up to nine DC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8**, (left to right). The DC PSMs in slots **PSM0** through **PSM8** provide power to the all router components including MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and fan trays **0**, **1**, **2**, and **3**.

NOTE: The MX2020 systems configured for DC (240 V China) input power must use only DC (240 V China) PDMs and DC PSMs. AC and DC PSMs or PDMs must not be mixed within a single system.

Up to nine PSMs may be connected in parallel to increase available system power across MPCs as needed and provide redundancy. Figure 54 on page 150) shows the DC PSM.

Figure 54: DC Power Supply Module (240 V China)



The DC power system is feed redundant. Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. If two feeds are connected, PSM input power will be drawn from the feed with the higher voltage present. There are two PDMs per power subsystem capable of carrying nine feeds each. Connect feeds from one source to one PDM and feeds from the other source to the second PDM of the power subsystem. The primary input of the PSM is a dual redundant feed, **INP0** and **INP1**. Both feeds are active during operation, but both feeds may or may not be providing current. Move the input mode DIP switch to the on or off position to determine the power supply feeds (see Table 41 on page 150 and Figure 55 on page 151). In addition, a PSM failure triggers the alarm LED on the craft interface. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly, see *MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications*.

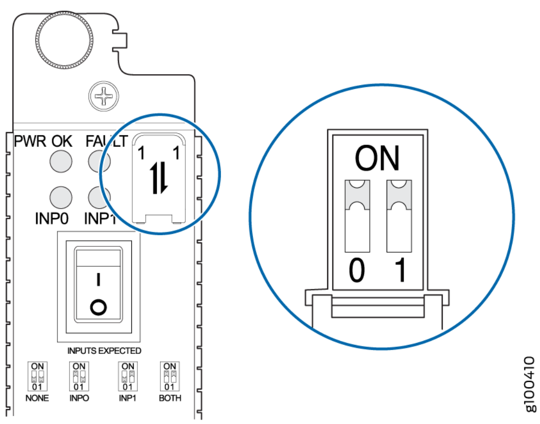
Table 41: DIP Switch Positions on the DC (240 V China) PSM

Left Switch Position	Right Switch Position	Input Source
Off	Off	None
On	Off	Input 0 (**INP0**)
Off	On	Input 1 (**INP1**)

Table 41: DIP Switch Positions on the DC (240 V China) PSM *(Continued)*

Left Switch Position	Right Switch Position	Input Source
On	On	Both Input 0 and Input 1

Figure 55: Selecting Input Feed on the DC Power Supply Module (240 V China)



RELATED DOCUMENTATION

MX2020 DC Power Supply Module LEDs

MX2000 DC Power Distribution Module (240 V China) LEDs

MX2000 Router Grounding Specifications | **183**

MX2010 Router DC (240 V China) System Electrical Specifications | **248**

MX2000 DC Power Distribution Module (240 V China) Description

DC Power Cable Specifications for the MX2020 Router

Site Electrical Wiring Guidelines for MX Series Routers

Installing an MX2020 Air Filter

Removing the MX2020 Air Filter

MX2010 DC Power Supply Module LEDs

Each DC PSM (-48 V and 240 China) faceplate contains four LEDs. These LEDs are described in Table 42 on page 152. Nine bicolor LEDs, labeled **0** through **8** for the nine PSMs, are located in the center of the craft interface.

The primary input of the PSM is a dual redundant feed, **INP0** and **INP1**. Both feeds are active during operation, but both feeds might or might not be providing current. In addition, a PSM failure triggers the alarm LED on the craft interface.

Table 42: MX2010 DC Power Supply Module LEDs

Label	Color	State	Description
PWR OK	Green	On	PSM is functioning normally with no alarms.
	Yellow	On	PSM controller is functioning normally.
	–	Off	PSM is not functioning normally or the PSM controller is off.
FAULT	Red	On	PSM is not functioning normally or the DC input voltage of one or more feeds is out of range.
	–	Off	PSM is functioning normally or both the DIP switches are set to off.
INP0	Green	On	DC input is within required voltage range and the DIP switch is set to on.
	Yellow	On	DC input is detected but voltage is out of range.
	–	Off	DC input to the PSM is not present.
INP1	Green	On	DC input is within required voltage range and the DIP switch is set to on.
	Yellow	On	DC input is detected but voltage is out of range.

Table 42: MX2010 DC Power Supply Module LEDs *(Continued)*

Label	Color	State	Description
	–	Off	DC input to the PSM is not present.

RELATED DOCUMENTATION

MX2010 Component LEDs on the Craft Interface | **36**
MX2010 Power System Description | **121**
MX2010 DC Power Supply Module (-48 V) Description | **147**
MX2010 DC Power (-48 V) System Electrical Specifications | **246**

MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description

NOTE: The MX2008, MX2010, and MX2020 routers support the same power modules AC, DC, 240 V China, and universal PSMs and PDMs.

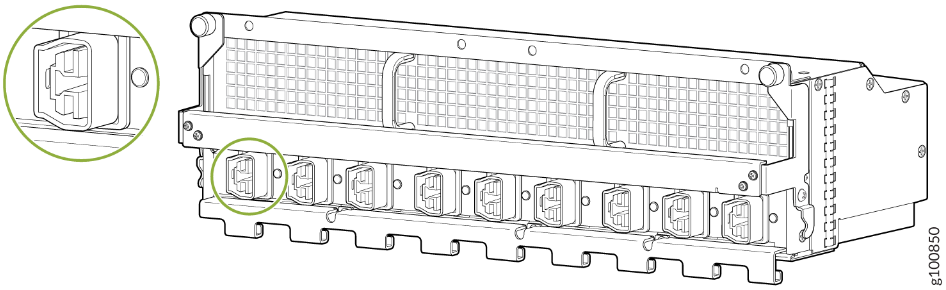
In the high-voltage second-generation universal (HVAC/HVDC) power configuration, the MX2000 router contains two high-voltage universal (MX2K-PDM-HV) PDMs located at the rear of the chassis in slots **PDM0/Input0** and **PDM1/Input1** (bottom to top). A minimum of one PDM is required per system (two PDMs per chassis) for nonredundant power. The universal (HVAC/HVDC) PDMs provide power interface to nine power supply modules (PSMs).

Two PDMs provide full redundancy for the router. In a redundant configuration, a total of a total of eighteen (9-feed PDMs) are supported.

NOTE: The power backplane for a subsystem distributes regulated 52 VDC to all boards supplied by that subsystem.

Each high-voltage universal (HVAC/HVDC) PDM has nine (HVAC/HVDC) inputs, (see Figure 56 on page 154).

Figure 56: MX2000 High-Voltage Universal (HVAC/HVDC) PDM



RELATED DOCUMENTATION

MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs | **154**

MX2000 Router Grounding Specifications | **183**

MX2020 High-Voltage Universal Power Requirements

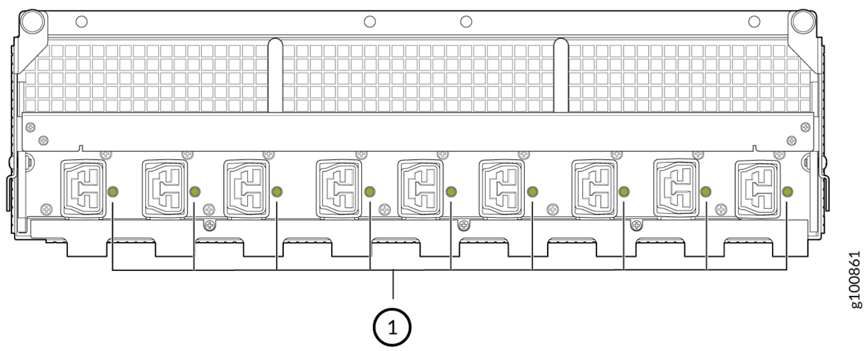
Determining High-Voltage Universal Power Requirements for Your MX2020 Router

Site Electrical Wiring Guidelines for MX Series Routers

MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs

Each universal PDM faceplate contains one LED for each of the nine input power feeds, indicating the correct or incorrect polarity connection of each feed. See Table 43 on page 155 and Figure 57 on page 155 high-voltage universal (HVAC/HVDC) PDM LEDs.

Figure 57: High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs



1– LED

Table 43: High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs

Color	State	Description
Green	On	Positive and negative input feeds are connected. PDM is functioning normally.
–	Off	Positive input feed is not connected or present.
		Negative input feed is not connected or present.

RELATED DOCUMENTATION

MX2020 Component LEDs on the Craft Interface

MX2020 Power Subsystem Description

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description

MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description

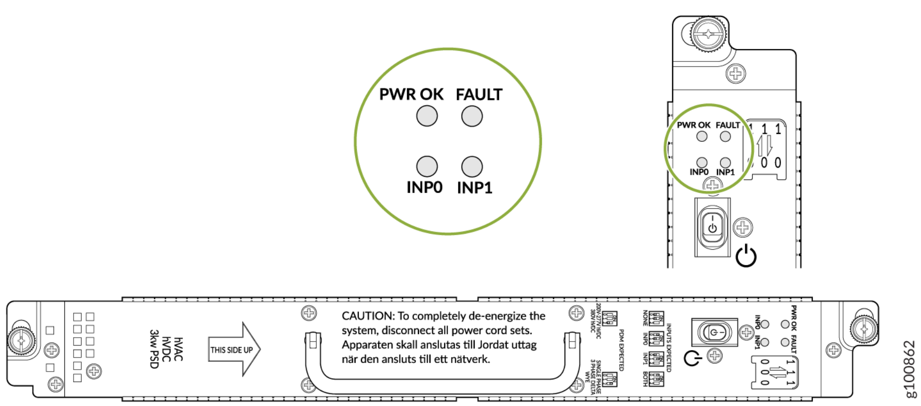
NOTE: The MX2008, MX2010, and MX2020 routers support the same power modules AC, DC, 240 V China, and universal PSMs and PDMs.

The MX2010 supports a universal HVAC/HVDC power system. The HVAC/HVDC power system operates with nine feeds. A total of nine feeds are required to fully power the MX2010. Another nine feeds are required to provide feed redundancy (a total of 18 feeds In the HVAC/HVDC power configuration, the router contains up to nine HVAC/HVDC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8**, (left to right). The HVAC/HVDC PSMs in slots **PSM0** through **PSM8** provide power to the all router components including MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and fan trays **0**, **1**, **2**, and **3**.

NOTE: The MX2010 systems configured for universal (HVAC/HVDC) input power must use only universal PDMs and PSMs. AC, DC, 240 V China, and universal PSMs or PDMs must not be mixed within a single system.

Up to nine PSMs may be connected in parallel to increase available system power across MPCs as needed and provide redundancy. Figure 58 on page 156 shows the universal PSM.

Figure 58: High-Voltage Universal (HVAC/HVDC) Power Supply Module

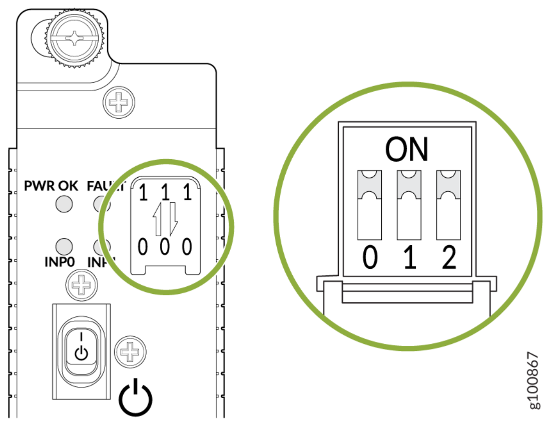


The HVAC/HVDC power system is feed redundant. Each universal PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. The PSM has two independent power trains connected in parallel at the output while each input is connected to its own feed. Power always is drawn from both feeds. There are two PDMs per power system capable of carrying nine feeds each. The bottom PDM in each power cage provides power to **INP0** of all PSMs installed in the cage, while top PDM in each power cage provides power to **INP1** of all PSMs installed in the cage. Feed connection to the PDMs should be done according to standard TIA-942 “Telecommunications Infrastructure Standard for Data” depending on tiering level. The primary input of the PSM is a dual-redundant feed, **INP0** and **INP1**. Both feeds are active during operation, and always carry current. Two dual-position DIP switches accessible from front panel indicate whether respective input **INP0** or **INP1** is expected to be connected or not. Set the input mode DIP switch to the on or off position to determine the power supply feeds (see Table 44 on page 157 and Figure 59 on page 158). In addition, a PSM failure triggers the alarm LED on the craft interface. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly. See "MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description" on page 156.

Table 44: DIP Switch Positions on the Universal (HVAC/HVDC) PSM

Switch Location Left (Input 0)	Switch Location Middle (Input 1)	Input Source
Off	Off	None are expected to be connected.
On	Off	Only input (**0**) is expected to be connected.
Off	On	Only input(**1**) is expected to be connected.
On	On	Both input **0** and input **1** are expected to be connected.

Figure 59: Selecting the Input Feed on the Universal (HVAC/HVDC) Power Supply Module



The universal HVAC/HVDC PSM has one more (third) DIP input switch accessible from the front panel, see Figure 59 on page 158. This switch indicates the PSM in the system is using the universal (MX2K-PDM-HV) PDM that has 30 A rated power cord. This should be in the **ON** position.

Table 45:

Switch Location Right (Input 2)	Meaning
On. See Figure 59 on page 158.	PSM is using the universal HVAC/HVDC PDM that has 30 A-rated power cord. **NOTE**: The switch must be in the On position for proper operation.

RELATED DOCUMENTATION

MX2000 Router Grounding Specifications | 183
MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | 153
MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs | 154
MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description | 156
Site Electrical Wiring Guidelines for MX Series Routers
Replacing the MX2010 Air Filters | 522

MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs

Each high-voltage second-generation universal (HVAC/HVDC) PSM faceplate contains four LEDs. These LEDs are shown in Figure 60 on page 159 and Table 46 on page 159. Nine bicolor LEDs, labeled **0** through **8** for the nine PSMs, are located in the center of the craft interface.

The primary input of the PSM is a dual redundant feed, **INP0** and **INP1**. Both feeds are active during operation, and both feeds share load current when present. In addition, a PSM failure triggers the alarm LED on the craft interface.

Figure 60: MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs

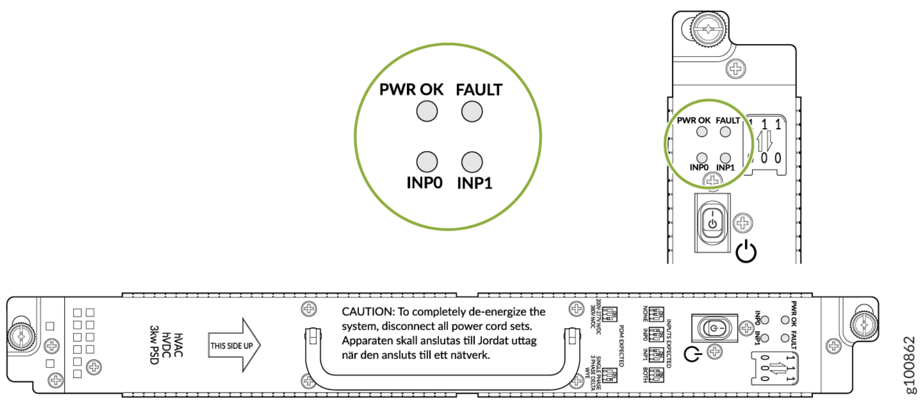


Table 46: MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs

INP0 (V) AC or DC within range	INP1 (V) AC or DC within range	Dip 0	Dip 1	PSM Switch	**INP0 LED**	**INP1 LED**	**PWR OK LED**	**FAULT LED**	PWR OK	52V out	5V out
Yes	Yes	1	0	Off	Green	Off	Blinking amber	Off	Off	Off	Off
Yes	0	1	0	On	Green	Off	Green	Off	On	On	On
0	Yes	0	1	Off	Off	Green	Blinking amber	Off	Off	Off	Off

Table 46: MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs *(Continued)*

INP0 (V) AC or DC within range	INP1 (V) AC or DC within range	Dip 0	Dip 1	PSM Switch	INP0 LED	INP1 LED	PWR OK LED	FAULT LED	PWR OK	52V out	5V out
0	Yes	1	1	On	Off	Green	Green	Off	On	On	On
Yes	Yes	1	1	Off	Green	Green	Blinking amber	Off	Off	Off	Off
Yes	Yes	1	1	On	Green	Green	Green	Off	On	On	On
Yes	Yes	0	0	Off	Green	Green	Blinking amber	Off	Off	Off	Off
Yes	Yes	0	0	On	Green	Green	Green	Off	On	On	On
Yes	0	0	1	Off	Green	Off	Blinking amber	Red	Off	On	Off
Yes	0	0	1	On	Green	Off	Green	Red	On	On	On
0	Yes	1	0	Off	Off	Green	Blinking amber	Red	Off	On	Off
0	Yes	1	0	On	Off	Green	Green	Red	On	On	On

RELATED DOCUMENTATION

MX2020 Component LEDs on the Craft Interface

MX2020 Power Subsystem Description

MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description

MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications

2

PART

Site Planning, Preparation, and Specifications

Planning and Preparing the Site | 162

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AC Power Requirements, Specifications, and Guidelines | 203

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Universal (HVAC/HVDC) Power Requirements, Specifications, and Guidelines | 257

CHAPTER 9

Planning and Preparing the Site

IN THIS CHAPTER

- Overview of Preparing the Site for the MX2010 Router | 162
- MX2010 Cabinet Airflow Requirements | 165
- MX2010 Cabinet Size and Clearance Requirements | 167
- MX2010 Chassis Moving Guidelines | 167
- MX2010 Physical Specifications | 168
- MX2010 Rack Requirements | 174
- MX2010 Router Transport Kit Moving Requirements and Guidelines | 178
- MX2010 Router Environmental Specifications | 182
- MX2000 Router Grounding Specifications | 183
- MX2010 Site Preparation Checklist | 185
- Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188

Overview of Preparing the Site for the MX2010 Router

To prepare a site for router installation:

1. Verify that environmental factors such as temperature and humidity do not exceed router tolerances. See:

   - "MX2010 Router Environmental Specifications" on page 182

2. Verify that the site and installation plan meets all safety guidelines and requirements. See:

   - *General Safety Guidelines for Juniper Networks Devices*

3. Locate sites for connection of system grounding. See:

   - MX2010 Router Grounding Specifications.

4. Calculate the power consumption and requirements.

Measure distance between external power sources and the router installation site. See:

AC power:

- *MX2000 Three-Phase AC Power Electrical Safety Guidelines*
- "MX2000 AC Power System Electrical Specifications" on page 218
- "MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications" on page 223
- "MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications" on page 223
- "MX2000 Single-Phase AC Power Distribution Module Electrical Specifications" on page 224
- "MX2010 AC Power Requirements" on page 203
- "MX2000 AC Power Cord Specifications" on page 214

DC Power:

- MX2010 DC Power Electrical Safety Guidelines
- "MX2010 DC Power (-48 V) System Electrical Specifications" on page 246
- "MX2010 DC Power Supply Module (-48 V) Description" on page 147
- "MX2000 DC Power Supply Module (240 V China) Description" on page 149
- "MX2010 DC Power Requirements" on page 233
- "DC Power Cable Specifications for the MX2010 Router" on page 255
- "MX2010 DC Power Distribution Description (-48 V)" on page 242
- "MX2000 DC Power Distribution Module (240 V China) Description" on page 143
- HVAC/HVDC Power:
  - "MX2010 High-Voltage Universal (HVAC/HVDC) Power Requirements" on page 257
  - *MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications*
  - "MX2010 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description" on page 153
  - *MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications*

"MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description" on page 156

5. Plan rack location, including required space clearances. See:

   - "Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router" on page 188
   - "MX2010 Physical Specifications" on page 168

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

   General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices

7. Verify that your rack meets the minimum requirements for the installation of the router. See:

   - "MX2010 Rack Requirements" on page 174
   - "MX2010 Chassis Description" on page 6

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

   - See: "MX2010 Rack Requirements" on page 174

9. Acquire cables and connections. See:

   - Determine the number of cables and type of cable needed based on your planned configuration.
     - *MX Series Interface Module Reference*
     - 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. See:
     - *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. See:

    - "MX2010 Cable Manager Description" on page 42
    - "Maintaining Cables That Connect to MX2010 MPCs or MICs" on page 713

RELATED DOCUMENTATION

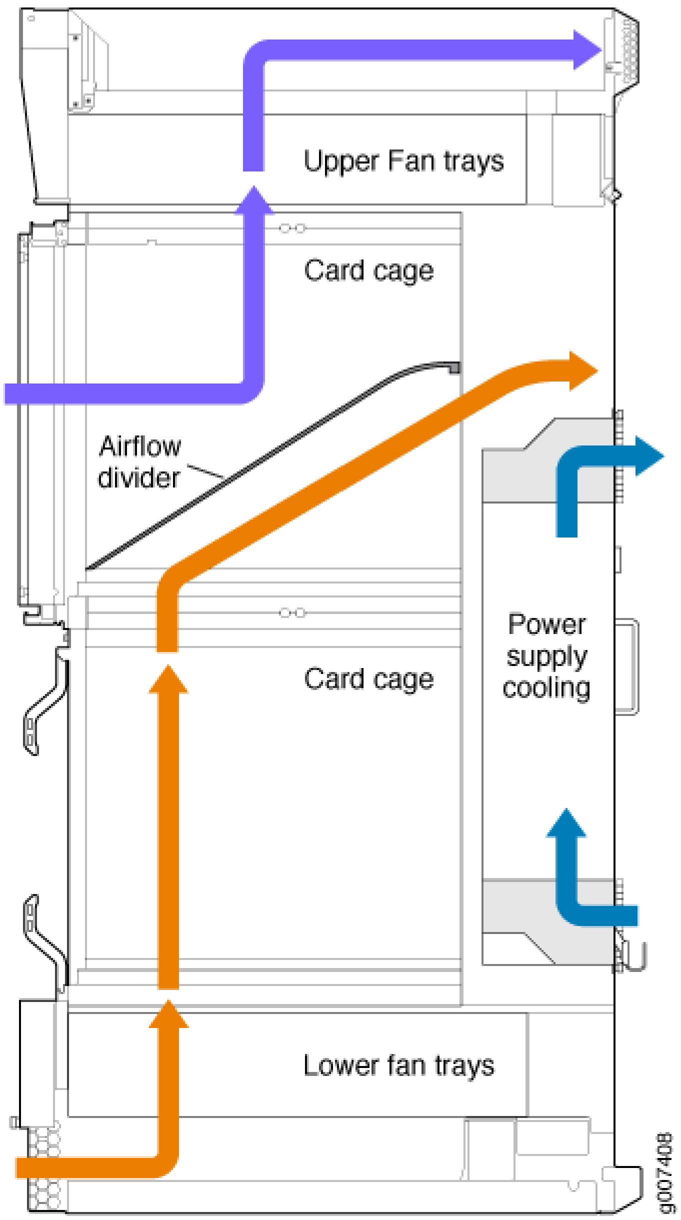
MX2010 Router Overview | 2

MX2010 Cabinet Airflow Requirements

Before you install the router in a cabinet, you must ensure that ventilation through the cabinet is sufficient to prevent overheating. Consider the following requirements to when planning for chassis cooling:

- Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router.
- Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. For an illustration of chassis airflow, see Figure 61 on page 166.
- Install the router as close as possible to the front of the cabinet so that the cable manager just clears the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.
- Route and dress all cables to minimize the blockage of airflow to and from the chassis.

Figure 61: Airflow Through Chassis



RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188
MX2010 Cabinet Size and Clearance Requirements | 167
MX2010 Rack Requirements | 174
MX2010 Rack-Mounting Hardware | 50

MX2010 Cabinet Size and Clearance Requirements

The minimum size cabinet that can accommodate the router is 23.62 in. (60 cm) wide, and 39.37 in. (100 cm) deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. To accommodate a single router, the cabinet must be at least 34 U high with a clearance of 36.20 in. (91.95 cm) to accommodate a standard cable manager. It must be at least 40.15 in. (102 cm) to accommodate an extended cable manager.

The minimum front and rear clearance requirements depends on the mounting configuration you choose. The minimum total clearance inside the cabinet is 36.20 in. (91.95 cm) between the inside of the front door and the inside of the rear door.

> **NOTE**: If you are installing the MX2010 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 34-U rack space from access during installation.

RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188
MX2010 Cabinet Airflow Requirements | 165
MX2010 Rack-Mounting Hardware | 50
MX2010 Rack Requirements | 174

MX2010 Chassis Moving Guidelines

The fully configured chassis with the cable managers weighs up to 985 lb (446.79 kg), or 324 lb (146.96 kg) with components removed. Observe the following guidelines for moving the router:

- Before moving the router, read the "Overview of Preparing the Site for the MX2010 Router" on page 162 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Do not attempt to move a fully-configured router by yourself. Use a pallet jack with the attachment and a four-person team to maneuver the router into a rack.
- Before moving the router, disconnect all external cables.

  To move routing devices and components, use the following guidelines:

- 1 person to lift or move up to 39.7 lb (18.0 kg)
- 2 people to lift or move up to 70.5 lb (32.0 kg)
- 3 people to lift or move up to 220 lb (99.8 kg)
- 4 people to lift or move over 300 lb (136.0 kg)

As when moving any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

RELATED DOCUMENTATION

General Safety Guidelines for Juniper Networks Devices

General Safety Warnings for Juniper Networks Devices

MX2010 Physical Specifications

Table 47 on page 168 and Table 48 on page 169 summarize the physical specifications for the router chassis and the components.

Table 47: MX2010 Shipping Weight Specifications

Item	Shipping Weight
Shipping crate and pallet	358 lb (162.4 kg)
Unpopulated MX2010	324 lb (146.96 kg)
Unpopulated MX2010 with shipping crate and pallet	682 lb (309.35 kg)
Fully populated MX2010	985 lb (446.79 kg)
Fully populated MX2010 with shipping crate and pallet	1343 lb (609.175 kg)

Table 48: Physical Specifications

Description	Weight	Width	Depth	Height
Chassis dimensions	Chassis with components removed: 324 lb (146.96 kg)	19 in. (48.26 cm) (including the mounting flanges or center-mounting brackets)	With standard cable manager: • 35.72 in (90.7 cm) with AC power • 36.4 in (92.5 cm) with DC power cable manager With extended cable manager: • 37.46 in (95.1 cm) with AC power • 38.14 in (96.9 cm) with DC extended power cable manager	59.50 in. (151.13 cm)
	Chassis with maximum configuration: 985 lb (446.79 kg)	19 in. (48.26 cm) (including the mounting flanges or center-mounting brackets)	With standard cable manager: • 36.20 in. (91.95 cm) With extended cable manager: • 40.15 in. (102 cm)	59.50 in. (151.13 cm)
Craft interface (with brackets)	1.5 lb (0.68 kg)	19.5 in. (49.53 cm)	4.75 in. (12.065 cm)	4.0 in. (10.16 cm)
ADC	15 lb (6.80 kg) Fully populated with 10 total: 150 lb (68.0 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	17.71 in. (44.98 cm)

Table 48: Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
MPC	MPC without MICs: 23.8 lb (10.79 kg) MPC with MICs: 25 lb (11.34 kg) Fully populated with 10 total: 250 lb (113.39 kg)	1.25 in. (3.17 cm)	21.25 in (53.97 cm)	15.5 in (39.37 cm)
Blank MPC panel	5.4 lb (2.45 kg)	1.25 in. (3.17 cm)	22.8 in (57.91 cm)	15.5 in (39.37 cm)
MIC	1.2 lb (0.54 kg)	1.25 in. (3.17 cm)	6.25 in (15.9 cm)	6.8 in (17.3 cm)
AC PSM	7.0 lb (3.17 kg) Fully populated with 9 total: 63 lb (28.57 kg)	1.65 in. (4.19 cm)	7.224 in. (18.34 cm)	15.10 in. (38.35 cm)
AC PDM	12 lb (5.44 kg) Fully populated with 2 total: 24 lb (10.88 kg)	17.1 in. (43.43 cm)	4.76 in. (12.09 cm)	7.361 in. (18.69 cm)
DC PSM (-48 V)	7.0 lb (3.17 kg) Fully populated with 9 total: 63 lb (28.57 kg)	1.65 in. (4.19 cm)	7.224 in. (18.34 cm)	15.10 in. (38.35 cm)
DC PSM (240 V China)	8.2 lb (3.71 kg) Fully populated with 9 total: 73.8 lb (33.39 kg)	1.65 in. (4.19 cm)	7.224 in. (18.34 cm)	15.10 in. (38.35 cm)

Table 48: Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
DC PDM (-48 V)	8.0 lb (3.62 kg) Fully populated with 2 total: 16 lb (7.25 kg)	16.8 in. (42.67 cm)	5.2 in. (13.20 cm)	4.2 in. (10.66 cm)
DC PDM (240 V China)	9.2 lb (4.17 kg) Fully populated with 2 total: 18.4 lb (8.34 kg)	16.7 in. (42.4 cm)	5.2 in. (13.20 cm)	5.12 in. (13.00 cm)
Universal (HVAC/HVDC) PSM	8 lb (3.63 kg) Fully populated with 9 total: 71.1 lb (32.4 kg)	1.65 in. (4.19 cm)	7.224 in. (18.34 cm)	15.10 in. (38.35 cm)
Universal (HVAC/HVDC) PDM	8.8 lb (3.98 kg) Fully populated with 2 total: 18.4 lb (8.34 kg)	16.7 in. (42.4 cm)	5.2 in. (13.20 cm)	5.12 in. (13.00 cm)
Air filter (lower)	1 lb (0.45 kg)	16.7 in. (42.4 cm)	19.7 in. (50 cm)	0.43 in. (1.1 cm)
PSM air filter	0.5 lb (0.23 kg)	16.0 in. (40.64 cm)	5.75 in. (14.60 cm)	0.3 in. (0.76 cm)
SFB	12 lb (5.44 kg) Fully populated with 8 total: 96 lb (43.55 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	16.23 in. (41.21 cm)

Table 48: Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
SFB2	16 lb (7.2 kg) Fully populated with 8 total: 128 lb (58 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	16.225 in. (41.21 cm)
Control Board and Routing Engine (CB-RE) RE-MX2000-1800X4 -S	15 lb (6.8 kg) Fully populated with 2 total: 30 lb (13.60 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	16.225 in. (41.21 cm)
Control Board and Routing Engine (CB-RE) REMX2K-X8-64G	18 lb (8.2 kg) Fully populated with 2 total: 36 lb (16.40 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	16.225 in. (41.21 cm)
Fan tray	25 lb (11.34 kg) Fully populated with 4 total: 100 lb (45.35 kg)	16.70 in. (42.41 cm)	28.16 in. (71.52 cm)	2.62 in. (6.65 cm)
Standard cable manager (top)	6.8 lb (3.08 kg)	18.99 in. (48.23 cm)	2.80 in. (7.11 cm)	8.226 in. (20.89 cm)
Standard cable manager (bottom)	7.0 lb (3.17 kg)	18.99 in. (48.23 cm)	2.80 in. (7.11 cm)	7.428 in. (18.86 cm)
Middle card-cage cable manager with air filter	4.5 lb (2.04 kg)	19.26 in. (48.92 cm)	2.80 in. (7.11 cm)	8.226 in. (20.89 cm)

Table 48: Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
Standard DC cable manager (rear)	1.2 lb (0.54 kg) Fully populated with 2 total: 2.4 lb (1.08 kg)	16.85 in. (42.79 cm)	2.93 in. (7.44 cm)	2.73 in. (6.93 cm)
Extended cable manager (top)	8.2 lb (3.72 kg)	18.99 in. (48.23 cm)	4.75 in. (12.06 cm)	8.23 in. (20.90 cm)
Extended cable manager (bottom)	10.2 lb (4.62 kg)	18.98 in. (48.20 cm)	3.95 in. (10.03 cm)	7.55 in. (19.17 cm)
Extended DC cable manager (rear)	0.7 lb (0.32 kg) Fully populated with 2 total: 1.4 lb (1.8 kg)	16.78 in. (42.62 cm)	2.93 in. (7.44 cm)	2.72 in. (6.90 cm)
Standard EMI cover	7.2 lb (3.3 kg)	17.45 in. (44.32 cm)	3.50 in. (8.9 cm)	18.86 in. (47.9 cm)
Extended EMI cover	9.65 lb (4.4 kg)	17.45 in. (44.32 cm)	5.40 in. (13.7 cm)	18.86 in. (47.9 cm)

RELATED DOCUMENTATION

MX2010 Chassis Moving Guidelines | 167
MX2010 Router Overview | 2
MX2010 Chassis Description | 6

MX2010 Rack Requirements

IN THIS SECTION

- Rack Size and Strength | 174
- Spacing of Mounting Bracket and Flange Holes | 177
- Connection to the Building Structure | 177

Rack Size and Strength

The MX2010 router 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 (ETSI). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the mounting brackets, which measure 19.2 in. (48.8 cm) from the 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 that 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.

The rack rails must be spaced widely enough to accommodate the chassis's external dimensions: 59.50 in. (151.1 cm) high, 36.20 in. (91.95 cm) deep, and 19 in. (48.3 cm) wide. The outer edges of the front-mounting flanges extend the width to 19.2 in. (48.8 cm), The spacing of rails and adjacent racks must also allow for the clearances around the chassis and rack that are specified in "Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router" on page 188. The cable manager and EMI cover on the front of the chassis is 36.20 in. (91.95 cm) deep. An extended cable manager extends the depth to 40.15 in. (102 cm).

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 (see Figure 63 on page 177).

For instructions about installing the mounting hardware, see "Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet" on page 294.

The weight and depth of the router depends on the type of cable manager installed.

With the standard or extended cable manager installed, use these guidelines:

- The rack must have sufficient vertical usable space to accommodate the height of the router: 59.50 in. (151.1 cm). You can install one chassis in a rack. A typical four-post rack measures 84 in. (213.4 cm) high, 24 in. (61 cm) through 30 in. (76.2 cm) deep, and 19 in. (48.3 cm) wide (see Figure 62 on page 176). A typical open-frame rack measures 84 in. (213.4 cm) high and 19 in. (48.3 cm) wide.

  > **NOTE**: A **U** is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronic Components Industry Association (ECIA) (http://www.ecianow.org).

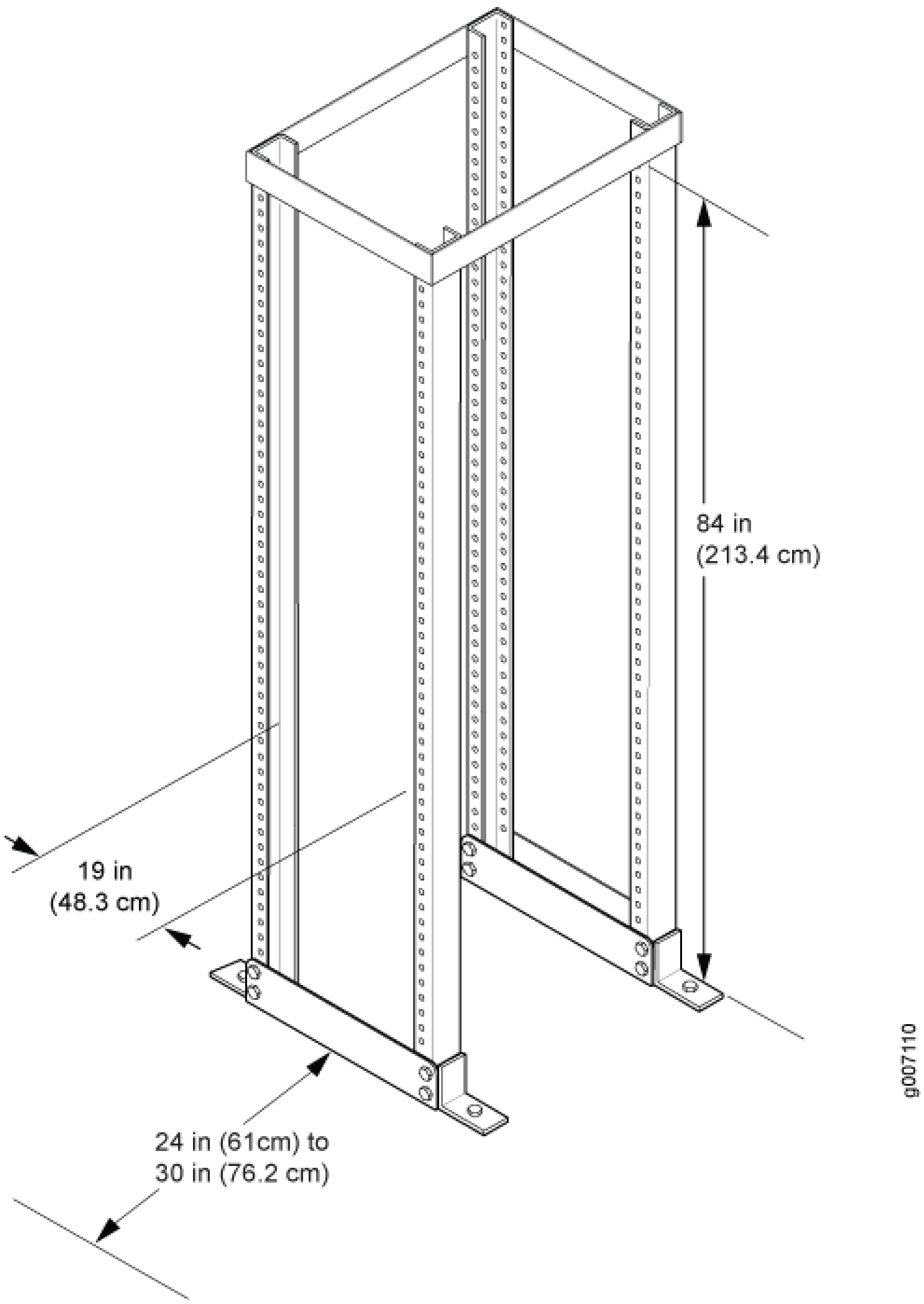
- The location of the rack must provide sufficient space to accommodate the depth of the router. The chassis with the standard cable manager is 36.20 in. (91.95 cm) deep.

- The chassis with the extended cable manager is 40.15 in. (102 cm) deep.

The rack must be strong enough to support the weight of the fully configured router, up to 985 lb (446.79 kg).

> **NOTE**: For a complete list of chassis configuration and individual line card and component weights and measurements, see "MX2010 Physical Specifications" on page 168.

Figure 62: Typical Four-Post Rack

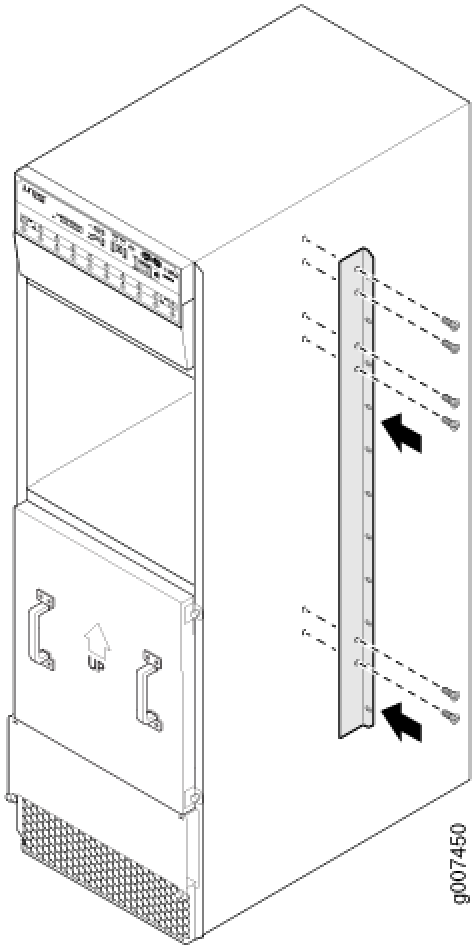


NOTE: There must be a minimum of 34-U of usable rack space when installing the MX2010 router.

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 1 U (1.75 in.). The router can be mounted in any rack that provides holes spaced at those distances. Figure 63 on page 177 shows the chassis center-mounting brackets.

Figure 63: Center-Mounting Brackets



Connection to the 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.

RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188

MX2010 Rack-Mounting Hardware | 50

MX2010 Cabinet Size and Clearance Requirements | 167

MX2010 Cabinet Airflow Requirements | 165

MX2010 Router Transport Kit Moving Requirements and Guidelines

IN THIS SECTION

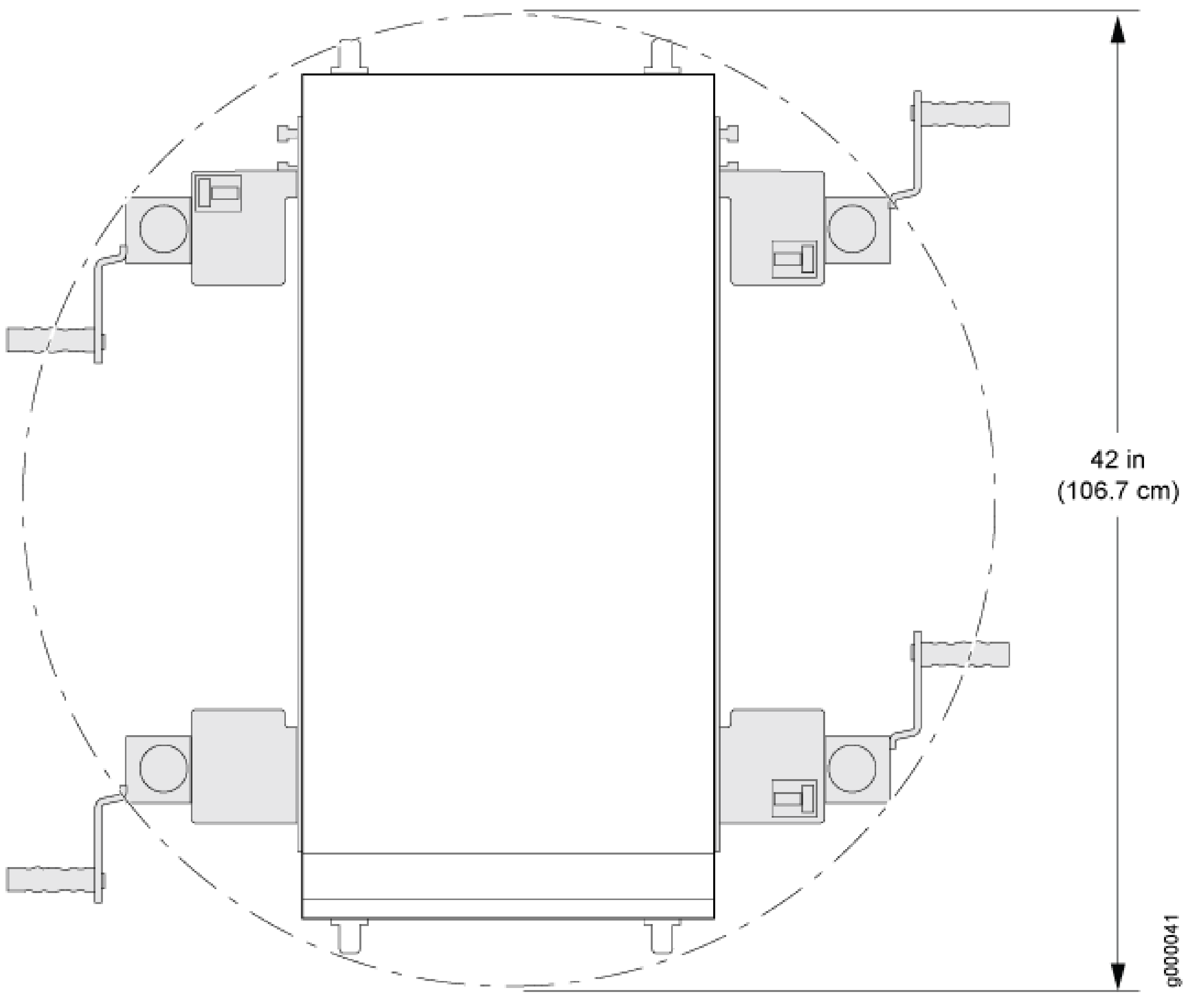
- Router Transport Kit Turning Radius | 178
- Router Transport Kit Requirements | 179

Router Transport Kit Turning Radius

The MX2010 requires a minimum 42 in. (106.7 cm) diameter of space to turn the chassis on the router transport kit (see Figure 64 on page 179).

NOTE: The router transport kit handles can be removed to accommodate aisle width.

Figure 64: Turning Diameter of Router Transport Kit

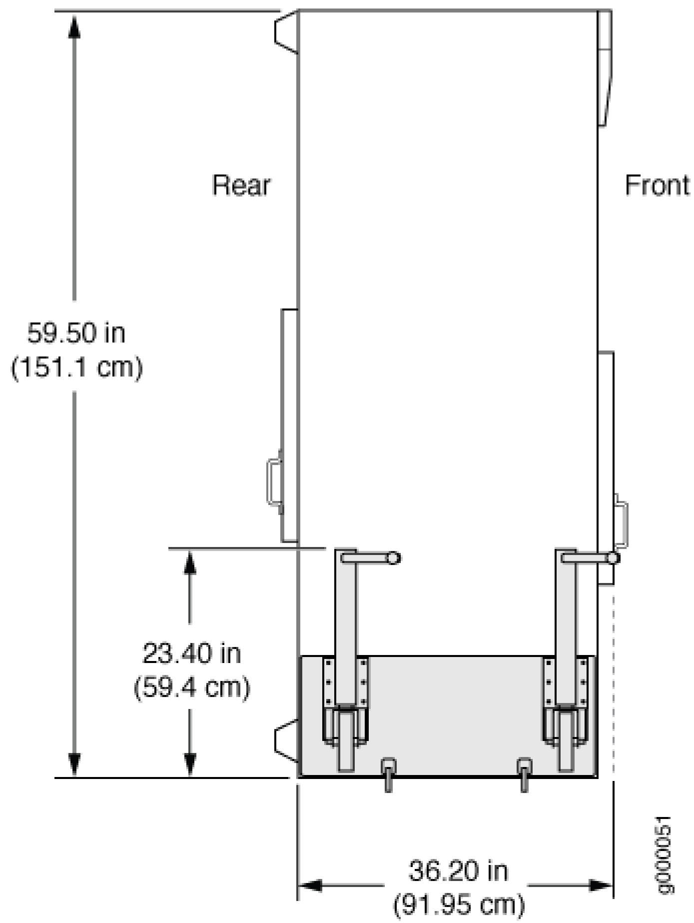


The weight of the router transport kit is 138.5 lb (63 kg). The maximum recommended height the MX2010 should be lifted from the floor by using the router transport kit is 1.5 in. (3.8 cm).

Router Transport Kit Requirements

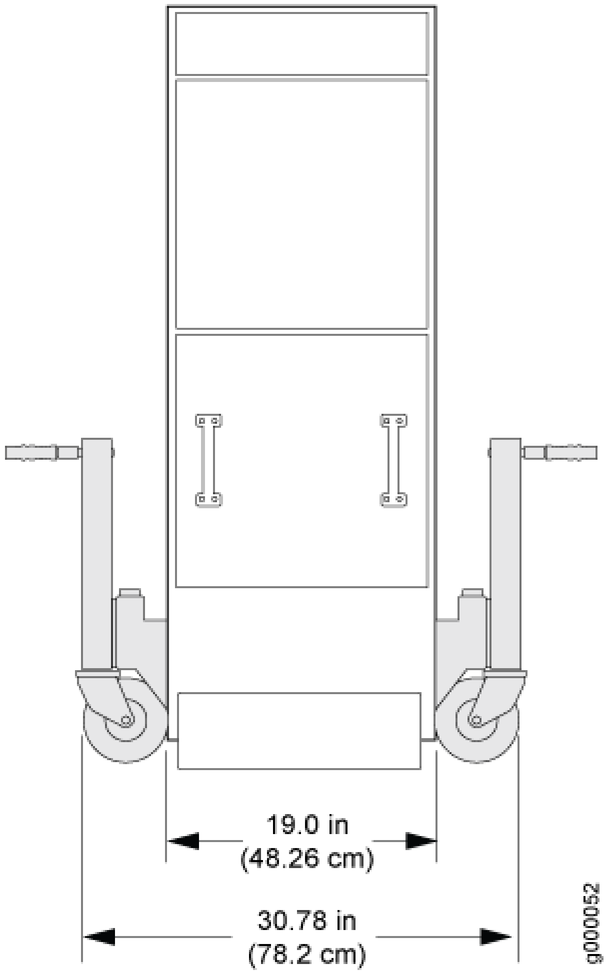
Viewed from the side, the MX2010 router with the router transport kit installed measures 59.49 in. (151.1 cm) high, 36.20 in. (91.95 cm) wide, with the transport kit measuring 23.40 in. (59.4 cm) high (see Figure 65 on page 180).

Figure 65: Measurements of the Router Transport Kit Installed on the MX2010 (Side View)



Viewed from the front, the MX2010 router with the router transport kit installed measures 30.78 in. (78.2 cm) wide, with the router measuring 19 in. (48.3 cm) wide (see Figure 66 on page 181).

Figure 66: Measurements of the Router Transport Kit Installed on the MX2010 (Front View)



RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188

MX2010 Rack-Mounting Hardware | 50

MX2010 Cabinet Size and Clearance Requirements | 167

MX2010 Cabinet Airflow Requirements | 165

MX2010 Router Environmental Specifications

Table 49 on page 182 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 49: Router Environmental Specifications

Description	Value
Relative humidity	Normal operation ensured in relative humidity range of 5% through 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32°F (0°C) through 104°F (40°C) Nonoperating storage temperature in shipping container: –40°F (–40°C) through 158°F (70°C)
Seismic	Designed to meet Telcordia Technologies Zone 4 earthquake requirements
Maximum thermal output	AC input power: 129,280 BTU/hour DC input power: 129,280 BTU/hour

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

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

Definition of Safety Warning Levels

MX2000 Router Grounding Specifications

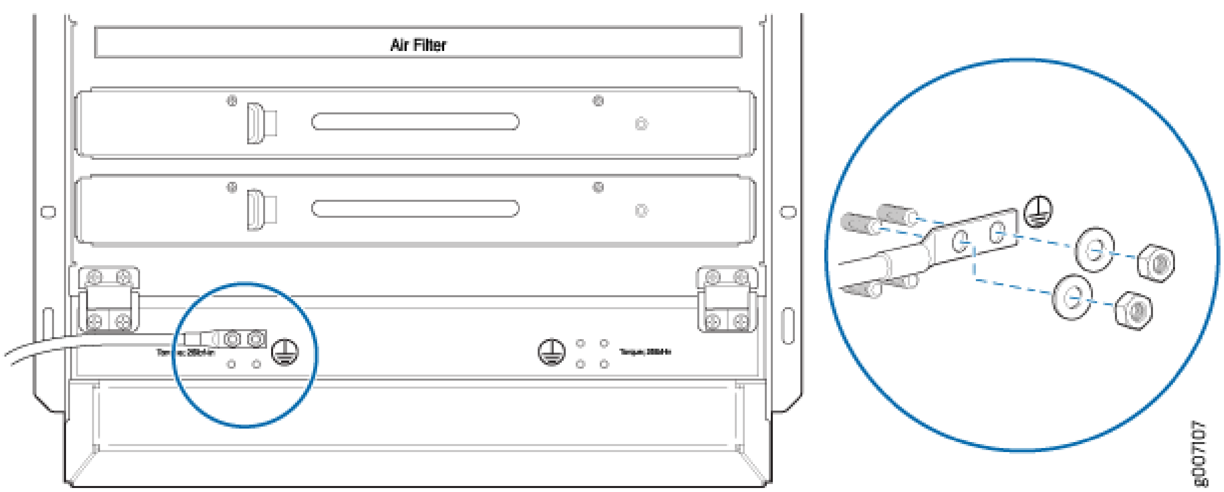
IN THIS SECTION

- MX2000 Series Chassis Grounding Points Specifications | 183
- MX2000 Series Router Grounding Cable Lug Specifications | 184
- MX2000 Series Router Grounding Cable Specifications | 185

MX2000 Series Chassis Grounding Points Specifications

You must install the router in a restricted-access location and ensure that the chassis is always properly grounded. The router has a two-hole protective grounding terminal provided on the chassis. See Figure 67 on page 183. 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 67: Connecting to a Chassis Grounding Point on the MX2000 Series Router



MX2000 Series Router Grounding Cable Lug Specifications

> **CAUTION**: Before you install the router, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.

The chassis has two grounding points. The upper pair is sized for UNC 1/4-20 nuts, and the lower pair is sized for M6 nuts. You only need to connect to one of the grounding points to properly ground the router. The grounding points are spaced at 0.625-in. (15.86-mm) centers. To ground the router, attach cable lugs to the grounding cable and secure the grounding cable to a grounding point on the chassis with two screws. The router is shipped with two Standard UNC 1/4–20 screws for connecting to the top (left) pair of grounding points.

> **WARNING**: The router is installed in a restricted access location. It has a separate protective earthing terminal (Metric [–M6] and Standard [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

> **NOTE**: The MX2000 series routers support 4-AWG DC power cable lugs for 80-A input and for 60-A input (see Figure 68 on page 184).

Figure 68: 4-AWG DC Power Cable Lug

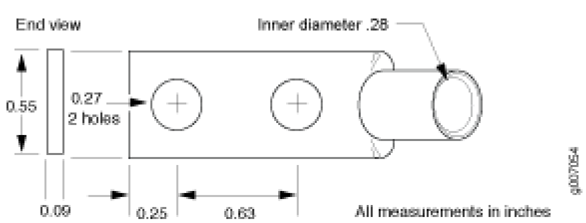


Table 50 on page 185 summarizes the specifications for the power cables, which you must supply.

Table 50: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 60-A or 80-A PDM. Minimum 75°C wire, or as required by the local code. You can select 60-A or 80-A input feed capacity on the DC PDM by setting the DIP switch on the PDM to the rated amperage of the DC power input feeds.

MX2000 Series Router Grounding Cable Specifications

The grounding cable must be minimum 4 AWG, or as required by the local code.

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

WARNING: The router is installed in a restricted-access location. It has a separate protective earthing terminal (Metric [–M6] and Standard [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

MX2010 Site Preparation Checklist

The checklist in Table 51 on page 185 summarizes the tasks you must perform when preparing a site for router installation.

Table 51: MX2010 Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			

Table 51: MX2010 Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"MX2010 Router Environmental Specifications" on page 182		
Power			
Measure distance between external power sources and router installation site.	"MX2010 DC Power Supply Module (-48 V) Description" on page 147 "MX2000 DC Power Supply Module (240 V China) Description" on page 149 "MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description" on page 156		
Locate sites for connection of system grounding.	MX2010 Router Grounding Specifications		
Calculate the power consumption and requirements.	"MX2010 AC Power Requirements" on page 203 "MX2010 DC Power Requirements" on page 233 "MX2010 High-Voltage Universal (HVAC/HVDC) Power Requirements" on page 257		
Rack			

Table 51: MX2010 Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Verify that your rack meets the minimum requirements for the installation of the router.	"MX2010 Rack Requirements" on page 174 "MX2010 Cabinet Size and Clearance Requirements" on page 167		
Plan rack or cabinet location, including required space clearances. **NOTE**: If you are installing the MX2010 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 34-U rack space from access during installation.	"MX2010 Cabinet Size and Clearance Requirements" on page 167, "MX2010 Rack Requirements" on page 174, "Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router" on page 188		
If a rack is used, secure rack to floor and building structure.	"MX2010 Rack Requirements" on page 174		
Cables and Transceivers			
Acquire cables and transceivers: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	*Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion* *Calculating Power Budget and Power Margin for Fiber-Optic Cables*		

Table 51: MX2010 Site Preparation Checklist ***(Continued)***

Item or Task	For More Information	Performed By	Date
Plan the cable routing and management.	"Maintaining Cables That Connect to MX2010 MPCs or MICs" on page 713		

RELATED DOCUMENTATION

Installing an MX2010 Router Overview | 276
Unpacking the MX2010 Router | 283

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router

IN THIS SECTION

- Clearance Requirements for MX2010 Routers with Standard Cable Managers | 189
- Clearance Requirements for MX2010 Routers with Extended Cable Managers | 190

When planning the installation site, you need to allow sufficient clearance around the rack for airflow and hardware maintenance. The clearance requirements vary, depending on whether the MX2010 uses AC or DC power and whether the MX2010 has a standard or extended cable manager.

> **NOTE**: There are no additional clearance requirements to accommodate the depth of the MX2010 power distribution modules (PDMs) and power supply modules (PSMs); they are within specification.

When planning for adequate clearance for airflow and hardware maintenance, keep the following in mind:

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

- Airflow must always be from front to back with respect to the rack. This ensures that fresh air from the front of the rack is supplied to the inlets, and the exhaust exits the rear of the rack.
- Check the cables to ensure there is no air leakage.
- There must be a minimum of 34-U of usable rack space when you install the MX2010.
- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. At least 36 in. (91.44 cm) is required both in front of and behind the router.

Clearance Requirements for MX2010 Routers with Standard Cable Managers

The clearance requirements for the MX2010 with standard cable managers differ depending on whether the MX2010 is using AC or DC power. Figure 69 on page 189and Figure 70 on page 190show the dimensions and clearance requirements for AC- and DC-powered MX2010 routers with standard cable managers.

Figure 69: Chassis Dimensions and Clearance Requirements for an AC-powered MX2010 Router with a Standard Cable Manager

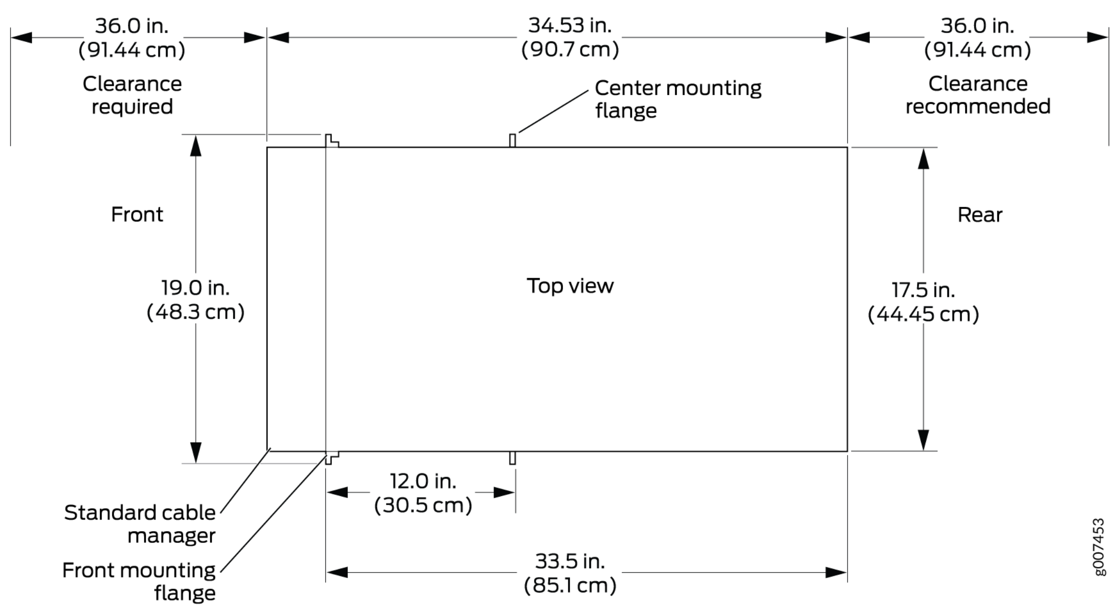
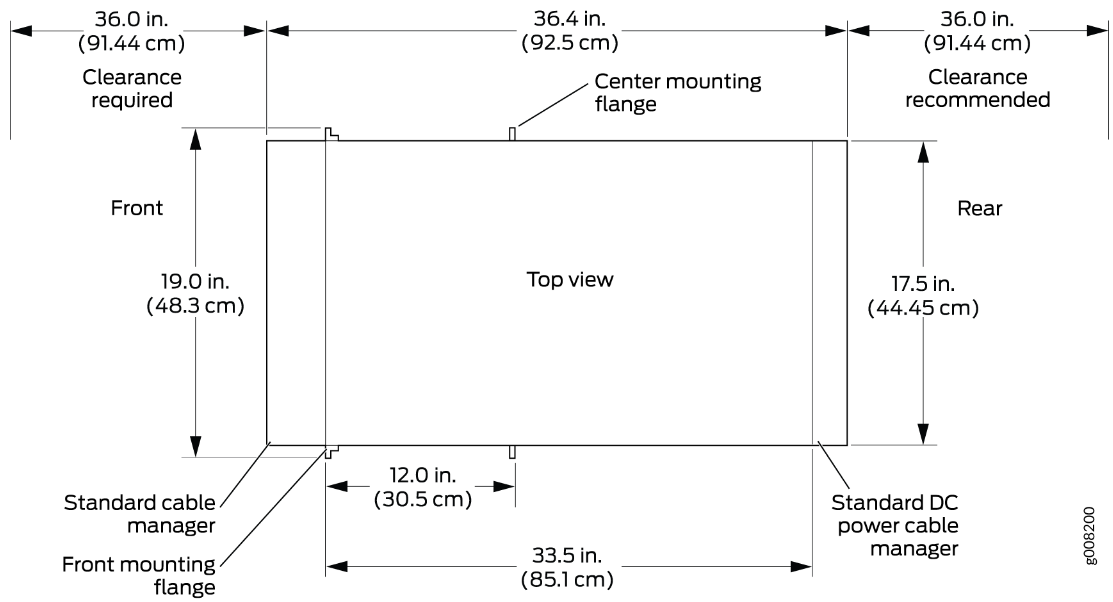


Figure 70: Chassis Dimensions and Clearance Requirements for a DC-powered MX2010 with a Standard Cable Manager



Clearance Requirements for MX2010 Routers with Extended Cable Managers

An MX2010 router with an extended cable manager requires extra clearance to accommodate the added depth. Figure 71 on page 191 and Figure 72 on page 191 show the dimensions and clearance requirements for AC- and DC-powered MX2010 routers with extended cable managers.

Figure 71: Chassis Dimensions and Clearance Requirements for an AC-powered MX2010 with an Extended Cable Manager

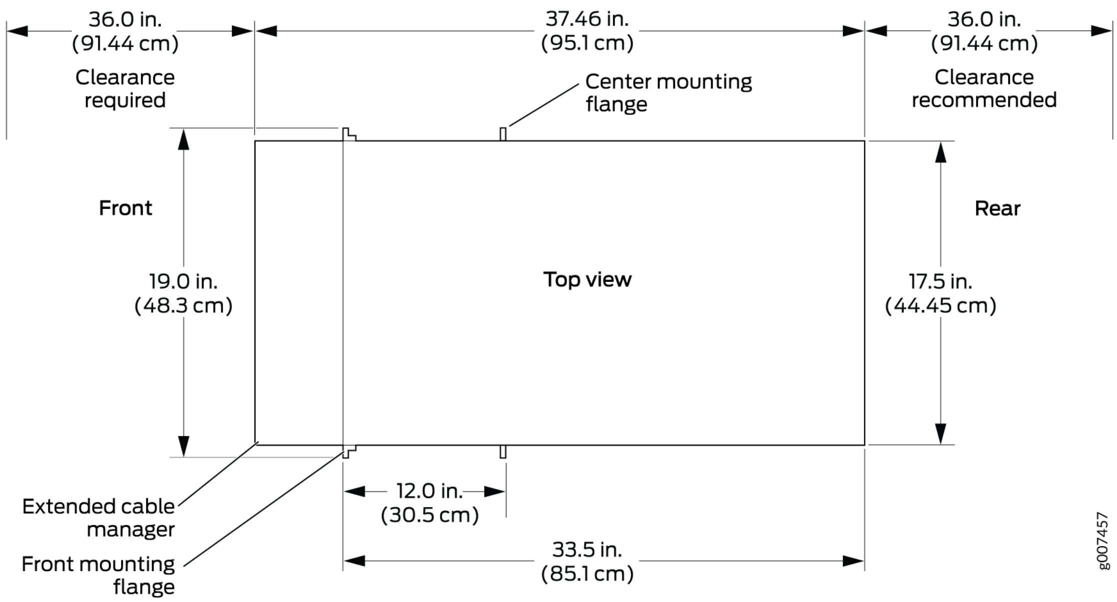
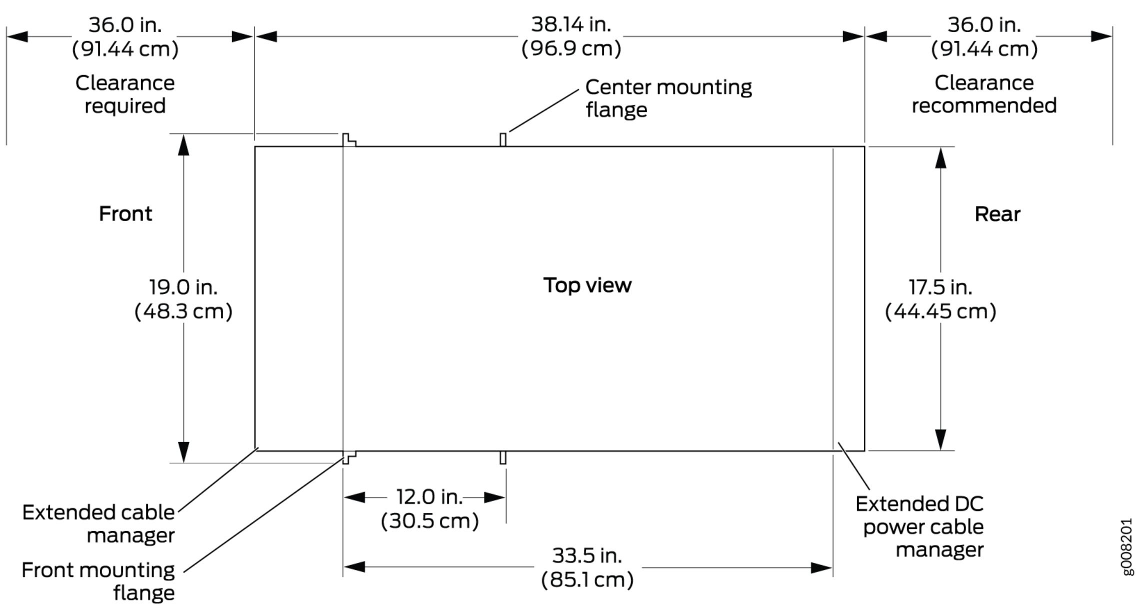


Figure 72: Chassis Dimensions and Clearance Requirements for a DC-powered MX2010 with an Extended Cable Manager



RELATED DOCUMENTATION

MX2010 Rack Requirements | 174

MX2010 Rack-Mounting Hardware | 50

MX2010 Cabinet Size and Clearance Requirements | 167

MX2010 Cabinet Airflow Requirements | 165

CHAPTER 10

Transceiver and Cable Specifications

IN THIS CHAPTER

- Calculating Power Budget and Power Margin for Fiber-Optic Cables | **193**
- Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion | **196**
- CB-RE and RCB Interface Cable and Wire Specifications for MX Series Routers | **197**
- Routing Engine Interface Cable and Wire Specifications for MX Series Routers | **198**

Calculating Power Budget and Power Margin for Fiber-Optic Cables

IN THIS SECTION

- How to Calculate Power Budget for Fiber-Optic Cables | **193**
- How to Calculate Power Margin for Fiber-Optic Cables | **194**

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 dBm – (–28 dBm)

P_B = 13 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 52 on page 194 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 52: 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

Table 52: Estimated Values for Factors Causing Link Loss *(Continued)*

Link-Loss Factor	Estimated Link-Loss Value
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 52 on page 194. This example calculates link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

P_M = 13 dB – 2 km (1 dB/km) – 5 (0.5 dB) – 2 (0.5 dB) – 0.5 dB

P_M = 13 dB – 2 dB – 2.5 dB – 1 dB – 0.5 dB

P_M = 7 dB

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 52 on page 194. 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.

Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

IN THIS SECTION

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable | **196**
- Attenuation and Dispersion in Fiber-Optic Cable | **196**

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.

CB-RE and RCB Interface Cable and Wire Specifications for MX Series Routers

Table 53 on page 197 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

NOTE: In routers where the Routing Engine (RE) and Control Board (CB) are integrated into a single board, a CB-RE is known as Routing and Control Board (RCB). The RCB is a single FRU that provides RE and CB functionality.

Table 53: Cable and Wire Specifications for Routing Engine and RCB Management and Alarm Interfaces

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

Table 53: Cable and Wire Specifications for Routing Engine and RCB Management and Alarm Interfaces *(Continued)*

Port	Cable Specification	Maximum Length	Router Receptacle
Alarm relay contacts	Wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2)	None	–

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

Routing Engine Interface Cable and Wire Specifications for MX Series Routers

Table 54 on page 198 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

NOTE: In routers where the Routing Engine (RE) and Control Board (CB) are integrated into a single board, a CB-RE is known as Routing and Control Board (RCB). The RCB is a single FRU that provides RE and CB functionality.

Table 54: Cable and Wire Specifications for Routing Engine and RCB Management and Alarm Interfaces

Port	Cable Specification	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	1.83 m	RJ-45 socket

Table 54: Cable and Wire Specifications for Routing Engine and RCB Management and Alarm Interfaces *(Continued)*

Port	Cable Specification	Maximum Length	Router Receptacle
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	100 m	RJ-45 autosensing
Alarm relay contacts	Wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2)	None	—

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

CHAPTER 11

Pinout Specifications

IN THIS CHAPTER

- RJ-45 Connector Pinouts for MX Series CB-RE or RCB Auxillary and Console Ports | **200**
- RJ-45 Connector Pinouts for an MX Series CB-RE or RCB Management Port | **201**

RJ-45 Connector Pinouts for MX Series CB-RE or RCB Auxillary and Console Ports

The ports–labeled—**AUX** and **CONSOLE**—on the Control Board and Routing Engine (CB-RE) or the Routing and Control Board (RCB) are asynchronous serial interfaces that accept an RJ-45 connector. The ports connect the Routing Engine to an auxiliary or console management device. Table 55 on page 200 describes the RJ-45 connector pinout.

NOTE: In routers where the Routing Engine and Control Board (CB) are integrated into a single board, a CB-RE is known as Routing and Control Board (RCB). The RCB is a single FRU that provides Routing Engine and CB functionality.

Table 55: RJ-45 Connector Pinout for the AUX and CONSOLE Ports

Pin	Signal	Description
1	RTS	Request to Send
2	DTR	Data Terminal Ready
3	TXD	Transmit Data

Table 55: RJ-45 Connector Pinout for the AUX and CONSOLE Ports *(Continued)*

Pin	Signal	Description
4	Ground	Signal Ground
5	Ground	Signal Ground
6	RXD	Receive Data
7	DSR/DCD	Data Set Ready
8	CTS	Clear to Send

RJ-45 Connector Pinouts for an MX Series CB-RE or RCB Management Port

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

NOTE: In routers where the Routing Engine and Control Board (CB) are integrated into a single board, a CB-RE is known as Routing and Control Board (RCB). The RCB is a single FRU that provides Routing Engine and CB functionality.

Table 56 on page 201 describes the RJ-45 connector pinout.

Table 56: RJ-45 Management Port Connector Pinouts for the CB-RE or RCB MGMT Port

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

Table 56: RJ-45 Management Port Connector Pinouts for the CB-RE or RCB MGMT Port *(Continued)*

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

CHAPTER 12

AC Power Requirements, Specifications, and Guidelines

IN THIS CHAPTER

- MX2010 AC Power Requirements | 203
- MX2000 AC Power Cord Specifications | 214
- MX2000 AC Power System Electrical Specifications | 218
- MX2000 Router Grounding Specifications | 220
- MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications | 223
- MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications | 223
- MX2000 Single-Phase AC Power Distribution Module Electrical Specifications | 224
- Calculating AC Power Requirements for MX2010 Routers | 225
- Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers | 229

MX2010 AC Power Requirements

To allow for future growth so that you can operate the router in any hardware configuration without upgrading the power infrastructure, we recommend that you provision 2800 W for each AC power distribution module (PDM) (three-phase or single-phase).

If you do not plan to provision 2800 W for each AC power supply module, use the information in Table 57 on page 204 and Table 58 on page 204 to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output.

Table 59 on page 205 lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

NOTE: Unlike all the other MPCs, *MPC6E*, *MPC8E*, and *MPC9E* do not require an adapter card (ADC) to house the MPC in the MX2010 router.

Table 57: Base AC Power Requirements

Component	Power Requirement (Watts)
Base system (not including MPCs, ADCs, and MICs) includes seven SFBs, one host subsystem (Control Board and Routing Engine [CB-RE], two fan trays, a craft interface, four PSMs, and two PDMs.	9,439 W (based on 55° C operation) 2,142 W (Typical)

Table 58: Typical AC Power Requirements for MX2010 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2010	
Fan trays, upper	MX2000-FANTRAY	100 W * 2 = 200 W
Fan trays, lower	MX2000-FANTRAY	100 W * 2 = 200 W
MPC	MPC-3D-16XGE-SFPP	440 W * 10 = 4400 W
ADC	ADC	150 W * 10 = 1500 W
CB-RE	RE-MX2000-1800X4	150 W
SFB—slots 0 through 7	MX2000-SFB	200 W * 8 = 1600 W
Three-phase delta AC PDM (2 per system) @ 50 A feed (input 1) and 25 A feed (input 2)	MX2000-PDM-AC-DELTA	2800 W

Table 58: Typical AC Power Requirements for MX2010 Router *(Continued)*

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Three-phase wye AC PDM @ 30 A feed (input 1) and 15 A (input 2)	MX2000-PDM-AC-WYE	2800 W
Nine-feed single-phase AC PDM	MX2K-PDM-AC-1PH	2800 W
Seven-feed single-phase AC PDM	MX2K-PDM-OP-AC	2800 W

If you do not plan to provision as recommended above, you can use the information in Table 59 on page 205 to calculate the power consumption for your hardware configuration.

Table 59: MX2010 FRU AC Power Requirements

Component	Model Number	Maximum Power Requirement
Switch Fabric Boards (SFBs)		
SFB	MX2000-SFB	200 W (Typical) 220 W at 55° C 220 W at 40° C 220 W at 25° C
SFB2	MX2000-SFB2-S	220 W (Typical) 265 W at 55° C 250 W at 40° C 240 W at 25° C
Fan Trays		

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
Fan trays, Upper)	MX2000-FANTRAY	100 W (Typical) 500 W at 55° C 330 W at 40° C 300 W at 25° C
Fan Trays, Lower	MX2000-FANTRAY	100 W (Typical) 1700 W at 55° C 1150 W at 40° C 350 W at 25° C
Adapter Cards		
ADC	MX2000-LC-ADAPTER	150 W
Control Board and Routing Engine		
CB-RE	RE-MX2000-1800X4	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
CB-RE	REMX2K-X8-64G	400 W
MPCs		
16x10GE MPC (see *MPC-3D-16XGE-SFPP*)	MPC-3D-16XGE-SFPP	440 W at 55° C ambient

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC1 (see *MPC1*)	MX-MPC1-3D MX-MPC1E-3D	165 W **With MICs and optics:** 239 W at 55° C 227 W at 40° C 219 W at 25° C
MPC1 Q (see *MPC1 Q*)	MX-MPC1-3D-Q MX-MPC1E-3D-Q	175 W **With MICs and optics:** 249 W at 55° C 237 W at 40 C 228 W at 25° C
MPC2 (see *MPC2*)	MX-MPC2-3D MX-MPC2E-3D	274 W **With MICs and optics:** 348 W at 55° C 329 W at 40° C 315 W at 25° C
MPC2 Q (see *MPC2 Q*) MPC2 EQ (see *MPC2 EQ*)	MX-MPC2-3D-Q MX-MPC2-3D-EQ MX-MPC2E-3D-Q MX-MPC2E-3D-EQ	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC2E P (see *MPC2E P*)	MX-MPC2E-3D-P	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C
MPC3E (see *MPC3E*)	MX-MPC3E-3D	440 W **With MICs and optics:** 500 W at 55° C, two 40 W MICs 485 W at 40° C, two CFP MICs with LR4 optics 473 W at 25° C, two CFP MICs with LR4 optics
32x10GE MPC4E (see *32x10GE MPC4E*)	MX-MPC4E-3D-32XGE-SFPP	610 W **With MICs and optics:** 607 W at 55° C, two 40 W MICs 590 W at 40° C, two CFP MICs with LR4 optics 585 W at 25° C, two CFP MICs with LR4 optics
2x100GE + 8x10GE MPC4E (see *2x100GE + 8x10GE MPC4E*)	MX-MPC4E-2CGE-8XGE	610 W **With MICs and optics:** 610 W at 55° C, two 40 W MICs 550 W at 40° C, two CFP MICs with LR4 optics 530 W at 25° C, two CFP MICs with LR4 optics

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
6x40GE + 24x10GE MPC5E	MPC5E-40G10G	645 W
6x40GE + 24x10GE MPC5EQ	MPC5EQ-40G10G	**With optics:** 604 W at 55° C, with SFPP ZR and CFP LR4 optics 541 W at 40° C, with SFPP ZR and CFP LR4 optics 511 W at 25° C, with SFPP ZR and CFP LR4 optics
2x100GE + 4x10GE MPC5E *2x100GE + 4x10GE MPC5EQ*	MPC5E-100G10G MPC5EQ-100G10G	**With optics:** 607 W at 55° C 541 W at 40° C 511 W at 25° C
MPC6E	MX2K-MPC6E	1088 W with MICs and optics
MPC7E-MRATE	MPC7E-MRATE	400 W (Typical) 545 W at 55° C 465 W at 40° C 440 W at 25° C
MPC8E (without MICs)	MX2K-MPC8E	688 W (Typical) 805 W at 55° C 720 W at 40° C 690 W at 25° C

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC9E (without MICs)	MX2K-MPC9E	838 W (Typical) 1018 W at 55° C 870 W at 40° C 840 W at 25° C
MICs		
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	35 W
Gigabit Ethernet MIC with SFP	MIC-3D-20-GE-SFP	37 W
10-Gigabit Ethernet MIC with XFP	2-Port: MIC-3D-2XGE-XFP 4-Port: MIC-3D-4XGE-XFP	2-Port: 29 W 4-Port: 37 W
10-Gigabit Ethernet MIC with SFP+	MIC6-10G	74 W **With optics:** 53 W at 55° C, 40° C and 25° C with 10G BASE-SR and 10G BASE-LR optics 66 W at 55° C, 40° C and 25° C with 10G BASE-ER optics 74 W at 55° C, 40° C and 25° C with 10G BASE-ZR optics

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	84 W **With optics:** 63 W at 55° C with 10G BASE-LR OTN optics 63 W at 40° C with 10G BASE-LR OTN optics 63 W at 25° C with 10G BASE-LR OTN optics
40-Gigabit Ethernet MIC with QSFPP	MIC3-3D-2X40GE-QSFPP	18 W
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	40 W
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	20 W
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	104 W **With optics:** 94 W at 55° C with 100G BASE-LR4 OTN optics 86 W at 40° C with 100G BASE-LR4 OTN optics 74 W at 25° C with 100G BASE-LR4 OTN optics

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
100-Gigabit Ethernet MIC with CXP	MIC6-100G-CXP	57 W 49 W at 55° C with CXP SR10 optics 49 W at 40° C with CXP SR10 optics 49 W at 25° C with CXP SR10 optics
100-Gigabit DWDM OTN MIC with CFP2	MIC3-100G-DWDM	**With optics:** 91 W at 55° C 83 W at 25° C
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48 8-Port: MIC-3D-8OC3OC12-4OC48	4-Port: 24 W at 55° C 22.75 W at 40° C 21.5 W at 25° C 8-Port: 29 W at 55° C 27.75 W at 40° C 26.5 W at 25° C
OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55° C 38.5 W at 40° C 36 W at 25° C

Table 59: MX2010 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
Channelized SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4CHOC3-2CHOC12 8-Port: MIC-3D-8CHOC3-4CHOC12	4-Port: 41 W at 55° C 40 W at 40° C 39 W at 25° C 8-Port: 52 W at 55° C 50.5 W at 40° C 49 W at 25° C
Channelized OC48/STM16 MIC with SFP	MIC-3D-1CHOC48	56.5 W at 55° C 54.5 W at 40° C 53 W at 25° C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W
MIC MRATE	MIC-MRATE	• When installed into MPC8E: 1.250 A @ 48 V (60 W) • When installed into MPC9E: 1.771 A @ 48 V (85 W)
DS3/E3 MIC	MIC-3D-8DS3-E3 MIC-3D-8CHDS3-E3-B	36 W at 55° C 35 W at 40° C 34 W at 25° C
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	33.96 W

RELATED DOCUMENTATION

MX2010 Power System Description | 121

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | 368

Connecting Power to an MX2000 Single-Phase AC Power Distribution Module | 372

MX2000 AC Power Cord Specifications | 214

MX2000 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 next to the rack that houses the router. An AC power cord connects each power distribution module (PDM) to the power distribution panel. Detachable AC power cords are supplied with the router. For single–phase PDMs, the coupler type is C21. For three-phase power, the power cord wires are inserted into the AC input terminal with the help of a screwdriver. The plug end of the power cord fits into the power source receptacle for your geographical location.

For more information about AC PDM input power mapping, see "Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers" on page 229.

CAUTION: In North America, AC power cords must not exceed approximately 14.75 ft (4.5 m) 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.

CAUTION: 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 on the power cord. This separate protective earthing terminal must be permanently connected to earth.

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

NOTE: Three-phase power cords provided with the router are approximately 14.75 ft (4.5 m) in length. Single–phase power cords provided with the router are approximately 8.2 ft (2.5 m) in length.

Table 60 on page 215 and Table 61 on page 216 provide specifications for the AC power cords for each region supported. Figure 73 on page 215 and Figure 74 on page 216 illustrate the plug on the three-phase Delta and Wye AC power cords.

Table 60: Three-Phase Delta and Wye AC Power Cord Specifications

Region	Model Number
North America	CBL-MX2000-3PH-DELTA
Europe	CBL-MX2000-3PH-WYE

Figure 73: Three-Phase Delta AC Power Cord

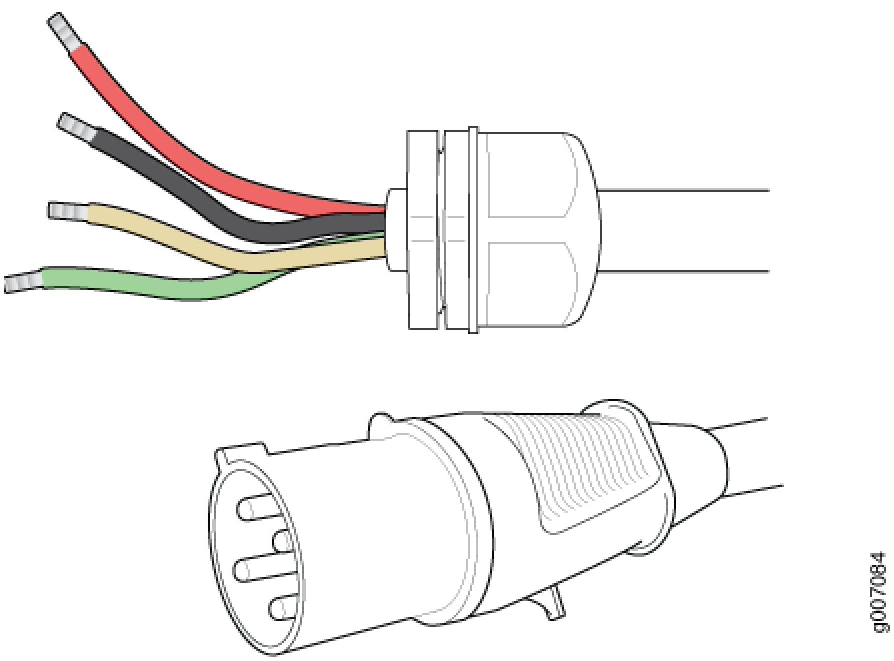


Figure 74: Three-Phase Wye AC Power Cord

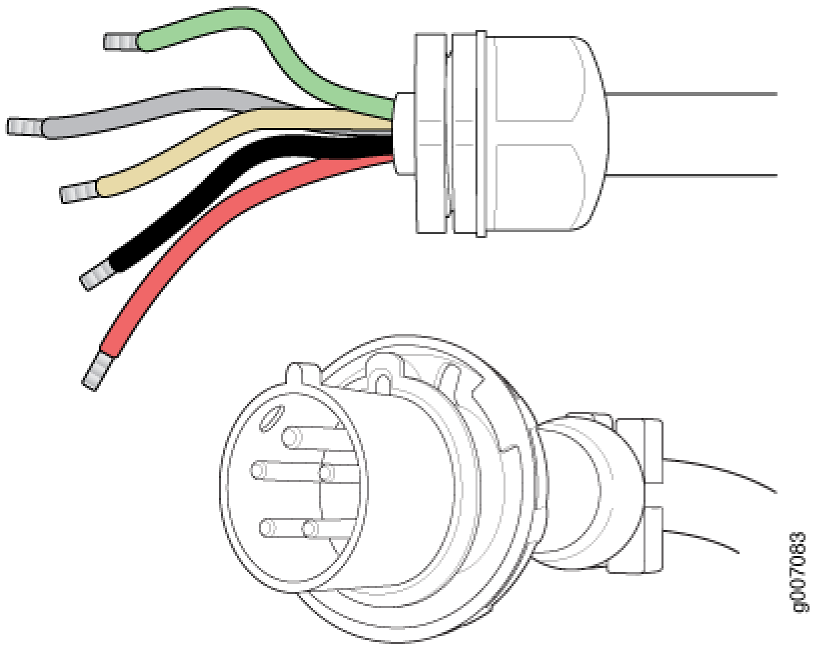


Table 61: Single-Phase AC Power Cord Specifications

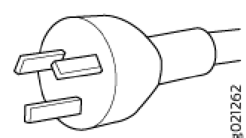
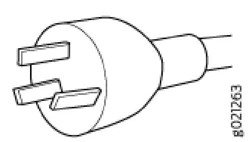
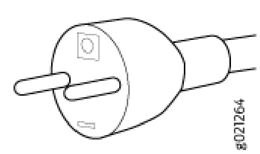
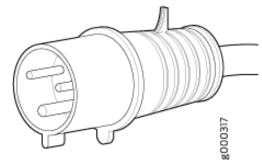
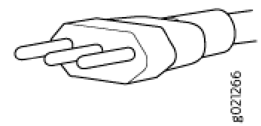
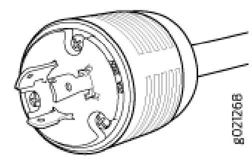
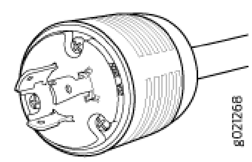
Region	Model Number	Electrical Specification	Plug Type	Graphic
Australia	CBL-PWR-C21S-AU	15 A @ 250 VAC	AS/NZS 3112	
China	CBL-PWR-C21S-CH	16 A @ 250 VAC	GB 1002/GB 2099	
Europe	CBL-PWR-C21S-EU	16 A @ 250 VAC	CEE (7) VII	

Table 61: Single-Phase AC Power Cord Specifications *(Continued)*

Region	Model Number	Electrical Specification	Plug Type	Graphic
International	CBL-PWR-C21S-INTL	16 A @ 250 VAC	IEC60309	
Italy	CBL-PWR-C21S-IT	16 A @ 250 VAC	CEI 23-50	
Japan	CBL-PWR-C21S-JP	15 A @ 250 VAC	(NEMA) L6-20 Japan	
US/Canada	CBL-PWR-C21S-US	20 A @ 250 VAC	(NEMA) L6-20	

RELATED DOCUMENTATION

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | 368

Replacing an MX2020 Three-Phase Delta AC Power Cord

Replacing an MX2020 Three-Phase Wye AC Power Cord

MX2000 AC Power System Electrical Specifications

IN THIS SECTION

- AC Power Supply Input Fuses | 219

Table 62 on page 218 lists the AC power system electrical specifications for the MX2000 line of routers.

Table 62: MX2000 AC Power System Electrical Specifications

Item	Specification
AC input voltage	Delta operating range: 200–240 VAC (line-to-line) (nominal) Wye operating range: 200–240 VAC (line-to-neutral) (nominal) Single-phase operating range: 200-240 VAC (nominal)
AC input line frequency	Delta: 50/60 Hz (+/-3Hz) Wye: 50/60 Hz (+/-3Hz) Single-phase: 50/60 Hz (+/-3Hz)
AC system current rating	Delta: 50 A @ 200 VAC–(input #1 for each PDM) and 25 A @ 200 VAC–(input #2 for each PDM) Wye: 30 A @ 200 VAC–(input #1 for each PDM) and 15 A @ 200 VAC–(input #2 for each PDM) Single-phase: 30 A @ 200 VAC
AC system input power	Delta: 16800 W (input #1), 8400 W (input #2) Wye: 16800 W (input #1), 8400 W (input #2)
Efficiency	90.5% at 50% load and 220 VAC IN

AC Power Supply Input Fuses

The AC PSM has line and neutral power supply input fuses in both INP0 and INP1. Table 63 on page 219 lists the electrical specifications for each fuse.

Table 63: Electrical Specifications for AC Power Supply Input Fuses

Electrical Characteristic	Value
INP0/INP1 Line Fuse	Littelfuse 0324020.MX65LP
• Ampere Rating	20A
• Voltage Rating	250V
• Interrupting Rating	1000A @ 250V
• Nominal Cold Resistance	3.55 mOhm
• Melting Integral	631 A^2 sec
INP0/INP1 Neutral Fuse	Littelfuse 0325020.MXD65LP
• Ampere Rating	20A
• Voltage Rating	250V
• Interrupting Rating	1500A @ 250V
• Nominal Cold Resistance	4.2 mOhm
• Melting Integral	2500 A^2 sec

RELATED DOCUMENTATION

MX2000 Three-Phase AC Power Electrical Safety Guidelines
MX2000 Three-Phase Delta AC Power Distribution Module Description | 129
MX2000 Three-Phase Wye AC Power Distribution Module Description | 131
MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description | 134
MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description | 135
MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications | 223
MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications | 223
MX2000 Single-Phase AC Power Distribution Module Electrical Specifications | 224

MX2000 Router Grounding Specifications

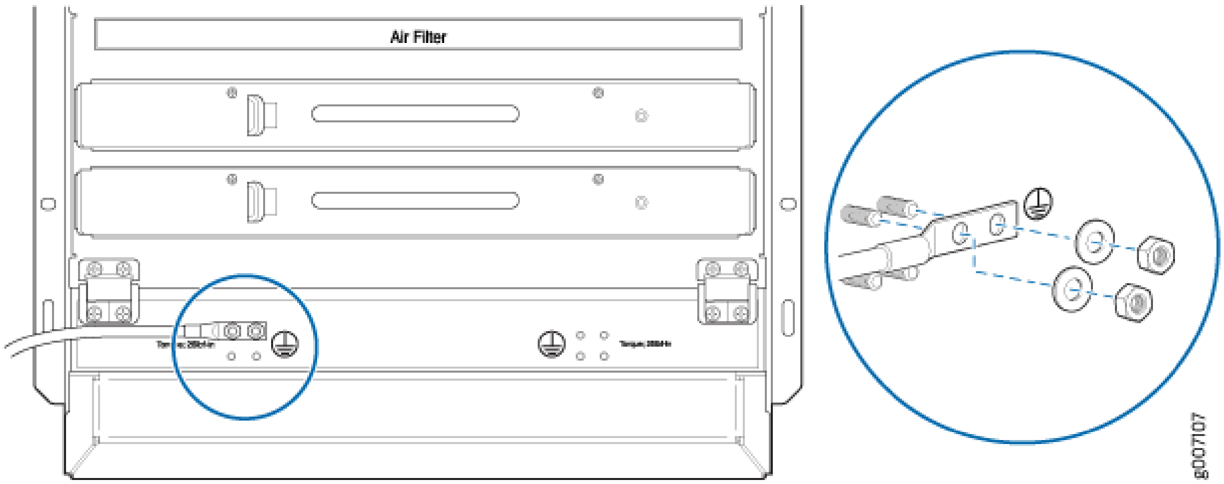
IN THIS SECTION

- MX2000 Series Chassis Grounding Points Specifications | 220
- MX2000 Series Router Grounding Cable Lug Specifications | 221
- MX2000 Series Router Grounding Cable Specifications | 222

MX2000 Series Chassis Grounding Points Specifications

You must install the router in a restricted-access location and ensure that the chassis is always properly grounded. The router has a two-hole protective grounding terminal provided on the chassis. See Figure 75 on page 221. 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: Connecting to a Chassis Grounding Point on the MX2000 Series Router



MX2000 Series Router Grounding Cable Lug Specifications

CAUTION: Before you install the router, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.

The chassis has two grounding points. The upper pair is sized for UNC 1/4-20 nuts, and the lower pair is sized for M6 nuts. You only need to connect to one of the grounding points to properly ground the router. The grounding points are spaced at 0.625-in. (15.86-mm) centers. To ground the router, attach cable lugs to the grounding cable and secure the grounding cable to a grounding point on the chassis with two screws. The router is shipped with two Standard UNC 1/4–20 screws for connecting to the top (left) pair of grounding points.

WARNING: The router is installed in a restricted access location. It has a separate protective earthing terminal (Metric [–M6] and Standard [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

NOTE: The MX2000 series routers support 4-AWG DC power cable lugs for 80-A input and for 60-A input (see Figure 76 on page 222).

Figure 76: 4-AWG DC Power Cable Lug

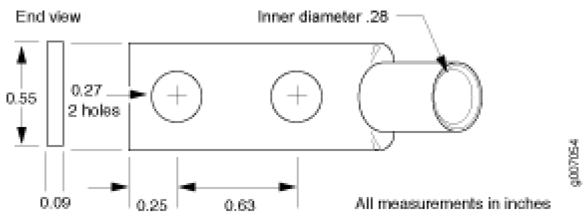


Table 64 on page 222 summarizes the specifications for the power cables, which you must supply.

Table 64: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 60-A or 80-A PDM. Minimum 75°C wire, or as required by the local code. You can select 60-A or 80-A input feed capacity on the DC PDM by setting the DIP switch on the PDM to the rated amperage of the DC power input feeds.

MX2000 Series Router Grounding Cable Specifications

The grounding cable must be minimum 4 AWG, or as required by the local code.

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

WARNING: The router is installed in a restricted-access location. It has a separate protective earthing terminal (Metric [–M6] and Standard [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications

Table 65 on page 223 lists the three-phase delta AC power distribution monitor (PDM) electrical specifications.

Table 65: Three-Phase Delta AC Power Distribution Module Electrical Specifications

Item	Specification
AC input voltage	Operating range: 200–240 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)
AC input current rating	50 A @ 200 VAC (input #1 for each PDM) 25 A @ 200 VAC (input #2 for each PDM)
AC system input power	16800 W (input #1), 8400 W (input #2)
Efficiency	90.5% at 50% load and 220 VAC IN

RELATED DOCUMENTATION

MX2000 Three-Phase Delta AC Power Distribution Module Description | 129

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364

MX2000 AC Power System Electrical Specifications | 218

MX2000 AC Power Cord Specifications | 214

MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications

Table 66 on page 224 lists the three-phase wye AC PDM electrical specifications.

Table 66: Three-Phase Wye AC Power Distribution Module Electrical Specifications

Item	Specification
AC input voltage	Operating range: 200-240 VAC (line-to-neutral) or 345-415 VAC (line-to-line) (nominal)
AC input line frequency	50/60 Hz (nominal)
AC input current rating	30 A @ 200 VAC (input #1 for each PDM) 15 A @ 200 VAC (input #2 for each PDM)

RELATED DOCUMENTATION

MX2000 Three-Phase Wye AC Power Distribution Module Description | 131

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | 368

MX2000 AC Power System Electrical Specifications | 218

MX2000 AC Power Cord Specifications | 214

MX2000 Single-Phase AC Power Distribution Module Electrical Specifications

Table 67 on page 224 lists the single-phase AC power distribution module (PDM) electrical specifications for the MX2000 line of routers.

Table 67: Single-Phase AC Power Distribution Module Electrical Specifications

Item	Specification
AC input voltage	Operating range: 200–240 VAC (nominal)
AC input line frequency	50/60 Hz (nominal)

Table 67: Single-Phase AC Power Distribution Module Electrical Specifications *(Continued)*

Item	Specification
AC input current rating	14 A @ 200 VAC

RELATED DOCUMENTATION

MX2000 AC Power Cord Specifications | 214

Calculating AC Power Requirements for MX2010 Routers

The information in this topic helps you determine which of the two input ratings for the PSM is suitable for various configurations. You determine suitability by subtracting the total power draw from the maximum output of the PSMs. Afterward, you calculate the required input current. Finally, you calculate the thermal output.

We recommend that you provision power according to the maximum input current listed in the power system electrical specifications.

Use the following procedures to calculate the power requirement:

1. Calculate the power requirement.
2. Evaluate the power budget.
3. Calculate input power.
4. Calculate thermal output (BTUs) for cooling requirements.

To calculate the AC power requirements:

1. Calculate the power (usage) using the values (see"MX2010 AC Power Requirements" on page 203).
2. Evaluate the power budget, including the budget for each configuration if applicable, and check the required power against the maximum output power of available PDM options.

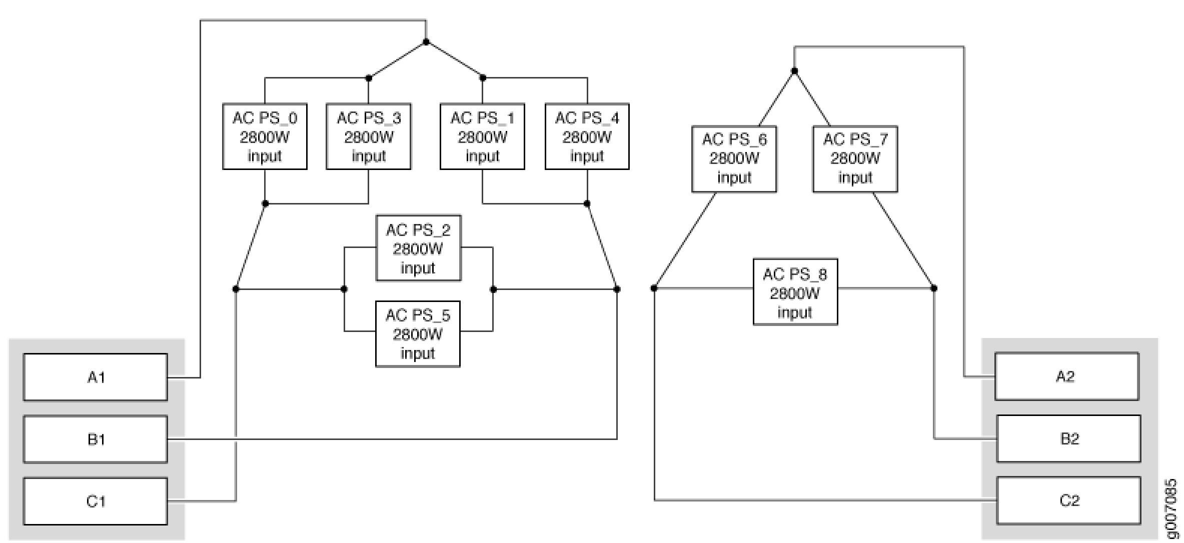
   Table 68 on page 226 lists the three-phase delta and wye feed requirements, maximum input and output power per PSM, and power efficiency.

Table 68: Calculating AC Power Budget

Power Distribution Module	Typical Input Power per PSM	Maximum Input Power per PSM	Maximum Output Power per PSM	Power Supply Module Efficiency
Three-phase delta AC PDM (2 per system)—50 A feed (input #1), and 25 A feed (input #2)	2142 W	2800 W	2500 W	91%
Three-phase wye AC PDM (2 per system)—30 A feed (input #1), and 15 A feed (input #2)	2142 W	2800 W	2500 W	91%

3. To calculate necessary input power for three-phase delta AC PDM, follow the procedure below (see Figure 77 on page 226).

Figure 77: AC PDM Three-Phase Delta Input Power



AC PSM VIN=200-240 single phase:

a. Two AC PSMs are connected in parallel between two lines.

b. Nominal value of input current for one AC PSM is 2800 W / 200 V = 14 A.

c. Nominal input current for two AC PSMs is 2 * 14 A = 28 A.

d. Nominal value of line current is 28 A * √3 = 48.5 A.

e. Current rating for input 1 is 50 A.

f. Only one AC PSM is connected between two lines.

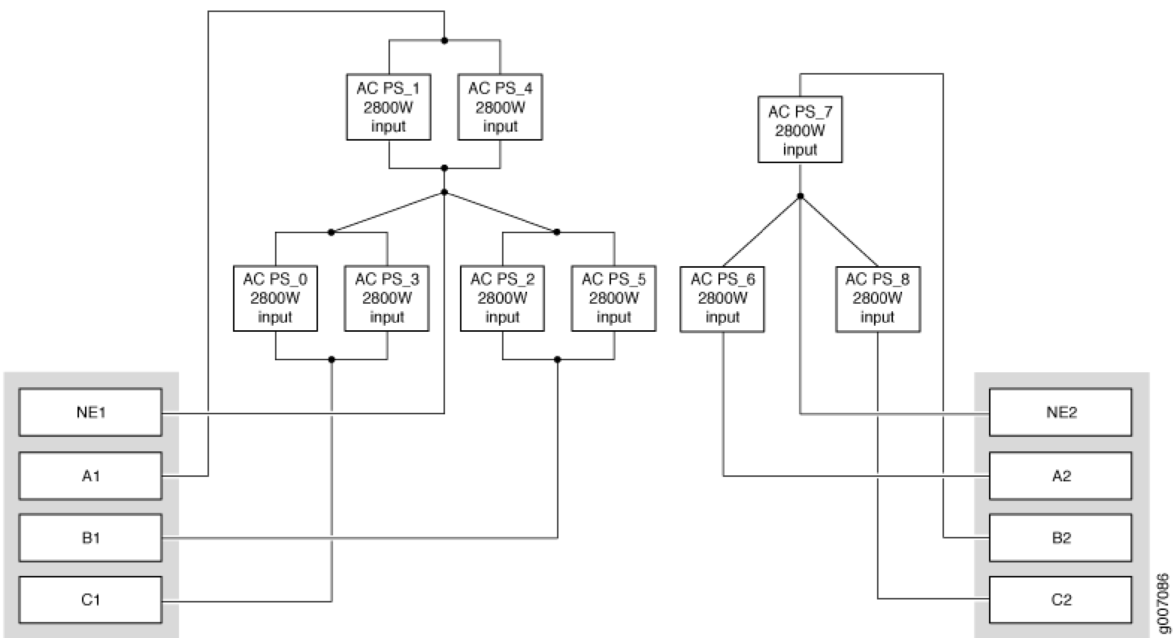
g. Nominal value of input current for one AC PSM is 2800 W / 200 V = 14 A.

h. Nominal value of line current is 14 A * √3 = 24.5 A.

i. Current rating for input 2 is 25 A.

4. To calculate necessary input power for three-phase wye AC PDM, follow the procedure below (see Figure 78 on page 227).

Figure 78: AC PDM Three-Phase Wye Input Power



AC PSM VIN=200-240 single phase:

a. Two AC PSMs are connected in parallel between two lines and neutral.

b. Nominal value of input current for one AC PSM is 2800 W / 200 V = 14 A.

c. Nominal input current for two AC PSMs is 2 * 14 A = 28 A.

d. Nominal value of line current is 28 A.

e. Current rating for input 1 is 28 A.

f. Only one AC PSM is connected between two lines and neutral.

g. Nominal value of input current for one AC PSM is 2800 W / 200 V = 14 A.

h. Nominal value of line current is 14 A.

i. Current rating for input 2 is 14 A.

5. Calculate thermal output (BTUs). Multiply the input power requirement (in watts) by 3.41 as shown in Table 69 on page 228.

Table 69: Calculating AC Thermal Output

Power Distribution Module	Thermal Output (BTUs per hour)
MX2010 three-phase delta AC PDM	Maximum power divided by 0.91 * 3.41 = BTU/hr. Input power = Maximum power divided by 0.91 Refer to "MX2010 AC Power Requirements" on page 203 to calculate maximum power, which is dependent on configuration and temperature.
MX2010 three-phase wye AC PDM	Maximum power divided by 0.91 * 3.41 = BTU/hr. Input power = Maximum power divided by 0.91 Refer to "MX2010 AC Power Requirements" on page 203 to calculate maximum power, which is dependent on configuration and temperature.

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MX2010 Power System Description | 121

MX2010 AC Power Requirements | 203

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | 368

MX2000 AC Power System Electrical Specifications | 218

MX2000 AC Power Cord Specifications | 214

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers

You connect AC power to the router by connecting two AC power cords to each AC PDM. One feed maps to six PSMs and the other maps to three PSMs. Figure 79 on page 229 shows the mapping for the MX2010 and Figure 80 on page 230 shows the mapping for the MX2020. The arrangement matches the internal components of the PDM. Table 70 on page 231 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1** (MX2010 and MX2020). Table 71 on page 231 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1** (MX2020 only).

Figure 79: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2010)

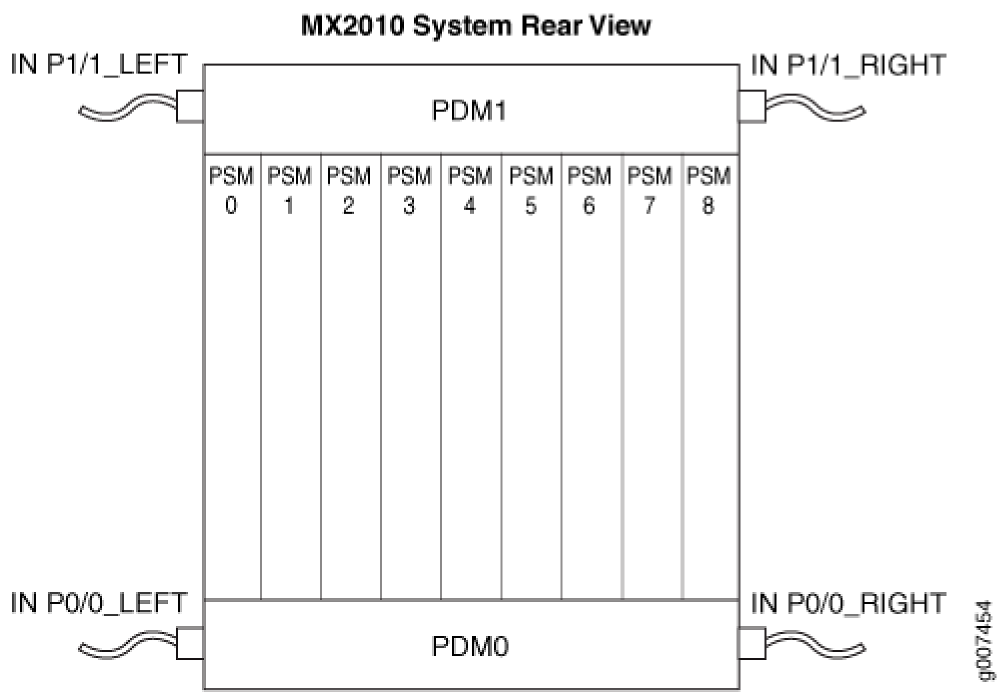

Figure 80: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2020)

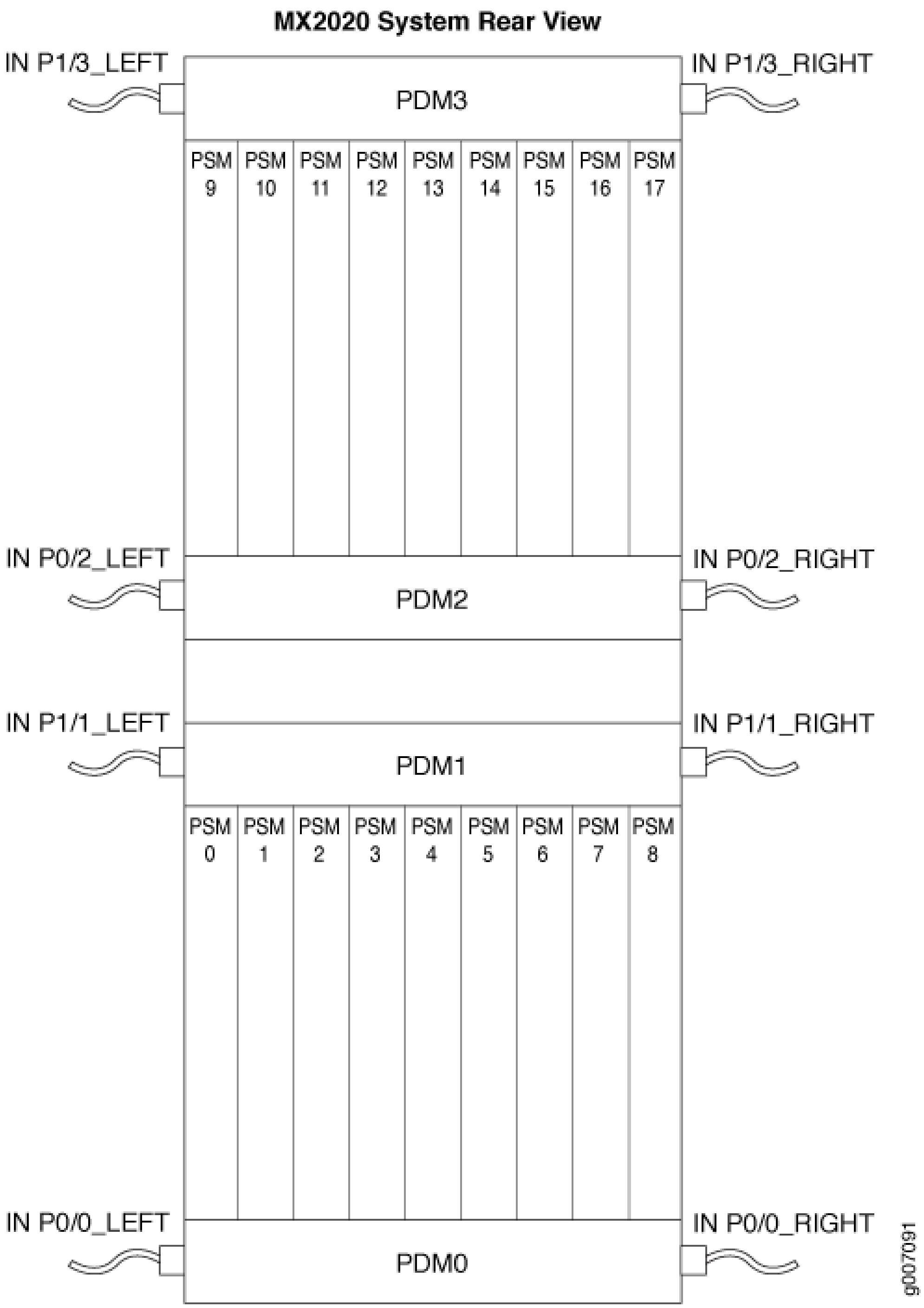

Table 70: Input AC Power Mapping for PDM0 and PDM1

PDM0/Input0 (Left)	PDM0/Input0 (Right)	PDM1/Input1 (Left)	PDM1/Input1 (Right)
PSM0	PSM3	PSM0	PSM6
PSM1	PSM4	PSM1	PSM7
PSM2	PSM5	PSM2	PSM8
–	PSM6	PSM3	–
–	PSM7	PSM4	–
–	PSM8	PSM5	–

Table 71: Input AC Power Mapping for PDM2 and PDM3

PDM2/Input0 (Left)	PDM2/Input0 (Right)	PDM3/Input1 (Left)	PDM3/Input1 (Right)
PSM9	PSM12	PSM9	PSM15
PSM10	PSM13	PSM10	PSM16
PSM11	PSM14	PSM11	PSM17
–	PSM15	PSM12	–
–	PSM16	PSM13	–
–	PSM17	PSM14	–

BEST PRACTICE: To achieve complete redundancy when you have two power sources, such as Source A and Source B, we recommend that you connect them as follows:

- Connect Source A to PDM0-left and PDM0-right
- Connect Source B to PDM1-left and PDM1-right

RELATED DOCUMENTATION

Powering On a Three-Phase AC-Powered MX2000 Router

CHAPTER 13

DC Power Requirements, Specifications, and Guidelines

IN THIS CHAPTER

- MX2010 DC Power Requirements | 233
- MX2010 DC Power Distribution Description (-48 V) | 242
- MX2010 DC Power Distribution (240 V China) Description | 244
- MX2010 DC Power (-48 V) System Electrical Specifications | 246
- MX2010 Router DC (240 V China) System Electrical Specifications | 248
- Calculating DC Power Requirements for MX2010 Routers | 250
- DC Power (-48 V) Circuit Breaker Requirements for the MX2010 Router | 254
- DC Power (240 V China) Circuit Breaker Requirements for the MX2000 Router | 255
- DC Power Cable Specifications for the MX2010 Router | 255

MX2010 DC Power Requirements

Table 72 on page 234 lists the FRU power requirements for SFBs, CB-REs, MPCs, and MICs. In addition, Table 72 on page 234 lists the MPC power requirements with MICs and optics at various operating temperatures.

Typical power represents power under certain temperatures and normal operating conditions.

For PDMs with 60 A feeds, we recommend that you select the 60 A @ –48 VDC switch for each input.

For PDMs with 80 A feeds, we recommend that you select the 80 A @ –48 VDC switch for each input.

NOTE: The 240 V China DC PDMs do not have a switch selection.

If you do not plan to provision as recommended above, you can use the information in Table 72 on page 234 to calculate the power consumption for your hardware configuration.

> **NOTE**: Unlike all the other MPCs, *MPC6E*, *MPC8E*, and *MPC9E* does not require an adapter card (ADC) to house the MPC in the MX2010 router.

Table 72: FRU DC Power Requirements

Component	Model Number	Maximum Power Requirement
Switch Fabric Boards (SFBs)		
SFB	MX2000-SFB-S	200 W (Typical) 220 W at 55° C 220 W at 40° C 220 W at 25° C
SFB2	MX2000-SFB2-S	220 W (Typical) 265 W at 55° C 250 W at 40° C 240 W at 25° C
Fan Trays		
Fan trays, Upper	MX2000-FANTRAY-S	100 W (Typical) 330 W at 55° C 330 W at 40° C 300 W at 25° C
Fan Trays, Lower		100 W (Typical) 1700 W at 55° C 1150 W at 40° C 350 W at 25° C

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
Adapter Cards		
ADC	MX2000-LC-ADAPTER	150 W
Control Board and Routing Engine (CB-RE)		
CB-RE	RE-MX2000-1800X4-S	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
MPCs		
16x10GE MPC (see *MPC-3D-16XGE-SFPP*)	MPC-3D-16XGE-SFPP	440 W at 55° C ambient
MPC1 (see *MPC1*)	MX-MPC1-3D MX-MPC1E-3D	165 W **With MICs and optics:** 239 W at 55° C 227 W at 40° C 219 W at 25° C
MPC1 Q (see *MPC1 Q*)	MX-MPC1-3D-Q MX-MPC1E-3D-Q	175 W **With MICs and optics:** 249 W at 55° C 237 W at 40° C 228 W at 25° C

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC2 (see *MPC2*)	MX-MPC2-3D MX-MPC2E-3D	274 W **With MICs and optics:** 348 W at 55° C 329 W at 40° C 315 W at 25° C
MPC2 Q (see *MPC2 Q*) MPC2 EQ (see *MPC2 EQ*)	MX-MPC2-3D-Q MX-MPC2-3D-EQ MX-MPC2E-3D-Q MX-MPC2E-3D-EQ	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C
MCP2E P (see *MPC2E P*)	MX-MPC2E-3D-P	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C
MPC3E (see *MPC3E*)	MX-MPC3E-3D	440 W **With MICs and optics:** 520 W at 55° C, two 40 W MICs 420 W at 40° C, two CFP MICs with LR4 optics 408 W at 25° C, two CFP MICs with LR4 optics

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
32x10GE MPC4E (see *32x10GE MPC4E*)	MX-MPC4E-3D-32XGE-SFPP	610 W **With MICs and optics:** 610 W at 55° C, two 40 W MICs 560 W at 40° C, two CFP MICs with LR4 optics 550 W at 25° C, two CFP MICs with LR4 optics
2x100GE + 8x10GE MPC4E (see *2x100GE + 8x10GE MPC4E*)	MX-MPC4E-2CGE-8XGE	610 W **With MICs and optics:** 610 W at 55° C, two 40 W MICs 550 W at 40° C, two CFP MICs with LR4 optics 530 W at 25° C, two CFP MICs with LR4 optics
6x40GE + 24x10GE MPC5E *6x40GE + 24x10GE MPC5EQ*	MPC5E-40G10G MPC5EQ-40G10G	**With optics:** 607 W at 55° C 541 W at 40° C 511 W at 25° C
2x100GE + 4x10GE MPC5E *2x100GE + 4x10GE MPC5EQ*	MPC5E-100G10G MPC5EQ-100G10G	**With optics:** 607 W at 55° C 541 W at 40° C 511 W at 25° C
MPC6E	MX2K-MPC6E	1088 W with MICs and optics

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC7E-MRATE	MPC7E-MRATE	400 W (Typical) 545 W at 55° C 465 W at 40° C 440 W at 25° C
MPC8E (without MICs)	MX2K-MPC8E	688 W (Typical) 805 W at 55° C 720 W at 40° C 690 W at 25° C
MPC9E (without MICs)	MX2K-MPC9E	838 W (Typical) 1018 W at 55° C 870 W at 40° C 840 W at 25° C
MICs		
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	35 W
Gigabit Ethernet MIC with SFP	MIC-3D-20-GE-SFP	37 W
10-Gigabit Ethernet MIC with XFP	2-Port: MIC-3D-2XGE-XFP 4-Port: MIC-3D-4XGE-XFP	2-Port: 29 W 4-Port: 37 W

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
10-Gigabit Ethernet MIC with SFP+	MIC6-10G	74 W **With optics:** 53 W at 55° C, 40° C and 25° C with 10G BASE-SR and 10G BASE-LR optics 66 W at 55° C, 40° C and 25° C with 10G BASE-ER optics 74 W at 55° C, 40° C and 25° C with 10G BASE-ZR optics
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	84 W **With optics:** 63 W at 55° C with 10G BASE-LR OTN optics 63 W at 40° C with 10G BASE-LR OTN optics 63 W at 25° C with 10G BASE-LR OTN optics
40-Gigabit Ethernet MIC with QSFPP	MIC3-3D-2X40GE-QSFPP	18 W
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	40 W
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	20 W

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	104 W **With optics:** 94 W at 55° C with 100G BASE-LR4 OTN optics 86 W at 40° C with 100G BASE-LR4 OTN optics 74 W at 25° C with 100G BASE-LR4 OTN optics
100-Gigabit Ethernet MIC with CXP	MIC6-100G-CXP	57 W 49 W at 55° C with CXP SR10 optics 49 W at 40° C with CXP SR10 optics 49 W at 25° C with CXP SR10 optics
100-Gigabit DWDM OTN MIC with CFP2	MIC3-100G-DWDM	**With optics:** 91 W at 55° C 83 W at 25° C
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48 8-Port: MIC-3D-8OC3OC12-4OC48	4-Port: 24 W at 55° C 22.75 W at 40° C 21.5 W at 25° C 8-Port: 29 W at 55° C 27.75 W at 40° C 26.5 W at 25° C

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55° C 38.5 W at 40° C 36 W at 25° C
Channelized SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4CHOC3-2CHOC12 8-Port: MIC-3D-8CHOC3-4CHOC12	4-Port: 41 W at 55° C 40 W at 40° C 39 W at 25° C 8-Port: 52 W at 55° C 50.5 W at 40° C 49 W at 25° C
Channelized OC48/STM16 MIC with SFP	MIC-3D-1CHOC48	56.5 W at 55° C 54.5 W at 40° C 53 W at 25° C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W
MIC MRATE	MIC-MRATE	• When installed into MPC8E: 1.250 A @ 48 V (60 W) • When installed into MPC9E: 1.771 A @ 48 V (85 W)
DS3/E3 MIC	MIC-3D-8DS3-E3 MIC-3D-8CHDS3-E3-B	36 W at 55° C 35 W at 40° C 34 W at 25° C

Table 72: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	33.96 W

RELATED DOCUMENTATION

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Connecting Power to a DC-Powered MX2010 Router with Power Distribution Modules (-48 V) | 377

MX2010 DC Power (-48 V) System Electrical Specifications | 246

MX2010 DC Power Distribution Description (-48 V) | 242

MX2010 DC Power Distribution Description (-48 V)

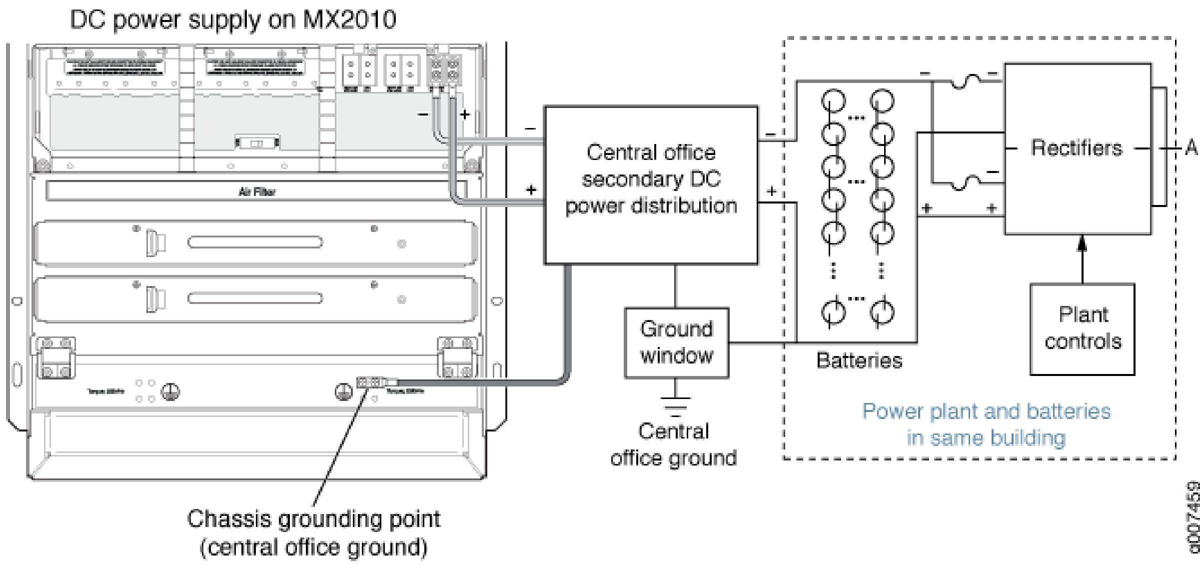
Most sites distribute DC power through a main conduit that leads to frame-mounting DC power distribution panels, one of which might be located at a location near the rack that houses the router. A pair of cables (one input and one return) connects each set of PDM input terminal studs to the power distribution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

The PSMs can be connected to two separate feeds from different sources that are used for feed redundancy. There are two PDMs located in slots **PDM0/Input0** and **PDM1/Input1** that are capable of carrying seven to nine feeds each. Each feed is connected from one source to one PDM and feeds from the other source to the second PDM of the DC power system. This configuration balances power draw for the system by using the commonly deployed A/B feed redundancy.

Each system provides *N*+1 PSM redundancy along with *N*+*N* feed redundancy. If both DC feeds are available, operating power draws from the feed with higher voltage. These feeds are set by the input mode DIP switch located on the DC PSM (see "MX2010 DC Power Supply Module (-48 V) Description" on page 147). Each set of power cables powers a single DC PSM and is capable of delivering 2500 W of power if 80-A feeds are connected. If feeds that connect to one PDM fail in a redundant configuration, the other feed starts to provide full power.

Figure 81 on page 243 shows a typical DC source cabling arrangement.

Figure 81: Typical DC Source Cabling to the Router



All DC PSMs in a subsystem share the load. If one PSM fails in a redundant configuration, the remaining PSMs provide power to FRUs. Up to nine PSMs might be required to supply power to a fully configured router. A portion of power from each zone is reserved to power critical FRUs. These FRUs allow the system to operate even if power to a complete zone fails.

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 PDM.

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

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

RELATED DOCUMENTATION

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Installing MX2010 DC Power Supply Modules

Replacing an MX2010 DC Power Distribution Module Cable | **593**

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DC Power Cable Specifications for the MX2010 Router | **255**

MX2010 DC Power Distribution (240 V China) Description

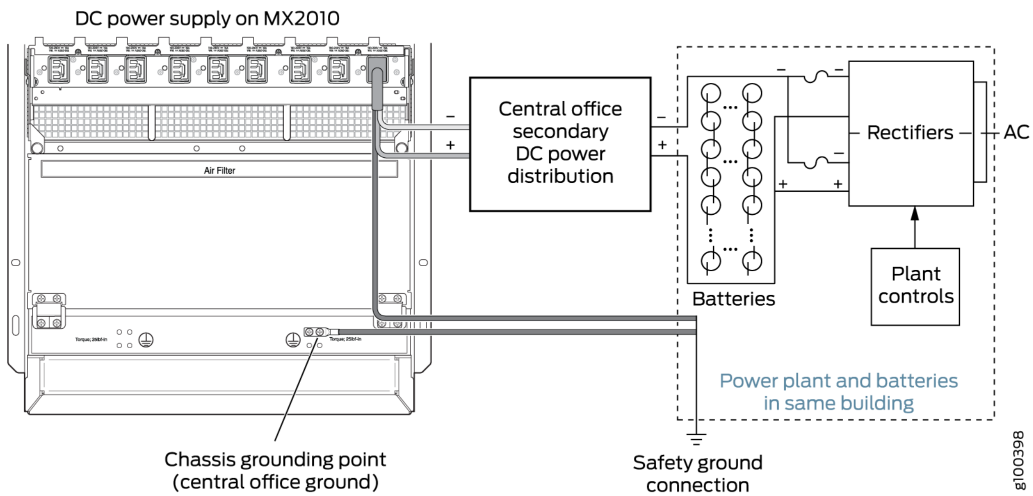
Most sites distribute DC power through a main conduit that leads to frame-mounting DC power distribution panels, one of which might be located at a location near the rack that houses the router. The 240 V China PDM cable connects the PDM to the power distribution panel and safety ground connection.

The PSMs can be connected to two separate feeds from different sources that are used for feed redundancy. There are two PDMs located in slots **PDM0/Input0** and **PDM1/Input1** that are capable of carrying nine feeds each. Each feed is connected from one source to one PDM and feeds from the other source to the second PDM of the DC power system. This configuration balances power draw for the system by using the commonly deployed A/B feed redundancy.

Each system provides *N*+1 PSM redundancy along with *N*+*N* feed redundancy. If both DC feeds are available, operating power draws from the feed with higher voltage.). Each set of power cables powers a single DC PSM and is capable of delivering 2500 W of power. If feeds that connect to one PDM fail in a redundant configuration, the other feed starts to provide full power.

Figure 82 on page 245 shows a typical DC source cabling arrangement.

Figure 82: Typical DC (240 V China) Source Cabling to the Router



All DC PSMs in a subsystem share the load. If one PSM fails in a redundant configuration, the remaining PSMs provide power to FRUs. Up to nine PSMs might be required to supply power to a fully configured router. A portion of power from each zone is reserved to power critical FRUs. These FRUs allow the system to operate even if power to a complete zone fails.

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 PDM.

CAUTION: The two input sources must have similar grounding type because the PSM can see 480 V if one source has positive ground (-240 V), and the other source has negative ground (+240 V). This might damage the PSM.

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

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

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Installing MX2010 DC Power Supply Modules

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DC Power Cable Specifications for the MX2010 Router | 255

MX2010 DC Power (-48 V) System Electrical Specifications

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- DC Power Supply Input Fuses | 247

Table 73 on page 246 lists the DC power system electrical specifications.

Table 73: DC PSM Electrical Specifications per Input Configurations

Item	Specification
Maximum input current rating input voltage @ –40 VDC to –72 VDC	60 A (for 2100 W output) 73 A (for 2500 W output)
Maximum output power	2100 W @ 60 A 2500 W @ 73 A
Redundancy	*N*+1 PSM *N*+*N* feed redundancy

Table 73: DC PSM Electrical Specifications per Input Configurations *(Continued)*

Item	Specification
DC input voltage	–40 VDC to –72 VDC
DC nominal input current @ 48 VDC IN	49 A (for 2100 W output) 59 A (for 2500 W output)
Maximum DC output @ 52 VDC (upper and lower cage)	2500 W
DC standby output @ 5 VDC	30 W
Efficiency **NOTE**: This value is within load range 17–67% and nominal input voltage at 48 VDC.	91%

DC Power Supply Input Fuses

The DC (-48 V) PSM has a power supply input fuse in the negative terminals of both INP0 and INP1. Table 74 on page 247 lists the electrical specification for this fuse.

Table 74: Electrical Specifications for the DC Power Supply Input Fuse

Electrical Characteristic	Value
Fuse	Littelfuse FUSE M P 80A 170VDC E, P/N TLS080LS
Voltage Rating	170 Vdc
Ampere Range	80 A
Interrupting Rating	100 kA

Table 74: Electrical Specifications for the DC Power Supply Input Fuse *(Continued)*

Electrical Characteristic	Value
Approvals	UL Recognized (File: E71611)
Construction	Body: Glass melamine Caps: Silver-plated brass
Environmental	RoHS Compliant, Lead (Pb) Free

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MX2010 DC Power Distribution Module (-48 V) Description | 142
MX2010 DC Power Supply Module (-48 V) Description | 147
MX2010 DC Power Electrical Safety Guidelines

MX2010 Router DC (240 V China) System Electrical Specifications

IN THIS SECTION

- DC Power Supply Input Fuses | 249

Table 75 on page 249 lists the DC power system electrical specifications.

Table 75: DC PSM (240 V China) Electrical Specifications Per Input Configurations

Item	Specification
Maximum input current rating input voltage @ 190 - 290 VDC	16 A (for 2500 W output)
Maximum output power	2500 W @ 190 V/16 A
Redundancy	N+1 PSM N+N feed redundancy
DC input voltage	190 VDC to 290 VDC
DC nominal input current @ 240 VDC IN	14 A (for 2500 W output)
Maximum DC output @ 52 VDC (upper and lower cage)	2500 W
DC standby output @ 5 VDC	30 W
Efficiency **NOTE**: This value is within load range 17-67% and nominal input voltage at 240 VDC.	91%

DC Power Supply Input Fuses

The DC PSM has a power supply input fuse in the negative terminals of both INP0 and INP1. Table 76 on page 250 lists the electrical specification for this fuse.

Table 76: Electrical Specifications for the DC Power Supply (240 V China) Input Fuse

Electrical Characteristic	Value
Fuse	Fuse Walter MHP-20
Voltage Rating	500 Vdc
Ampere Range	20 A
Interrupting Rating	20 kA
Approvals	UL Recognized (File: E71611)
Construction	Body: Glass melamine Caps: Silver-plated brass
Environmental	RoHS Compliant, Lead (Pb) Free

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MX2010 DC Power Electrical Safety Guidelines

Calculating DC Power Requirements for MX2010 Routers

The information in this topic helps you determine which PSMs are suitable for various configurations, as well as which PSMs are not suitable because output power is exceeded. You determine suitability by subtracting the total power draw from the maximum output of the PSMs. Afterward, you calculate the required input current. Finally, you calculate the thermal output. A sample configuration is provided in Table 77 on page 251.

We recommend that you provision power according to the maximum input current listed in the power system electrical specifications (see "MX2010 DC Power (-48 V) System Electrical Specifications" on page 246).

Use the following procedures to calculate the power requirement:

1. Calculate the power requirement.

2. Evaluate the power budget.

3. Calculate input power.

4. Calculate thermal output (BTUs) for cooling requirements.

The MX2010 DC power system provides power to the FRUs in the chassis (see Table 77 on page 251 for information about power). Each power system is made up of two DC PDMs, nine PSMs, ten MPCs, four fan trays, eight SFBs, and two Control Board and Routing Engines (CB-REs).

When calculating power requirements, be sure that there is adequate power for the system.

Table 77: MX2010 DC Power System Sample Configuration

Chassis Power Configuration	Power Distribution Modules (PDMs)	Power Supply Modules (PSMs)	Description
3 PSMs, 2 CB-REs, 8 SFBs, and 4 fan trays (no line cards installed)	PDM 0 and 1	3 PSMs	The power consumed by CB-REs and SFBs is 250 W each. The power consumed by 2 CB-REs and 8 SFBs is 2.5 KW. The power consumed by fan trays **0** and **1** is 2 KW and fan trays **2** and **3** is 1 KW. The total Kilowatts of power consumed is 5.5 KW.
10 Line cards	PDM 0 and 1	5 PSMs	Each line card consumes up to 1 KW. One PSM is needed for every set of 2 line cards.

Table 77: MX2010 DC Power System Sample Configuration *(Continued)*

Chassis Power Configuration	Power Distribution Modules (PDMs)	Power Supply Modules (PSMs)	Description
N+1 redundant system with *N*+*N* redundancy for SFBs, CB-REs, and 1 out of 2 fan trays.	PDM 0 and 1	9 PSMs	This provides *N*+*N* redundnacy for critical FRUs (CB-REs, SFBs, and fan trays) and *N*+1 redundancy for line cards.

1. Calculate the power requirements (usage) using the values in "MX2010 DC Power Requirements" on page 233 as shown in Table 78 on page 252.

   Table 78: Typical DC Power Requirements for MX2010 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2010-BB	–
Fan trays (upper and lower)	MX2000-FANTRAY-BB	1700 * 2 + 500* 2 W = 4400 W
MPC	MPC-3D-16XGE-SFPP	440 W * 10 = 4400 W
ADC	ADC	150 W * 10 = 1500 W
CB-RE	RE-MX2000-1800X4-S	250 W * 2 = 500 W
SFB—slots 0 through 7	MX2000-SFB-S	220 W * 8 = 1760 W
MX2010 DC power system (60 A feeds to each PDM input) MX2010 DC power system (80 A feeds to each PDM input)		2100 W * 8 PSMs=16,800 W (+ 1 PSM@2100 W redundant capacity) 2500 W * 8 PSMs=20,000 W (+ 1 PSM@2500 W redundant capacity)

2. Evaluate the power budget, including the budget for each configuration if applicable, and check the required power against the maximum output power of available PDM options.

Table 79 on page 253 lists the PSMs, their maximum output power, and unused power (or a power deficit).

Table 79: Calculating DC Power Budget

Power Supply Module	Maximum Output Power of Power Supply Module (Watt)	Maximum Output Power for System (Watt)—Including Redundant Capacity
MX2010 DC PSM 60 A (feed to each input)	2100	18,900
MX2010 DC PSM 80 A or DC PSM (240 V China) (feed to each input)	2500	22,500

3. Calculate input power. Divide the total output requirement by the efficiency of the PSM as shown in Table 80 on page 253.

Table 80: Calculating DC Input Power

Power Supply Module	Power Supply Module Efficiency	Output Power Requirement (Watt) —per PSM	Input Power Requirement (Watt)—per PSM
MX2010 DC PSM 60 A	91%	2100	2307
MX2010 DC PSM 80 A or DC PSM (240 V China)	91%	2500	2747

4. Calculate thermal output (BTUs). Multiply the input power requirement (in watts) by 3.41 as shown in Table 81 on page 254.

Table 81: Calculating DC Thermal Output

Power Distribution Module	Thermal Output (BTUs per hour)
MX2010 DC PDM	34.5 KW divided by 0.91 * 3.41 = 129,280 BTU/hr. 34.5 KW of output power consumed by the chassis. This is the maximum output the chassis can consume in a redundant configuration. The input power is 16.5 divided by 0.91 = 37.9 KW.

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MX2010 Power Midplane Description | 128

Overview of Preparing the Site for the MX2010 Router | 162

MX2010 DC Power Distribution Description (-48 V) | 242

MX2010 DC Power (-48 V) System Electrical Specifications | 246

DC Power (-48 V) Circuit Breaker Requirements for the MX2010 Router

To operate a maximally or minimally configured DC-powered router, you must use a dedicated circuit breaker for each input DC feed. The circuit breaker must have the following specifications:

- Breaker Type: Hydraulic Magnetic
- Voltage Rating: Up to 125VDC
- Current Rating: 80A DC
- Delay Feature: DC Short Delay
- Interrupting Rating : 5000A
- Number of Poles: Single

RELATED DOCUMENTATION

MX2010 DC Power Distribution Module (-48 V) Description | 142
MX2010 DC Power Electrical Safety Guidelines
MX2010 DC Power (-48 V) System Electrical Specifications | 246

DC Power (240 V China) Circuit Breaker Requirements for the MX2000 Router

For PDMs, if you plan to operate a maximally configured DC-powered router, we recommend that you provision at least 20 A @ 240 VDC (nominal) for each DC input to the system. Use a customer site 2 pole circuit breaker rated according to respective National Electrical Code and customer site internal standards to maintain proper level of protection for the current specified above.

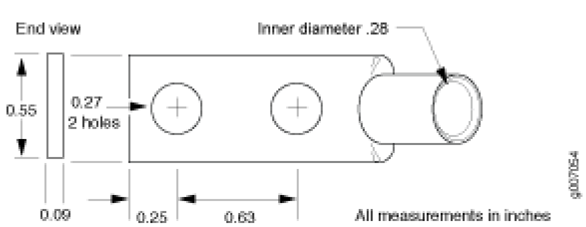
If you plan to operate a DC-powered router at less than the maximum configuration, we recommend that you provision a 2 pole circuit breaker according to respective National Electrical Code and customer site internal standards to maintain proper level of protection for the current specified above or each DC power supply rated for at least 125% of the continuous current that the system draws at 240 VDC.

DC Power Cable Specifications for the MX2010 Router

The cable lugs attach to the terminal studs of each PDM (see Figure 83 on page 255).

NOTE: The MX2010 supports 4-AWG DC power cable lugs for 80-A input and for 60-A input.

Figure 83: 4-AWG DC Power Cable Lug



CAUTION: Before you install the router, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.

CAUTION: The router is installed in restricted access location. It has a separate protective earthing terminal (Metric [–M6] and English [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

Table 82 on page 256 summarizes the specifications for the DC power cables, which you must supply.

Table 82: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 60-A or 80-A PDM. Minimum 75°C wire, or as required by the local code. You can select 60-A or 80-A input feed capacity on the DC PDM by setting the DIP switch on the PDM to the rated amperage of the DC power input feeds.

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 PDM.

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Connecting an MX2010 DC Power Distribution Module Cable | 594

CHAPTER 14

Universal (HVAC/HVDC) Power Requirements, Specifications, and Guidelines

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- MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications | 266
- MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications | 269
- Determining High-Voltage Universal (HVAC/HVDC) Power Requirements for Your MX2010 Router | 271
- High-Voltage Universal (HVAC/HVDC) Power Circuit Breaker Requirements for the MX2000 Router | 274

MX2010 High-Voltage Universal (HVAC/HVDC) Power Requirements

Table 83 on page 258 lists the FRU power requirements for SFBs, CB-REs, MPCs, and MICs. In addition, Table 83 on page 258 lists the MPC power requirements with MICs and optics at various operating temperatures.

Typical power represents power under certain temperatures and normal operating conditions.

NOTE: The universal PDMs do not have a switch selection.

If you do not plan to provision as recommended above, you can use the information in Table 83 on page 258 to calculate the power consumption for your hardware configuration.

NOTE: Unlike all the other MPCs, *MPC6E*, *MPC8E*, and *MPC9E* does not require an adapter card (ADC) to house the MPC in the MX2020 router.

Table 83: FRU DC Power Requirements

Component	Model Number	Maximum Power Requirement
Switch Fabric Boards (SFBs)		
SFB	MX2000-SFB	200 W (Typical) 220 W at 55° C 220 W at 40° C 220 W at 25° C
SFB2	MX2000-SFB2-S	250 W (Typical) 295 W at 55° C 280 W at 40° C 270 W at 25° C
Fan Trays		
Fan trays, upper	MX2000-FANTRAY	200 W (Typical) 1700 W at 55° C 1150 W at 40° C 350 W at 25° C
Fan trays, lower	MX2000-FANTRAY	200 W (Typical) 1700 W at 55° C 1150 W at 40° C 350 W at 25° C
Adapter Cards		
ADC	MX2000-LC-ADAPTER	150 W
Control Board and Routing Engine (CB-RE)		

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
CB-RE	RE-MX2000-1800X4	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
CB-RE	REMX2K-X8-64G	400 W
MPCs		
MPC-3D-16XGE-SFPP	MPC-3D-16XGE-SFPP	440 W at 55° C ambient
MPC1	MX-MPC1-3D MX-MPC1E-3D	165 W **With MICs and optics:** 239 W at 55° C 227 W at 40° C 219 W at 25° C
MPC1 Q	MX-MPC1-3D-Q MX-MPC1E-3D-Q	175 W **With MICs and optics:** 249 W at 55° C 237 W at 40° C 228 W at 25° C
MPC2	MX-MPC2-3D MX-MPC2E-3D	274 W **With MICs and optics:** 348 W at 55° C 329 W at 40° C 315 W at 25° C

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC2 Q *MPC2 EQ*	MX-MPC2-3D-Q MX-MPC2-3D-EQ MX-MPC2E-3D-Q MX-MPC2E-3D-EQ	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C
MPC2E P	MX-MPC2E-3D-P	294 W **With MICs and optics:** 368 W at 55° C 347 W at 40° C 333 W at 25° C
MPC3E	MX-MPC3E-3D	440 W **With MICs and optics:** 520 W at 55° C, two 40 W MICs 420 W at 40° C, two CFP MICs with LR4 optics 408 W at 25° C, two CFP MICs with LR4 optics
32x10GE MPC4E	MPC4E-3D-32XGE-SFPP	610 W **With optics:** 610 W at 55° C, with SFPP ZR optics 560 W at 40° C, with SFPP ZR optics 550 W at 25° C, with SFPP ZR optics

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	610 W **With optics:** 610 W at 55° C, with SFPP ZR and CFP LR4 optics 550 W at 40° C, with SFPP ZR and CFP LR4 optics 530 W at 25° C, with SFPP ZR and CFP LR4 optics
6x40GE + 24x10GE MPC5E *6x40GE + 24x10GE MPC5EQ*	MPC5E-40G10G MPC5EQ-40G10G	**With optics:** 607 W at 55° C 541 W at 40° C 511 W at 25° C
2x100GE + 4x10GE MPC5E *2x100GE + 4x10GE MPC5EQ*	MPC5E-100G10G MPC5EQ-100G10G	**With optics:** 607 W at 55° C 541 W at 40° C 511 W at 25° C
MPC6E	MX2K-MPC6E	1088 W with MICs and optics
MPC7E-MRATE	MPC7E-MRATE	400 W (Typical) 545 W at 55° C 465 W at 40° C 440 W at 25° C

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
MPC8E (without MICs)	MX2K-MPC8E	688 W (Typical) 805 W at 55° C 720 W at 40° C 690 W at 25° C
MPC9E (without MICs)	MX2K-MPC9E	838 W (Typical) 1018 W at 55° C 870 W at 40° C 840 W at 25° C
MICs		
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	35 W
Gigabit Ethernet MIC with SFP	MIC-3D-20-GE-SFP	37 W
10-Gigabit Ethernet MIC with XFP	2-Port: MIC-3D-2XGE-XFP 4-Port: MIC-3D-4XGE-XFP	2-Port: 29 W 4-Port: 37 W
10-Gigabit Ethernet MIC with SFP+	MIC6-10G	74 W **With optics:** 53 W at 55° C, 40° C and 25° C with 10G BASE-SR and 10G BASE-LR optics 66 W at 55° C, 40° C and 25° C with 10G BASE-ER optics 74 W at 55° C, 40° C and 25° C with 10G BASE-ZR optics

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	84 W **With optics:** 63 W at 55° C with 10G BASE-LR OTN optics 63 W at 40° C with 10G BASE-LR OTN optics 63 W at 25° C with 10G BASE-LR OTN optics
40-Gigabit Ethernet MIC with QSFPP	MIC3-3D-2X40GE-QSFPP	18 W
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	40 W
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	20 W
100-Gigabit Ethernet MIC with CFP2	MIC6-100G-CFP2	104 W **With optics:** 94 W at 55° C with 100G BASE-LR4 OTN optics 86 W at 40° C with 100G BASE-LR4 OTN optics 74 W at 25° C with 100G BASE-LR4 OTN optics

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
100-Gigabit Ethernet MIC with CXP	MIC6-100G-CXP	57 W 49 W at 55° C with CXP SR10 optics 49 W at 40° C with CXP SR10 optics 49 W at 25° C with CXP SR10 optics
100-Gigabit DWDM OTN MIC with CFP2	MIC3-100G-DWDM	**With optics:** 91 W at 55° C 83 W at 25° C
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48 8-Port: MIC-3D-8OC3OC12-4OC48	4-Port: 24 W at 55° C 22.75 W at 40° C 21.5 W at 25° C 8-Port: 29 W at 55° C 27.75 W at 40° C 26.5 W at 25° C
OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55° C 38.5 W at 40° C 36 W at 25° C

Table 83: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
Channelized SONET/SDH OC3/ STM1 Multi-Rate MIC	4-Port: MIC-3D-4CHOC3-2CHOC12 8-Port: MIC-3D-8CHOC3-4CHOC12	4-Port: 41 W at 55° C 40 W at 40° C 39 W at 25° C 8-Port: 52 W at 55° C 50.5 W at 40° C 49 W at 25° C
Channelized OC48/STM16 MIC with SFP	MIC-3D-1CHOC48	56.5 W at 55° C 54.5 W at 40° C 53 W at 25° C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W
MIC MRATE	MIC-MRATE	• When installed into MPC8E: 1.250 A @ 48 V (60 W) • When installed into MPC9E: 1.771 A @ 48 V (85 W)
DS3/E3 MIC	MIC-3D-8DS3-E3 MIC-3D-8CHDS3-E3-B	36 W at 55° C 35 W at 40° C 34 W at 25° C
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	33.96 W

RELATED DOCUMENTATION

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Connecting Power to a DC-Powered MX2010 Router with Power Distribution Modules (-48 V) | 377

MX2010 DC Power (-48 V) System Electrical Specifications | 246

MX2010 DC Power Distribution Description (-48 V) | 242

MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications

Table 84 on page 266 provides specifications and plug standards for the AC (20-input and 16-input) power cord applicable to the universal (HVAC/HVDC) PDMs.

Table 84: 20-A and 16-A Cabling Options

Spare Juniper Model Number	Locale	Cord Set Rating	Connector
CBL-JNP-SG4-C20	North America AC Power Cord	20 A, 250 VAC	C20 to Anderson 3-5958p4
CBL-JNP-SG4-JPL	Japan AC power cord	20 A, 250 VAC	SAF-D-Grid 400 to NEMAL6-20
CBL-JNP-SG4-C20-CH	Worldwide AC power cord	16A, 250 VAC	SAF-D-GRID 400 to IEC 60320 C20

Table 85 on page 267 provides specifications and connectors on the 30-A power cord provided for each country or region applicable to the universal (HVAC/HVDC) PDMs.

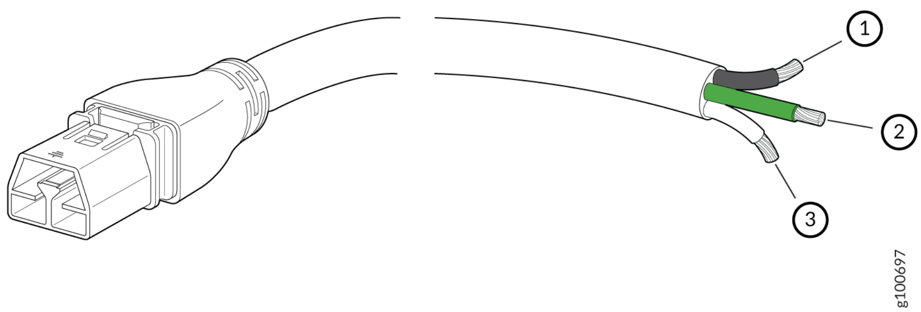
Table 85: 30-A Cabling Options

Spare Juniper Model Number	Locale	Cord Set Rating	Connector
CBL-PWR2-BARE See Figure 84 on page 268.	North America HVAC/HVDC power cord	30 A, 400 VAC	Anderson/straight to bare wire
CBL-PWR-SG4	North America HVAC/HVDC power cord	30-A, 400 VAC	SAF-D-GRID 400 right-angle (LH)
CBL-PWR2-L6-30P See Figure 85 on page 268.	North America AC Power Cord	30 A, 400 VAC	Anderson/straight to L6-30P
CBL-PWR2-332P6W-RA	Continental Europe AC power cord	30-A 250 VAC	Anderson/right-angle to IEC 332P6
CBL-PWR2-332P6W	Continental Europe AC power cord	30-A 250 VAC	Anderson/right-angle to IEC 332P6
CBL-PWR-SG4-RA	USA HVAC/HVDC power cord	30-A, 400 VAC	SAF-D-GRID 400 right-angle (LH)
CBL-PWR2-L6-30P-RA	North America AC power cord	30 A, 250 VAC	Anderson/right-angle to L6-30P
CBL-PWR2-330P6W-RA Figure 86 on page 268.	Continental Europe AC power cord	30 A, 250 VAC	Anderson/right-angle to IEC 330P6
CBL-PWR2-330P6W	North America AC power cord	30 A, 250 VAC	Anderson/right-angle to IEC 330P6

For the HVAC/HVDC power cord one end of the cable has an SAF-D-Grid 400 connector, the other end of the cable is bare wire. See Figure 84 on page 268 and Table 85 on page 267. These cables are separately orderable and are not shipped automatically with the MX2K-PDM-HV orders. An example of the bare wire cable and connector is shown in Figure 84 on page 268.

For connection to AC systems, Juniper provides a cable with either a NEMA 30-A connector (Figure 85 on page 268).

Figure 84: Bare Cable with Anderson Connector



1– Black wire–Positive (+)	3– White wire–Negative
2– Green wire-Ground	

Figure 85: NEMA L6-P30 Connector

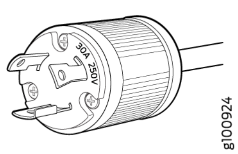
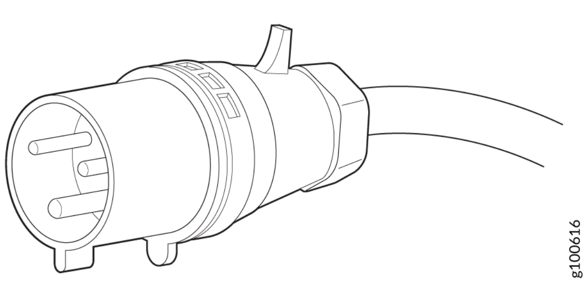


Figure 86: IEC 330P6W Connector



WARNING: The AC power cord for the router is intended for use with the router only and not for any other use.

WARNING:

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

Translation from Japanese: The attached power cable is only for this product. Do not use the cable for another product.

NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.75 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). You can order AC power cords that are in compliance.

WARNING: The router is installed in restricted access location. It has a separate protective earthing terminal (Metric [–M6] and English [–¼-20] screw ground lugs) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earth terminal must be permanently connected to earth.

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

MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications

Table 86 on page 270 lists the high-voltage second-generation universal power subsystem electrical specifications.

Table 86: High-Voltage Universal PSM Electrical Specifications Per Input Configurations

Item	Specification
Maximum input current rating input voltage @ 190 VDC or 180 VAC	Maximum input current 30 A (for 3000 W)
Maximum output power	3400 W (dual feed) and 3000 W (single feed) @ 57.7 A
Redundancy	N+1 PSM N+N feed redundancy
DC input voltage	190 VDC to 410 VDC
DC nominal input current @ 380 VDC IN	10 A (3000 W for single feed)
Maximum output @ 52 VDC (upper and lower cage)	3400 W (dual feed) and 3000 W (single feed)
DC standby output @ 5 VDC	30 W
AC input voltage	Operating range: 180-305 VAC
Maximum AC feed PSM input power	3365 W for single input, 1910 W for each input with dual-input configuration.
AC input line frequency	47-63 Hz (+/-3Hz)
AC system current rating	19 A (single input) @ 180 VAC input voltage, 11 A for each input with dual-input configuration.
Efficiency **NOTE**: This value is maximum load.	91% at full load

RELATED DOCUMENTATION

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description

MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description

Determining High-Voltage Universal (HVAC/HVDC) Power Requirements for Your MX2010 Router

The information in this topic helps you determine which PSMs are suitable for various configurations, as well as which PSMs are not suitable because output power is exceeded. You determine suitability by subtracting the total power draw from the maximum output of the PSMs. Afterward, you calculate the required input current. Finally, you calculate the thermal output.

We recommend that you provision power according to the maximum input current listed in the power system electrical specifications (see *MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications*).

Use the following procedures to calculate the power requirement:

1. Calculate the power requirement.
2. Evaluate the power budget.
3. Calculate input power.
4. Calculate thermal output (BTUs) for cooling requirements.

The MX2010 HVAC/HVDC power system provides power to the FRUs in the chassis. Each power system is made up of two HVAC/HVDC PDMs, nine PSMs, ten MPCs, four fan trays, eight SFBs, and two Control Board and Routing Engines (CB-REs).

1. Calculate the power requirements (usage) using the values in "MX2010 High-Voltage Universal (HVAC/HVDC) Power Requirements" on page 257 as shown in Table 87 on page 271.

Table 87: HVAC/HVDC Power Requirements for MX2010 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2010-BB	–

Table 87: HVAC/HVDC Power Requirements for MX2010 Router *(Continued)*

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Fan trays (upper and lower)	MX2000-FANTRAY-BB	1500 W * 2 + 300 W * 2= 3600 W
MPC	MX2K-MPC11E	1980W * 10 = 19800 W
ADC	ADC	150 W * 10 = 1500 W
CB-RE	RE-MX2000-1800X4-S	250 W * 2 = 500 W
SFB—slots 0 through 7	MX2000-SFB3	385 W * 8 = 3080 W
MX2010 HVAC/HVDC power system (upper and lower half of chassis, 19 A feeds to each PDM input)		3000 W * 8 PSMs=24,000 W (+ 1 PSM@3000 W redundant capacity)

2. Evaluate the power budget, including the budget for each configuration if applicable, and check the required power against the maximum output power of available PDM options.

   Table 88 on page 272 lists the PSMs, their maximum output power, and unused power (or a power deficit).

   Table 88: Calculating HVAC/HVDC Power Budget

Power Supply Module	Maximum Output Power of Power Supply Module (Watt)	Maximum Output Power for System (Watt)—Including Redundant Capacity
MX2010 Universal (HVAC/HVDC) PSM	3000 W for single feed 3400 W for dual feed	3000 * 9 PSM with single feed = 27,000 W (PSM redundancy) 3400 * 8 PSM with dual feed = 27,200 W (feed redundancy)

3. Calculate input power. Divide the total output requirement by the efficiency of the PSM as shown in Table 89 on page 273.

Table 89: Calculating HVAC/HVDC Input Power

Power Supply Module	Power Supply Module Efficiency	Input Power Requirement (Watt)—per PSM
MX2010 Universal (HVAC/HVDC) PSM	91%	3300 W for single feed, 3800 W for dual feed

4. Calculate thermal output (BTUs). Multiply the input power requirement (in watts) by 3.41 as shown in Table 90 on page 273.

Table 90: Calculating Typical HVAC/HVDC Thermal Output

Loaded Chassis Heat Load	Thermal Output (BTUs per hour)
Loaded chassis configuration	Typical power divided by (0.91 * 3.41) = BTU/hr. BTU = 18,000 divided by (0.91 * 3.41) = 5,800 BTU/hr. 18,000 KW of output power consumed by the chassis. This is the typical output the chassis can consume in a redundant configuration.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

MX2020 Power Subsystem Description

Overview of Preparing the Site for the MX2020 Router

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description

MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications

High-Voltage Universal (HVAC/HVDC) Power Circuit Breaker Requirements for the MX2000 Router

The circuit breaker protection on all the power supplies should be designed according to National Electrical Code (NEC) of country of system installation or any similar local standard based on maximum drawn current of the power supply specified in this document.

Each high-voltage universal (HVAC/HVDC) PSM has dual feeds. The input AC or DC receptacle inlet is located on front panel of the PDM.

Each power cord feed should have dedicated circuit breakers. We recommend that size of the circuit breaker protection should be designed according to National Electrical Code (NEC) of country of system installation or any similar local standard based on maximum drawn current of the power supply specified in this document.

CAUTION: Use a 2-pole Circuit Breaker rated at minimum of 125% of the rated current per NEC or as local codes. Primary Overcurrent Protection by the Building Circuit Breaker. This breaker must protect against excess current, short circuit, and earth grounding fault in accordance with NEC which is ANSI/NFPA 70.

3

PART

Initial Installation and Configuration

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Unpacking the Router | 282

Installing the Mounting Hardware | 294

Installing the Router | 299

Connecting the Router to Power | 362

Connecting the Router to the Network | 397

Initially Configuring the Router | 413

CHAPTER 15

Installation Overview

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- Installing an MX2010 Router Overview | **276**
- Tools and Parts Required to Unpack the MX2010 Router | **278**
- Tools Required to Install the MX2010 Router Using a Pallet Jack | **278**
- Tools Required to Install the MX2010 Router Using a Router Transport Kit | **279**
- Tools and Parts Required to Maintain the MX2010 Hardware Components | **280**
- Tools and Parts Required for Connecting an MX2000 Router to Power | **280**
- Tools and Parts Required for MX2010 Router Connections | **281**

Installing an MX2010 Router Overview

To install the MX2010 router:

1. Prepare your installation site. See:
   - "Overview of Preparing the Site for the MX2010 Router" on page 162
2. Review the safety guidelines. See:
   - *General Safety Guidelines for Juniper Networks Devices*
3. Unpack the router and verify the parts. See:
   - "Unpacking the MX2010 Router" on page 283
   - "Verifying the MX2010 Parts Received" on page 287
   - "Unpacking the MX2010 Router Transport Kit" on page 290
4. Install the mounting hardware. See:
   - "Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet" on page 294
5. Remove all components. See:
   - "Removing Components from the MX2010 Router Chassis Before Installing It in a Rack" on page 299

6. Install the router into the rack. See:

    - "Installing an MX2010 Router Using a Pallet Jack Overview" on page 315

    - "Installing an MX2010 Router Using a Router Transport Kit Overview" on page 322

7. Ground the router. See:

    - "Grounding an MX2000 Router" on page 362

8. Reinstall all components. See:

    - "Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack" on page 346

9. Connect cables to the network and external devices. See:

    - "Connecting the MX2010 Router to Management and Alarm Devices" on page 397.

10. Connect the AC power cord, 240-V China cables, DC power cables, universal (HVAC/HVDC) power cables. See:

    - Installing MX2010 AC Power Supply Modules

    - "Installing MX2000 Router DC Power Supply Modules (240 V China) " on page 440

    - *Installing MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Supply Modules*

    - Installing MX2010 DC Power Supply Modules

    - "Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules" on page 364

    - "Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules" on page 368

    - "Connecting Power to a DC-Powered MX2010 Router with Power Distribution Modules (-48 V)" on page 377

    - "Connecting Power to a DC-Powered MX2000 Router with DC Power Distribution Modules (240 V China)" on page 382

    - *Connecting Power to a High Voltage-Powered MX2000 Router with Power Distribution Modules*

11. Power on the router. See:

    - *Powering On a Three-Phase AC-Powered MX2000 Router*

    - "Powering On the DC-Powered MX2010 Router" on page 390

    - *Powering On the High-Voltage Powered Universal (HVAC/HVDC) MX2000 Router*

12. Perform the initial system configuration. See:

    - "Initially Configuring the MX2010 Router" on page 413

RELATED DOCUMENTATION

MX2010 Chassis Description | 6

Routine Maintenance Procedures for the MX2010 Router | 806

MX2010 Troubleshooting Resources | 816

Tools and Parts Required to Unpack the MX2010 Router

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

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

RELATED DOCUMENTATION

Unpacking the MX2010 Router | 283

Unpacking the MX2010 Router Transport Kit | 290

Verifying the MX2010 Parts Received | 287

MX2010 Router Overview | 2

Tools Required to Install the MX2010 Router Using a Pallet Jack

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

- Standard pallet jack (not provided)
- Pallet jack attachment—MX2000-PLLT-JCK-ADPTR
- Front component shipping covers
- Rear component shipping covers
- Phillips (+) screwdrivers, numbers 1, 2, and 3
- 9/16-in. or 14-mm open-end or socket wrench to remove bracket bolts from the shipping pallet
- ESD wrist strap

- Antistatic mat

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2010 Router | 162

Removing Components from the MX2010 Router Chassis Before Installing It in a Rack | 299

Installing the MX2010 Router Using a Pallet Jack with Attachment | 316

Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack | 346

Tools Required to Install the MX2010 Router Using a Router Transport Kit

To install the router by using a router transport kit, you need the following tools and equipment:

- Router transport kit (model number MX2K-TRNSPRT-KIT)
- Front component shipping cover
- Rear component shipping cover
- Phillips (+) screwdrivers, numbers 1, 2, and 3
- 1/2-in. (12.7 mm) drive ratchet
- 1/4-in. (6.35 mm) torque-controlled driver or socket wrench to tighten the nuts on the router transport kit
- 1-1/8-in. (28.57 mm) torque-controlled driver or socket wrench to tighten the router transport kit winch mechanism
- 9/16-in. or 14-mm open-end or socket wrench with extension to remove bracket bolts from the shipping pallet
- Electrostatic discharge wrist strap
- Antistatic mat

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2010 Router | 162

Installing the MX2010 Router Using a Pallet Jack with Attachment | 316

Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack | 346

Tools and Parts Required to Maintain the MX2010 Hardware Components

To maintain hardware components, you need the following tools and parts:

- ESD grounding wrist strap
- Flat-blade (–) screwdriver
- Phillips (+) screwdriver, number 1 and number 2

RELATED DOCUMENTATION

Routine Maintenance Procedures for the MX2010 Router | 806
Maintaining the MX2010 Host Subsystem | 756
Maintaining the Power Supply Modules on the MX2000 Line of Routers | 779

Tools and Parts Required for Connecting an MX2000 Router to Power

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

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5 mm flat-blade (–) screwdriver
- 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) tightening torque, for tightening nuts to terminal studs on each power distribution module (PDM).
- The terminal block connections on the AC delta and wye PDM use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

CAUTION: The maximum torque rating of the terminal studs on the DC PDM is 25 lb-in. (33.89 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC PDM terminal studs. Use an appropriately sized driver or socket wrench. Ensure that the driver is undamaged and properly calibrated and that you have been trained in its use. You may wish to use a driver that is designed to prevent overtorque when the preset torque level is achieved.

RELATED DOCUMENTATION

Grounding an MX2000 Router | 362

MX2000 Router Grounding Specifications | 183

Tools and Parts Required for MX2010 Router Connections

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

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (–) screwdriver
- 2.5-mm Phillips (+) screwdriver
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

RELATED DOCUMENTATION

Connecting the MX2010 Router to a Network for Out-of-Band Management | 402

Connecting an MX2000 Router to a Console or Auxiliary Device | 403

Connecting an MX2010 Router to an External Alarm-Reporting Device | 406

CHAPTER 16

Unpacking the Router

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- Unpacking the MX2010 Router | 283
- Verifying the MX2010 Parts Received | 287
- Unpacking the MX2010 Router Transport Kit | 290

Unpacking the MX2010 Router Overview

To unpack the router:

1. Gather the tools required to unpack the router. See:
   - "Tools and Parts Required to Unpack the MX2010 Router" on page 278
2. Remove the router, accessory box, and all parts from the shipping crate. See:
   - "Unpacking the MX2010 Router" on page 283
3. Unpack the router transport kit, if ordered. See:
   - "Unpacking the MX2010 Router Transport Kit" on page 290
4. Verify that all parts have been received. See:
   - "Verifying the MX2010 Parts Received" on page 287

RELATED DOCUMENTATION

Installing an MX2010 Router Overview | 276

Unpacking the MX2010 Router

The router is shipped in a wooden crate. A wooden pallet forms the base of the crate. The router chassis is bolted to this pallet. Metal latches secure the top and bottom in place. Quick Start installation instructions, a rack mount tray (for four-post or open-frame rack mounting), a pallet jack attachment, an EMI cover, and a cardboard accessory box are also included in the shipping crate. The total weight of the container including the router, FRUs, and accessories is 1343 lb (609.18 kg)

NOTE: Depending on your configuration, the MX2010 might be shipped with additional components already installed.

NOTE: The MX2010 can be ordered with extended EMI covers and extended cable managers.

There are two styles of shipping crates for the MX2010. Figure 87 on page 284 shows the smaller crate that measures 66.25 in. (168.3 cm) high, 42.0 in. (106.7 cm) wide, and 48.0 in. (121.9 cm) deep. Figure 88 on page 285 shows the larger crate that measures 68.4 in. (173.7 cm) high, 44.4 in. (112.7 cm) wide, and 51.6 in. (131.1 cm) deep. If you are not sure which crate you have, plan for the larger crate.

The total weight of the shipping crate with router and accessories will vary depending on your configuration. See "MX2010 Physical Specifications" on page 168 for more details.

Figure 87: MX2010 Shipping Crate Dimensions (smaller)

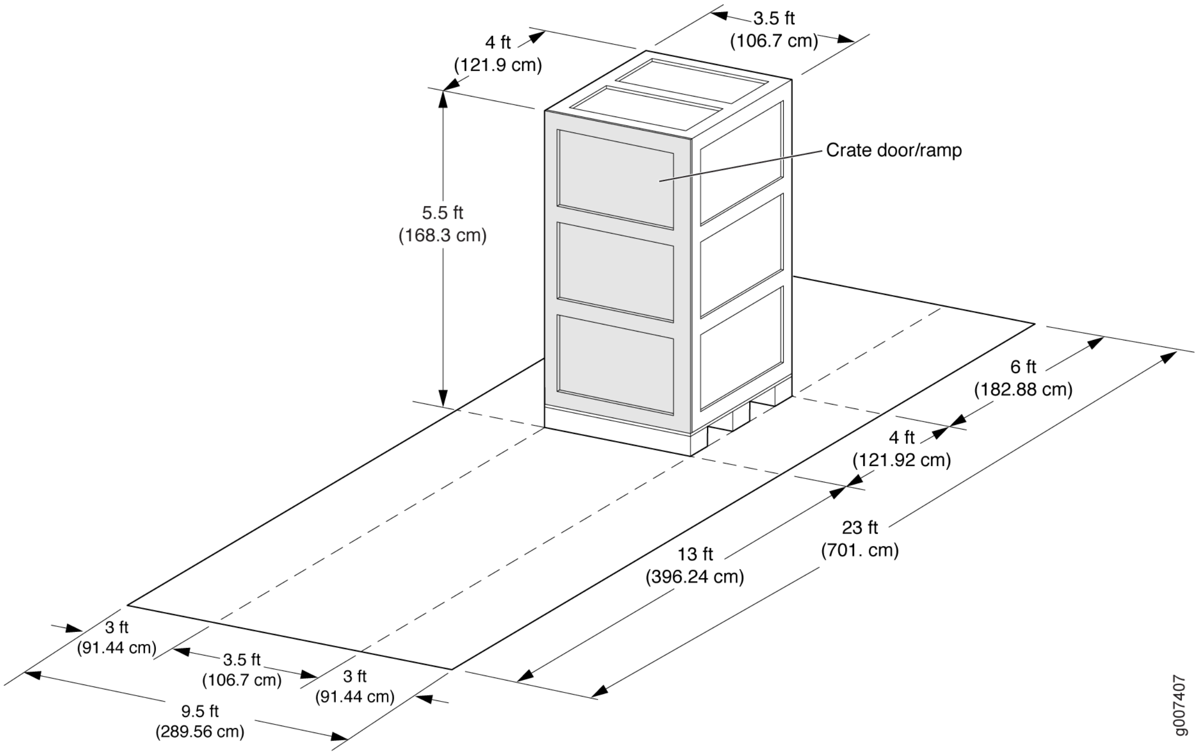
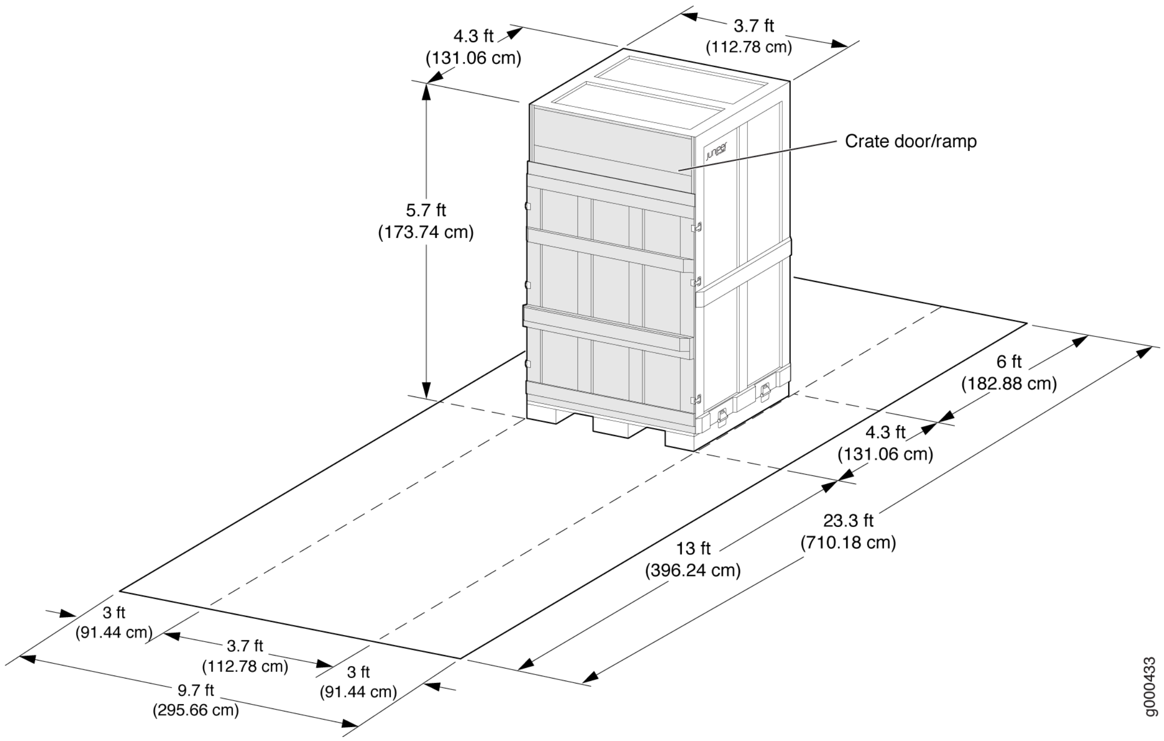


Figure 88: MX2010 Shipping Crate Dimensions (larger)



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

To unpack the router:

1. Move the shipping crate to an ESD-approved 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 shipping 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 and set it aside (see Figure 89 on page 286).

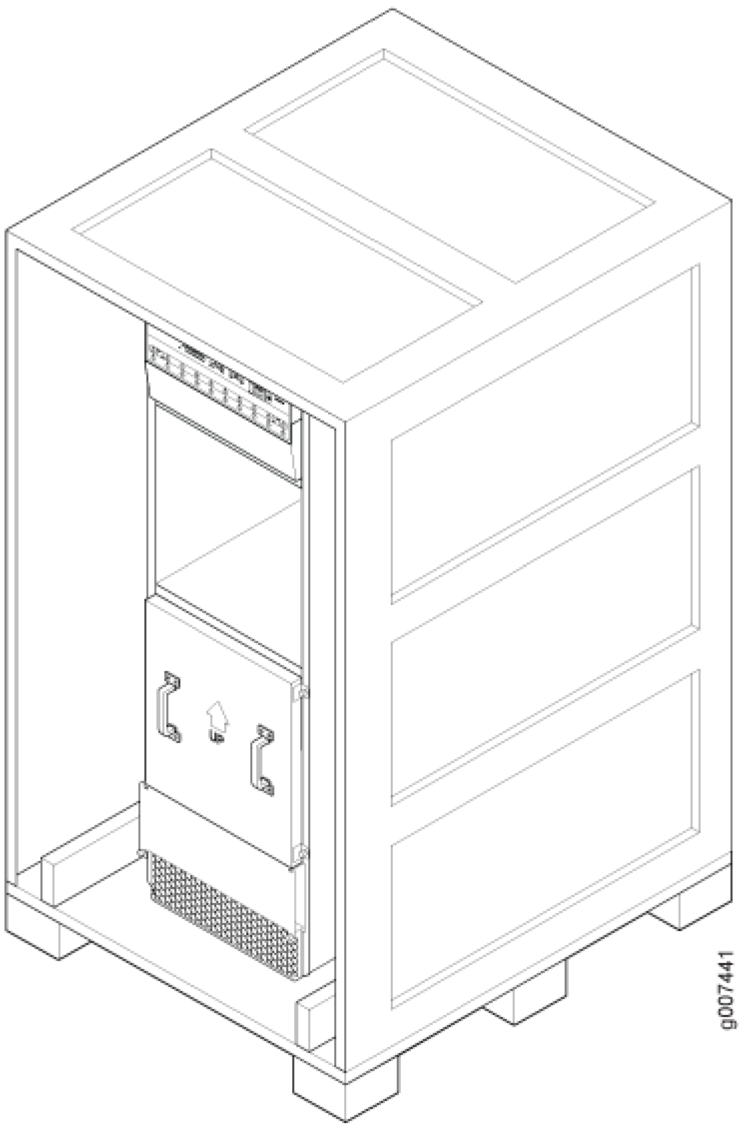
   NOTE: If you ordered a router transport kit, the shipping crate door is used as a ramp to guide the MX2010 out of the crate.

5. Using a two-person team, slide the remainder of the shipping crate off the pallet.
6. Remove the foam covering the top of the router.

7. Remove the large mounting tray, pallet jack attachment, accessory box, and the Quick Start installation instructions.

> **NOTE**: If you ordered a router transport kit, see "Unpacking the MX2010 Router Transport Kit" on page 290

Figure 89: Unpacking the MX2010



8. Verify the parts received against the list.
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 to the pallet, use a 9/16-in (14 mm) socket wrench, and use a number 2 Phillips screwdriver to remove the bolts and screws from the brackets.
11. Set the shipping brackets aside for later use to secure the router to the pallet jack attachment.

> **NOTE**: If you ordered a router transport kit, see "Unpacking the MX2010 Router Transport Kit" on page 290 for instructions on how to unpack and install the router transport kit.

12. Save the shipping crate cover, pallet, and packing materials in case you need to move or ship the router at a later time.

RELATED DOCUMENTATION

Tools and Parts Required to Unpack the MX2010 Router | **278**
Verifying the MX2010 Parts Received | **287**
Installing the MX2010 Router Using a Pallet Jack with Attachment | **316**
Installing an MX2010 Router Using a Router Transport Kit Overview | **322**

Verifying the MX2010 Parts Received

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

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

A fully configured router contains the router chassis with installed components, listed in Table 91 on page 287, and an accessory box, which contains the parts listed in Table 92 on page 289. The parts shipped with your router can vary depending on the configuration you ordered.

Table 91: Parts List for a Fully Configured MX2010 Router

Component	Quantity
Chassis, including backplane, and craft interface.	1
EMI cover	1

Table 91: Parts List for a Fully Configured MX2010 Router *(Continued)*

Component	Quantity
Four-post mounting shelf	1
Open-frame mounting shelf (optional)	1
MPCs	Up to 10
Adapter cards	Up to 10
MICs	Up to 20
SFBs	Up to 8
Combined Control Board with Routing Engines (CB-REs)	1 or 2
Power distribution modules (PDMs)	Up to 2
Power supply modules (PSMs)	Up to 9
Fan trays	4
Upper air baffle (optional)	1
PSM air filter	1
Air filter (lower)	1
Card-cage cable manager and air filter	1
Cable manager (lower)	1

Table 91: Parts List for a Fully Configured MX2010 Router *(Continued)*

Component	Quantity
DC cable manager (rear)	2
Quick Start installation instructions	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component.

Table 92: Accessory Box Parts List

Part	Quantity
Screws to mount chassis	14
Terminal block plug, 3 pole, 5.08 mm spacing, 12 A, to connect the router alarms	2
Label, accessories contents, MX2010	1
USB flash drive with Junos OS	1
Read me first document	1
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Document sleeve	1
3" x 5" pink bag	2

Table 92: Accessory Box Parts List *(Continued)*

Part	Quantity
9" x 12" pink bag, ESD	2
Accessory box, 19 x 12 x 3"	1
ESD wrist strap with cable	1

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

RELATED DOCUMENTATION

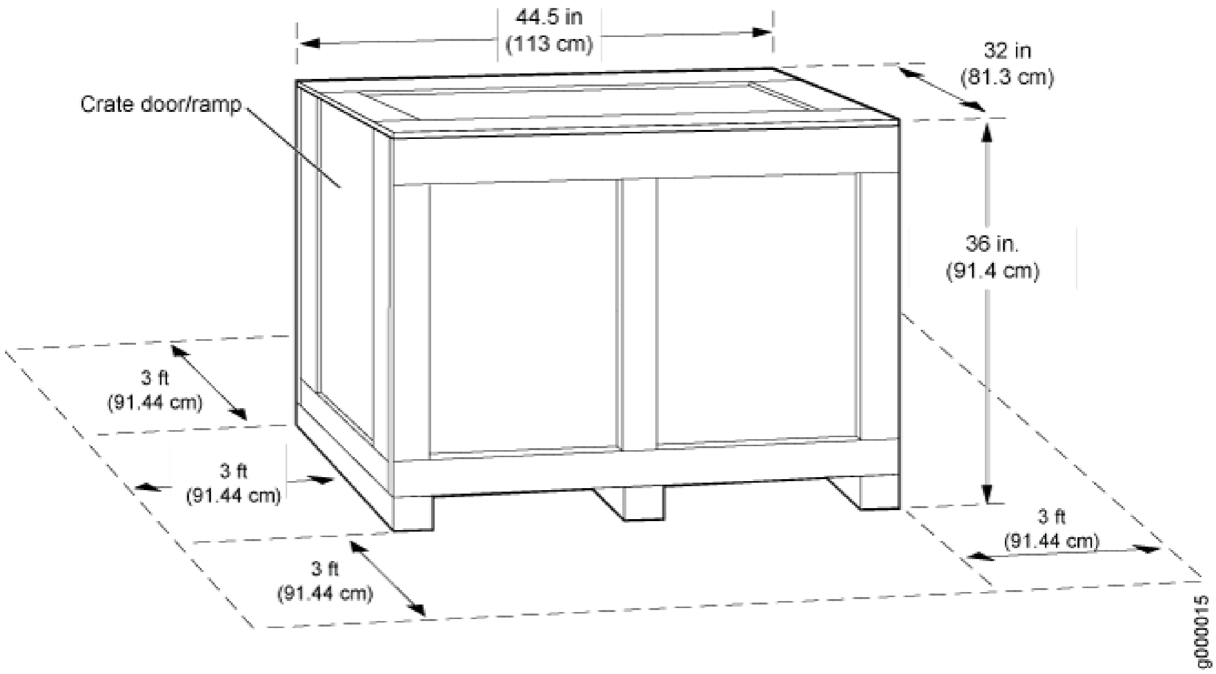
Tools and Parts Required to Unpack the MX2010 Router | **278**
Unpacking the MX2010 Router | **283**
MX2010 Router Overview | **2**

Unpacking the MX2010 Router Transport Kit

The router transport kit is shipped in a wooden crate. A wooden pallet forms the base of the crate. Metal clips secure the top and front of the crate in place.

The router transport kit shipping container measures 36 in. (91.4 cm) high, 32 in. (81.3 cm) wide, and 44.5 in. (113 cm) deep (see Figure 90 on page 291). The total weight of the container containing the router transport kit is 200 lb (90.71 kg).

Figure 90: Router Transport Kit Crate Dimensions

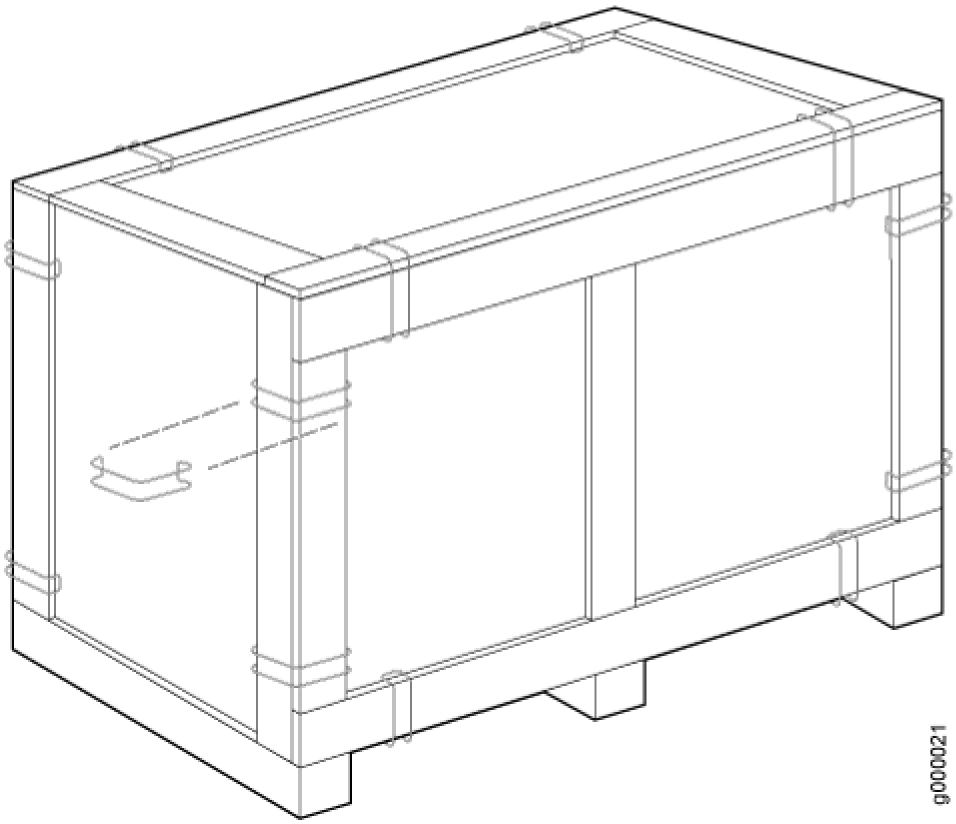


NOTE: The router transport kit is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the router transport kit:

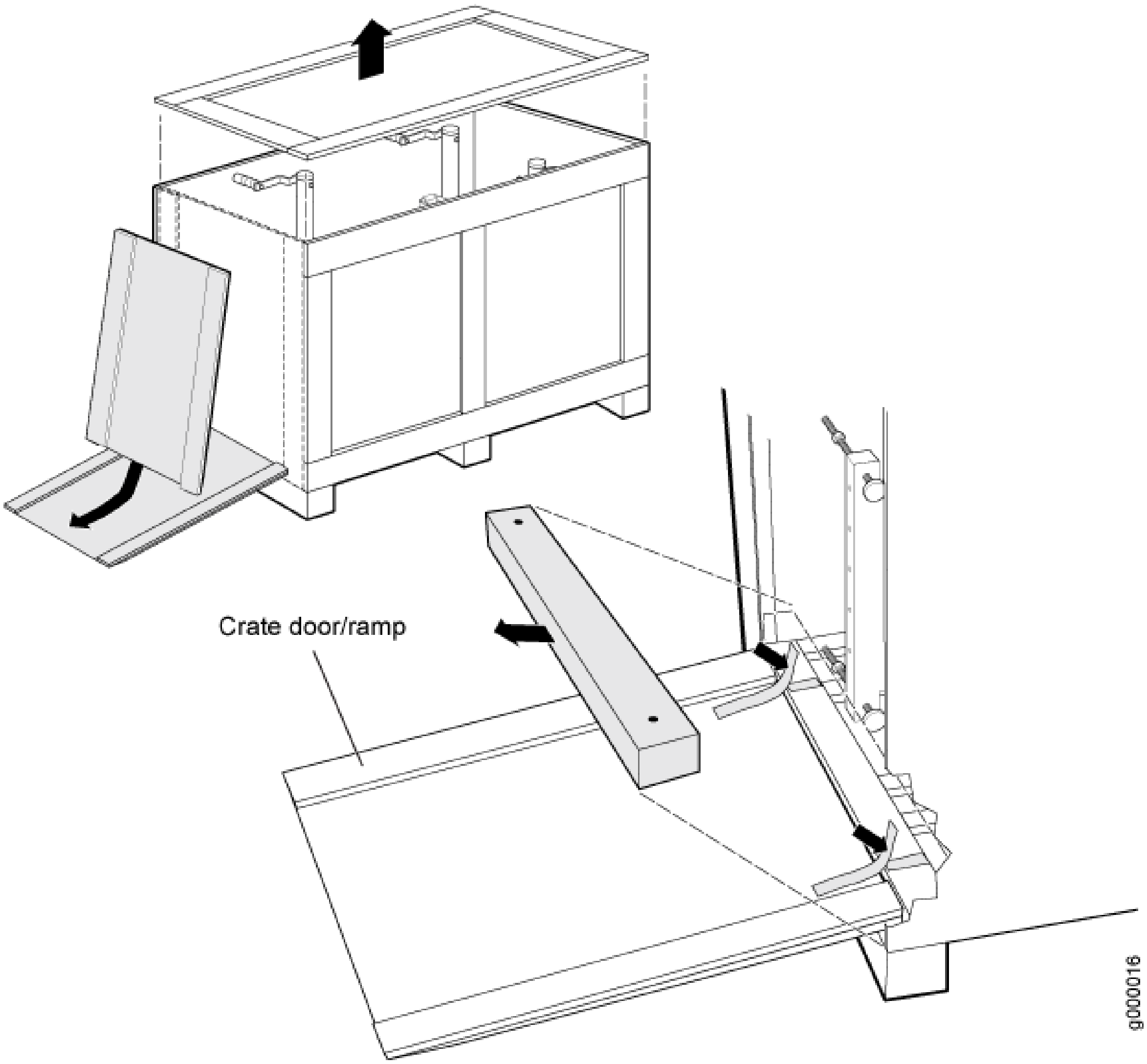
1. Move the router transport kit shipping crate to an ESD-approved staging area, where you have enough room to remove the kit for assembly.
2. Position the shipping crate with the arrows pointing up.
3. Remove the metal clips on the shipping crate that secure the top and front to the crate (see Figure 91 on page 292).

Figure 91: Open Router Transport Kit Shipping Crate



4. Remove the top and front of the shipping crate, and set them aside.
5. Remove the two wing nuts that secure the wooden brace to the shipping crate platform, and set them aside.
6. Align the crate door with the shipping crate platform, and secure the door to the platform by using the attached velcro straps (see Figure 92 on page 293).

Figure 92: Router Transport Kit Shipping Crate Door



7. Remove the router transport kit from the shipping container.
8. Remove the vapor corrosion inhibitor (VCI) packs attached to the pallet, being careful not to break the VCI packs open.
9. Save the shipping crate cover, pallet, and packing materials in case you need to move or ship the router transport kit at a later time.

RELATED DOCUMENTATION

Tools and Parts Required to Unpack the MX2010 Router | 278

Verifying the MX2010 Parts Received | 287

Installing an MX2010 Router Overview | 276

CHAPTER 17

Installing the Mounting Hardware

IN THIS CHAPTER

- Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet | 294

Installing the MX2010 Mounting Hardware for a Four-Post Rack or Cabinet

IN THIS SECTION

- Installing Cage Nuts, If Needed | 294
- Installing the Four-Post Mounting Shelf | 296
- Removing the Center-Mounting Brackets | 298

Installing Cage Nuts, If Needed

Insert cage nuts, if needed, into the holes listed in Table 93 on page 295 and Table 94 on page 295. The hole distances are relative to the standard U division on the rack that is aligned with the bottom of the mounting shelf.

To install cage nuts in a four-post rack:

1. On the rear side of both 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 93 on page 295).
2. On the front side of both 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 93 on page 295).

Table 93: Mounting Hole Locations for Installing the Four-Post Mounting Shelf

Hole	Distance Above U Division	
6	3.25 in. (8.3 cm)	1.86 U
5	2.63 in. (6.7 cm)	1.5 U
4	2.00 in. (5.1 cm)	1.14 U
3	1.50 in. (3.8 cm)	0.86 U
2	0.88 in. (2.2 cm)	0.50 U
1	0.25 in. (0.6 cm)	0.14 U

Table 94: Mounting Hole Locations for Installing a MX2010 Chassis in a Four-Post Rack or Cabinet

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
56	32.38 in. (82.2 cm)	18.50 U
47	27.13 in. (68.9 cm)	15.50 U

Table 94: Mounting Hole Locations for Installing a MX2010 Chassis in a Four-Post Rack or Cabinet *(Continued)*

Hole	Distance Above U Division	
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. (13.3 cm).

SEE ALSO

Verifying the MX2010 Parts Received | 287

Installing the Four-Post Mounting Shelf

A mounting shelf is required for installing the router in a four-post rack or cabinet. The shelf is not required for installing the router in an open-frame rack.

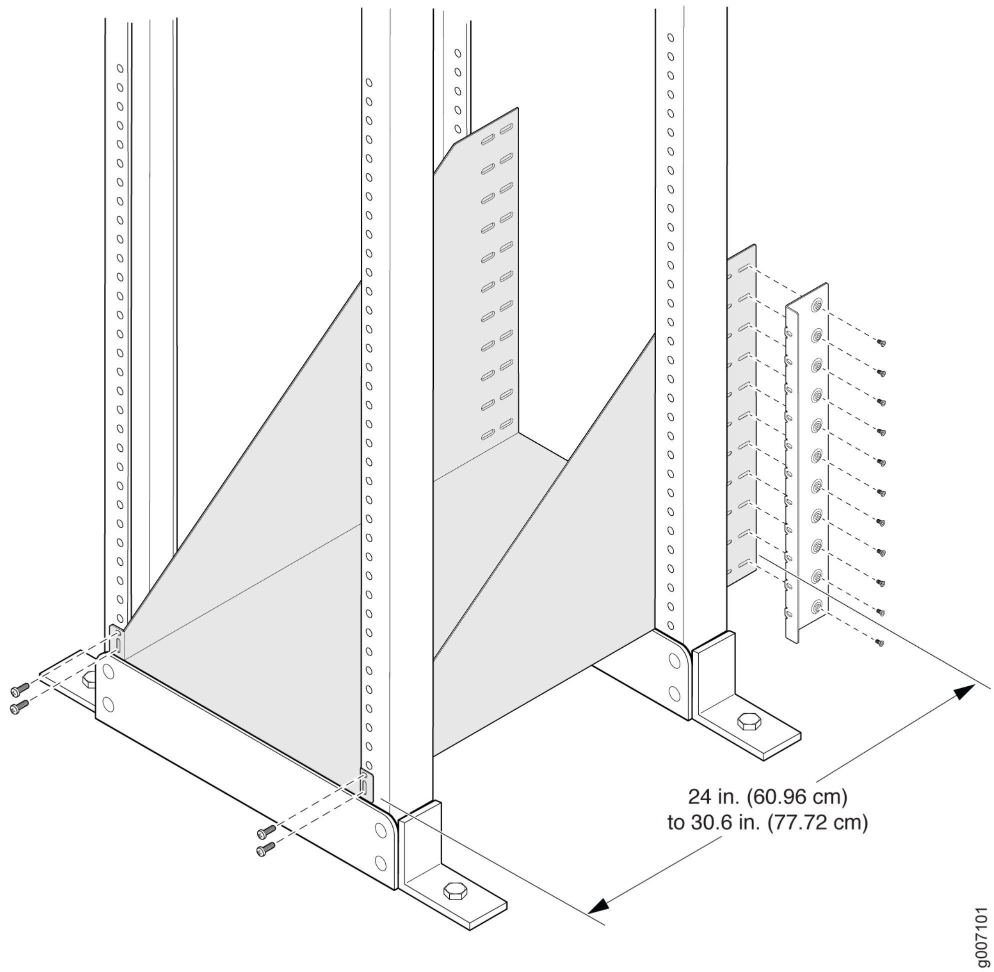
To install the four-post mounting shelf (see Figure 93 on page 297):

1. Slide the shelf between the rack rails, resting the bottom of the shelf on the rack rail supports. The shelf installs on the front of the rear rails, extending toward the front of the rack.
2. Partially insert screws into the open holes in the rear flanges of the four-post mounting shelf.

   NOTE: Depending on the type of rack or cabinet you have, cage nuts might be required.

3. Tighten all the screws completely.
4. On the front of each front rack rail, partially insert a mounting screw into the holes in each ear of the four-post mounting shelf.
5. Tighten all the screws completely.

Figure 93: Installing the Mounting Hardware for a Four-Post Rack or Cabinet



NOTE: The two rear flanges on the four-post mounting shelf are adjustable from 24 in. (60.96 cm) through 30 in. (76.2 cm) to accommodate different types of racks rails.

NOTE: There must be a minimum of 34-U unobstructed front-to-back usable rack space when installing the MX2010 router into a four-post rack or cabinet.

SEE ALSO

Installing the Router Transport Kit on the MX2010 Router | 322
Installing the MX2010 Router Using a Pallet Jack with Attachment | 316

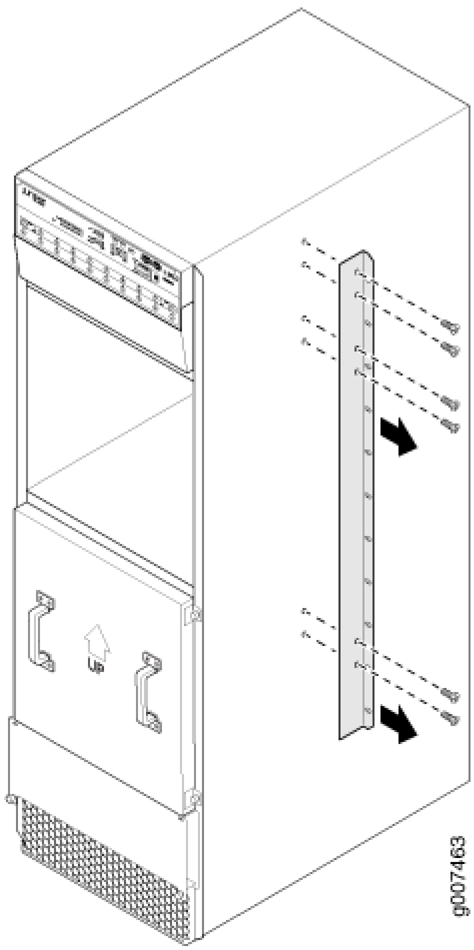
Removing the Center-Mounting Brackets

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 94 on page 298).
2. Remove each bracket.

Figure 94: Center-Mounting Bracket Removal



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MX2010 Rack-Mounting Hardware | 50

MX2010 Rack Requirements | 174

CHAPTER 18

Installing the Router

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- Installing an MX2010 Router Using a Pallet Jack Overview | 315
- Installing the Pallet Jack Attachment | 315
- Installing the MX2010 Router Using a Pallet Jack with Attachment | 316
- Installing an MX2010 Router Using a Router Transport Kit Overview | 322
- Installing the Router Transport Kit on the MX2010 Router | 322
- Securing the MX2010 Router to the Router Transport Platform | 325
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Removing Components from the MX2010 Router Chassis Before Installing It in a Rack

IN THIS SECTION

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- Removing the Power Supply Modules Before Installing an MX2000 Router | 304
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Before installing the router with a pallet jack, you must first remove shipping covers and components from the chassis. With components removed, the chassis weighs approximately 324 lb (146.96 kg).

CAUTION: The shipping covers help guide the chassis into the rack. Applying force to any other part of the chassis can cause damage.

Removing the Power Distribution Modules Before Installing an MX2000 Router with a Pallet Jack

Remove the topmost PDM (**PDM1**) first, and then work your way downward. To remove an AC, DC, 240 V China, or universal (HVAC/HVDC) PDM (see Figure 95 on page 301, Figure 96 on page 302 Figure 97 on page 303, and Figure 98 on page 304).

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. On an AC-powered router, move the AC circuit breaker from the power source to the off (**O**) position. On a DC-powered router, move the DC circuit breaker from the power source to the off (**O**) position.

   We recommend this precaution even though the PDMs are not connected to power sources.
3. Loosen the two captive screws on the PDM faceplate. Pull the two spring-loaded locking levers away from the chassis until it stops.

   NOTE: **PDM1** locking levers are pulled down to release from chassis, and **PDM0** locking levers are pulled up to release from chassis.

   The PDM is extended slightly away from the chassis.
4. With both hands, grasp the two handles and gently pull the PDM straight out of the chassis.

   CAUTION: Do not touch the power connector in the back of the PDM. They can get damaged.

   CAUTION: Do not stack PDMs on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 95: Removing an AC Power Distribution Module Before Installing the MX2000 Router

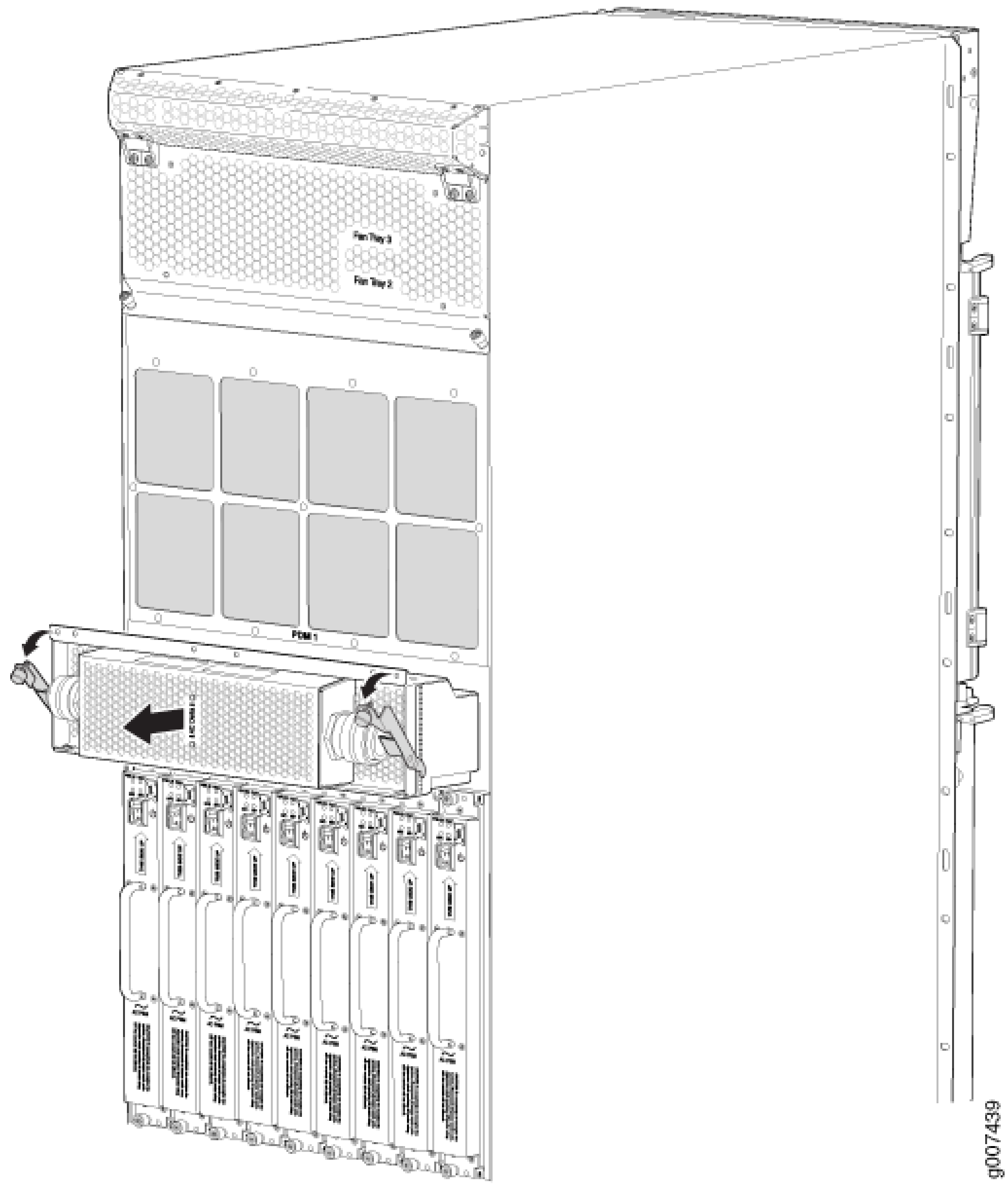


Figure 96: Removing a DC Power Distribution Module (-48 V) Before Installing the MX2000 Router

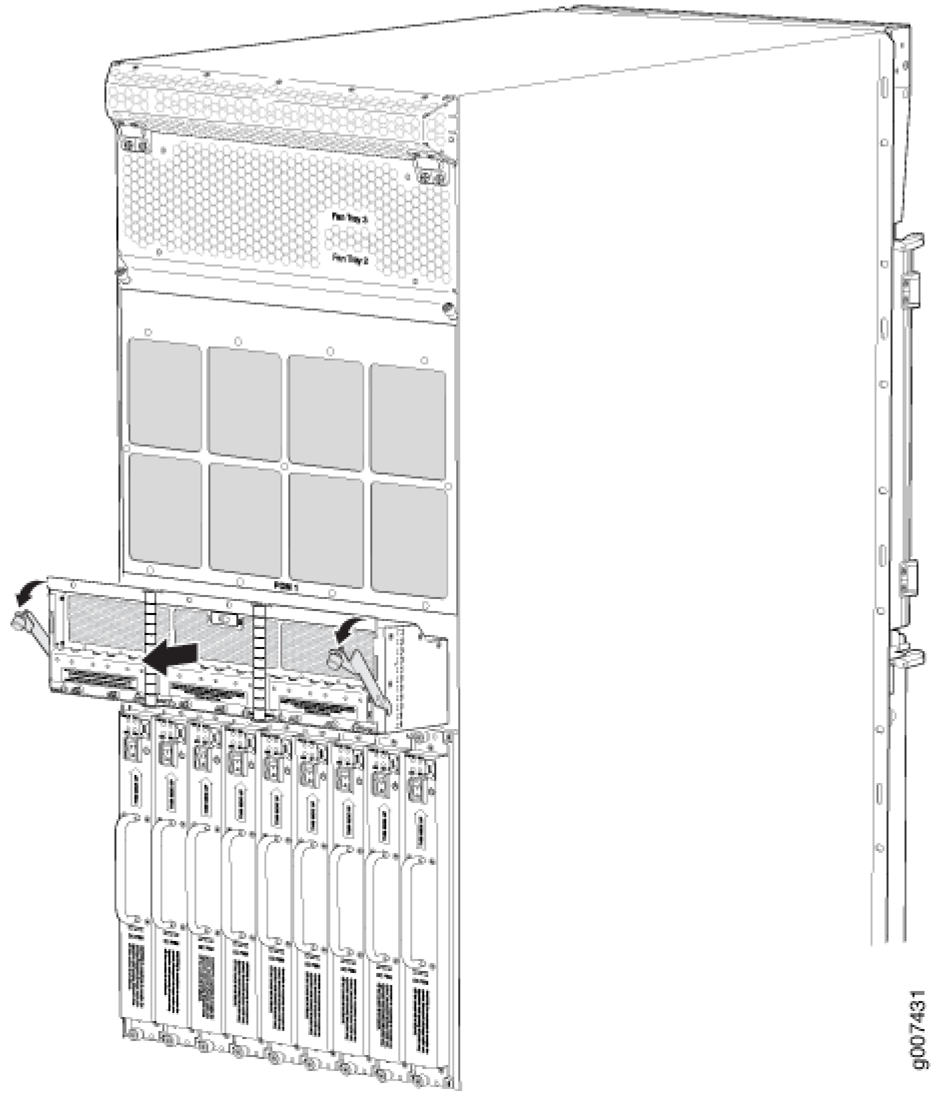


Figure 97: Removing a DC Power Distribution Module (240 V China) Before Installing the MX2000 Router

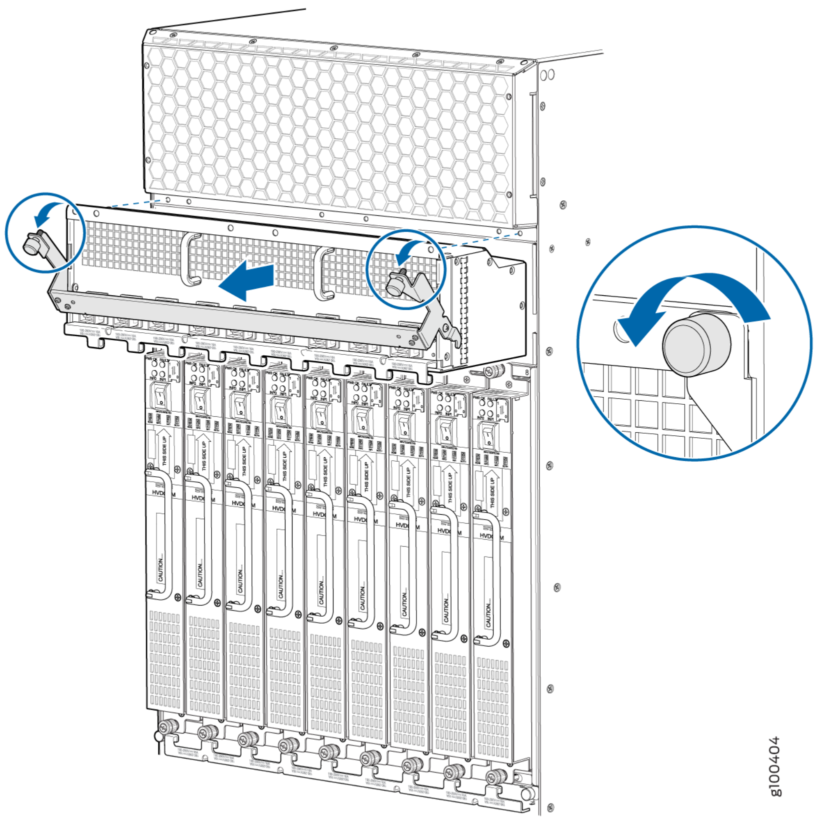
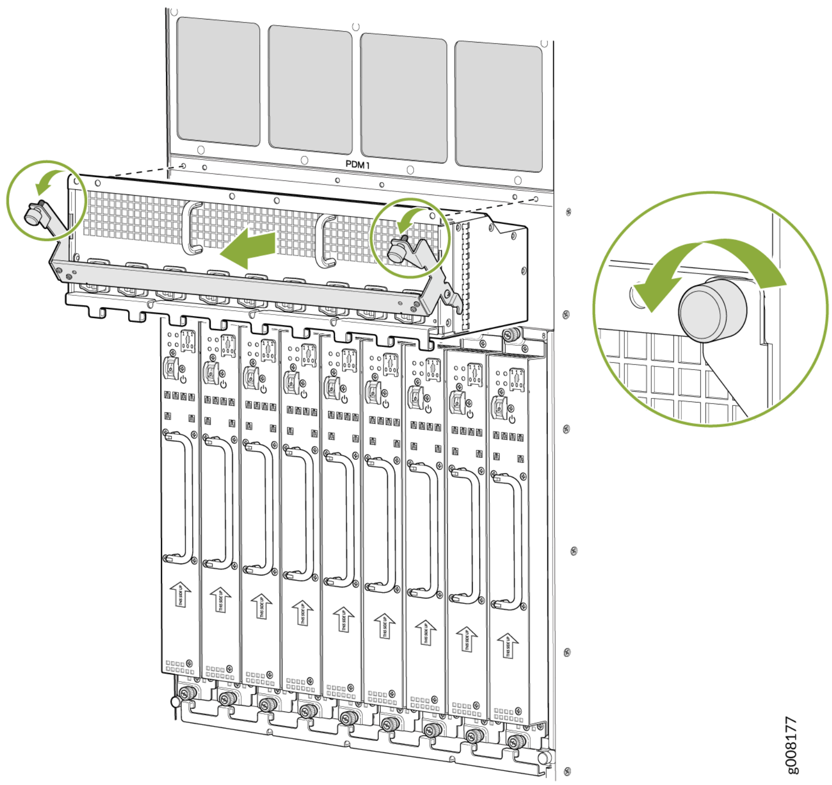


Figure 98: Removing a High-Voltage Universal (HVAC/HVDC) Power Distribution Module Before Installing the MX2000 Router



SEE ALSO

No Link Title

Removing the Power Supply Modules Before Installing an MX2000 Router

To remove the AC, DC, 240 V China, universal (HVAC/HVDC) PSMs (see Figure 99 on page 305, Figure 100 on page 306, Figure 101 on page 307, and Figure 102 on page 308):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. On an AC-powered router, move the AC power switch on each PSM to the off (**O**) position. On a DC-powered router, move the DC power switch on each PSM to the off (**O**) position.

   We recommend this even though the PSMs are not connected to power sources.
3. Loosen the two captive screws that secure the PSM to the chassis. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM.
4. Pull the PSM straight out of the chassis.

> ⚠ **CAUTION**: Do not touch the power connector on the back of the PSM. It can get damaged.

> ⚠ **CAUTION**: Do not stack PSMs on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 99: Removing a AC Power Supply Module Before Installing the MX2000 Router

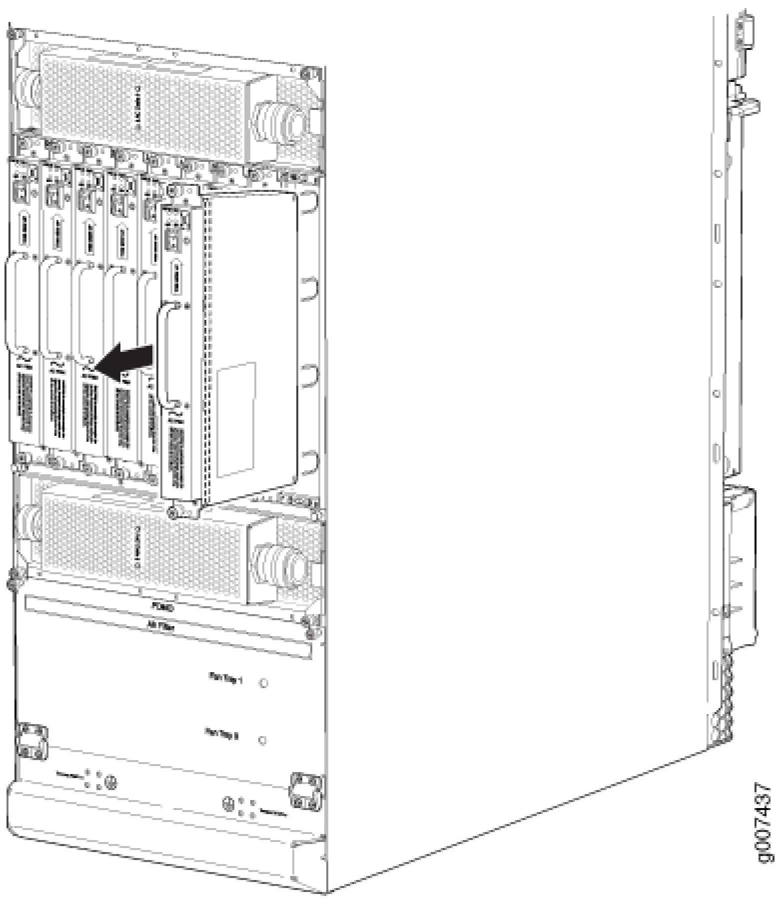


Figure 100: Removing a DC Power Supply Module (-48 V) Before Installing the MX2000 Router

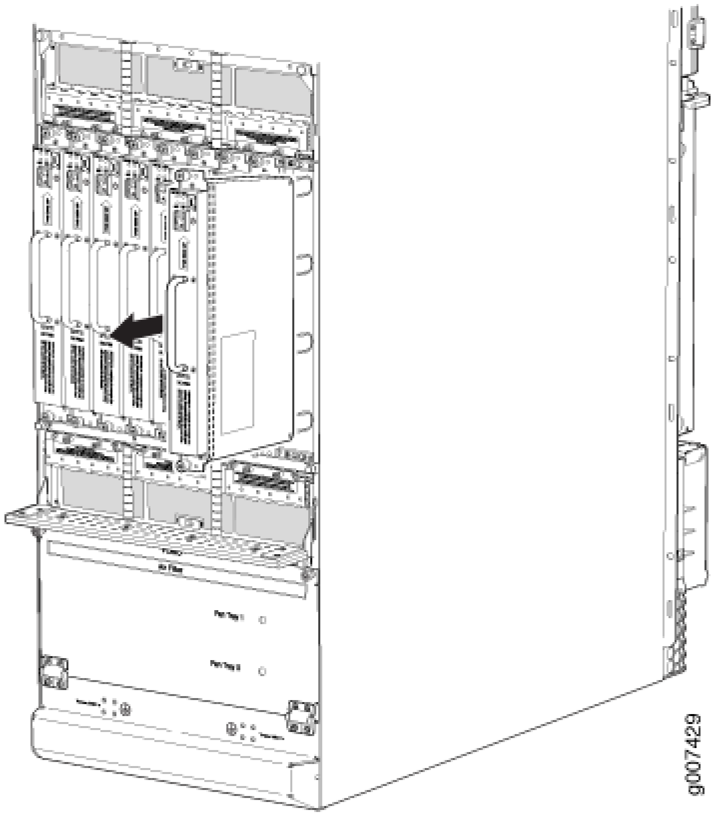


Figure 101: Removing a DC Power Supply Module (240 V China) Before Installing the MX2000 Router

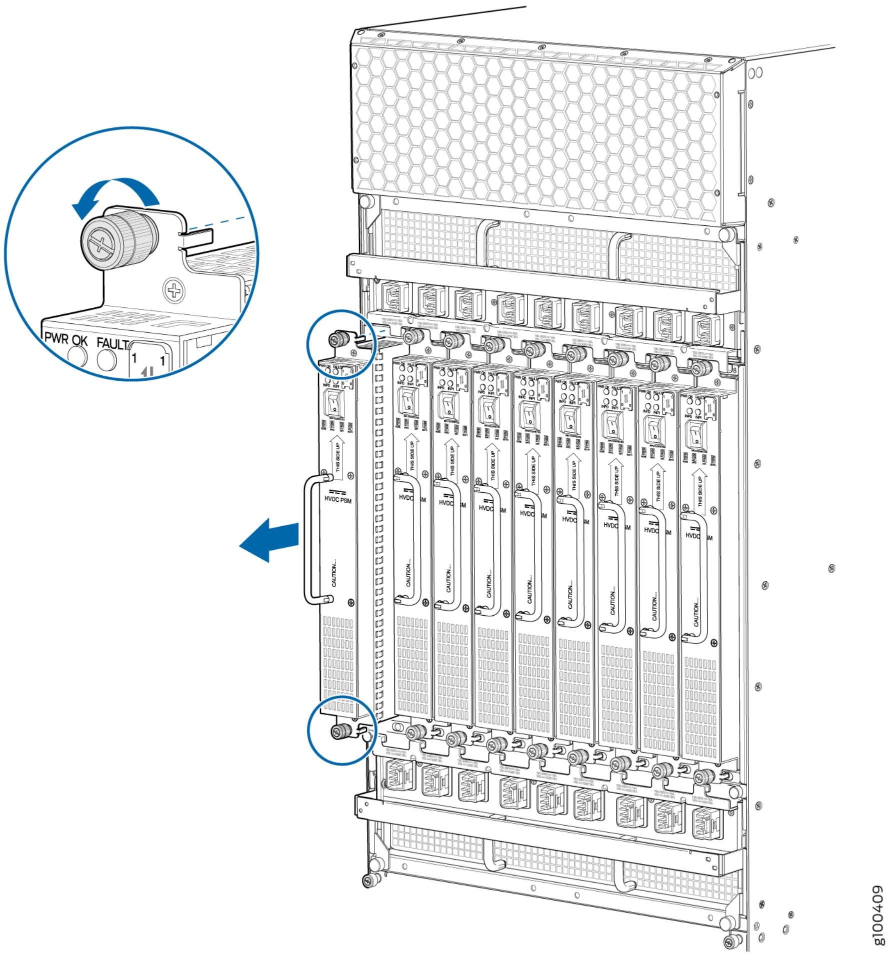
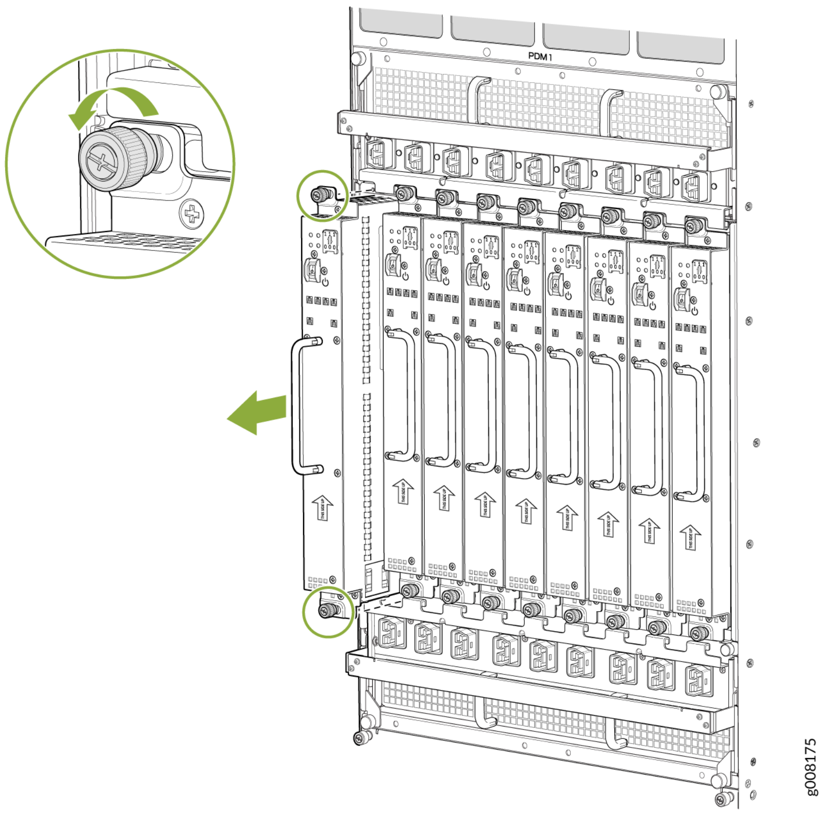


Figure 102: Removing a High-Voltage Universal (HVAC/HVDC) Power Supply Module Before Installing the MX2000 Router



SEE ALSO

> No Link Title

Removing the Fan Trays Before Installing an MX2010 Router

To remove the upper and lower fan trays (see Figure 103 on page 309 and Figure 104 on page 310):

> **NOTE**: The fan trays are interchangeable and are hot-insertable and hot-removable.

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the two captive screws on each side of the fan tray access panel and open the panel.
3. Loosen the two captive screws on the fan tray faceplate.

4. Press and hold the latch while simultaneously pulling the fan tray out approximately 1 to 3 in. Place one hand under the fan tray for support, while pulling the fan tray completely out of the router.

> **WARNING**: The fan trays use a double-latch safety mechanism. You must continually press and hold the latch while removing the fan trays.

5. Place each component on an antistatic mat resting on a stable, flat surface.

> **CAUTION**: Do not stack fan trays on one another after you remove them.

6. Repeat the procedure for each fan tray.

Figure 103: Removing Upper Fan Trays

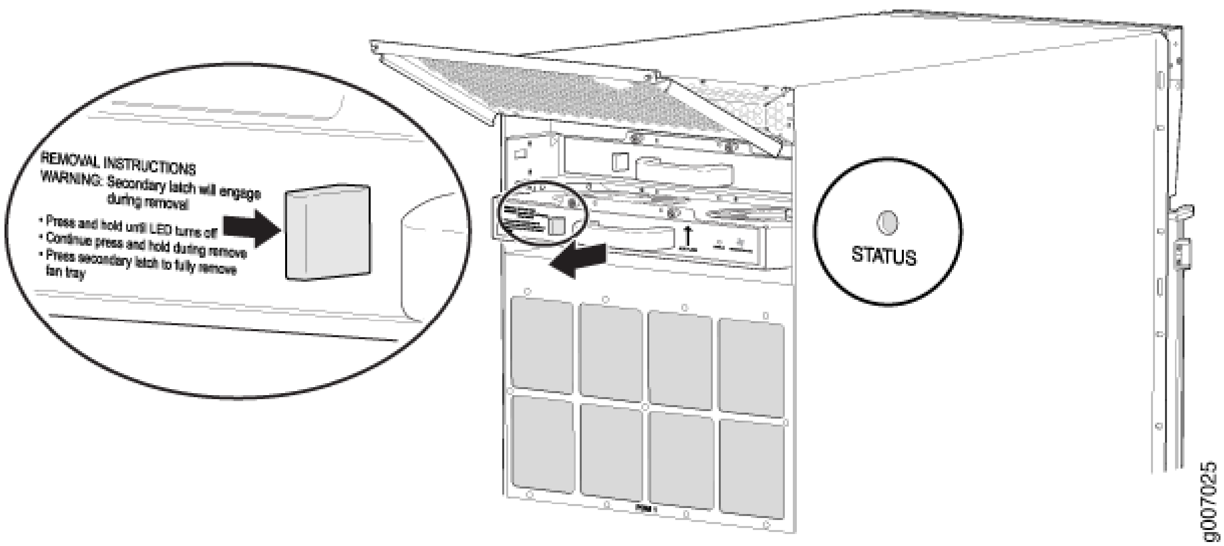
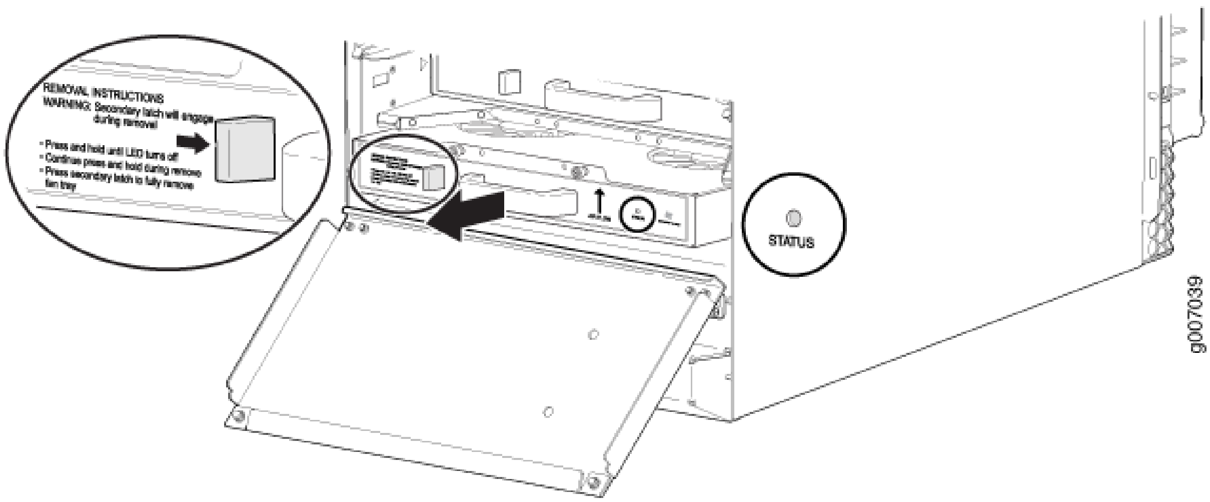


Figure 104: Removing Lower Fan Trays



Removing the SFBs Before Installing an MX2010 Router

To remove the SFBs (see Figure 105 on page 311):

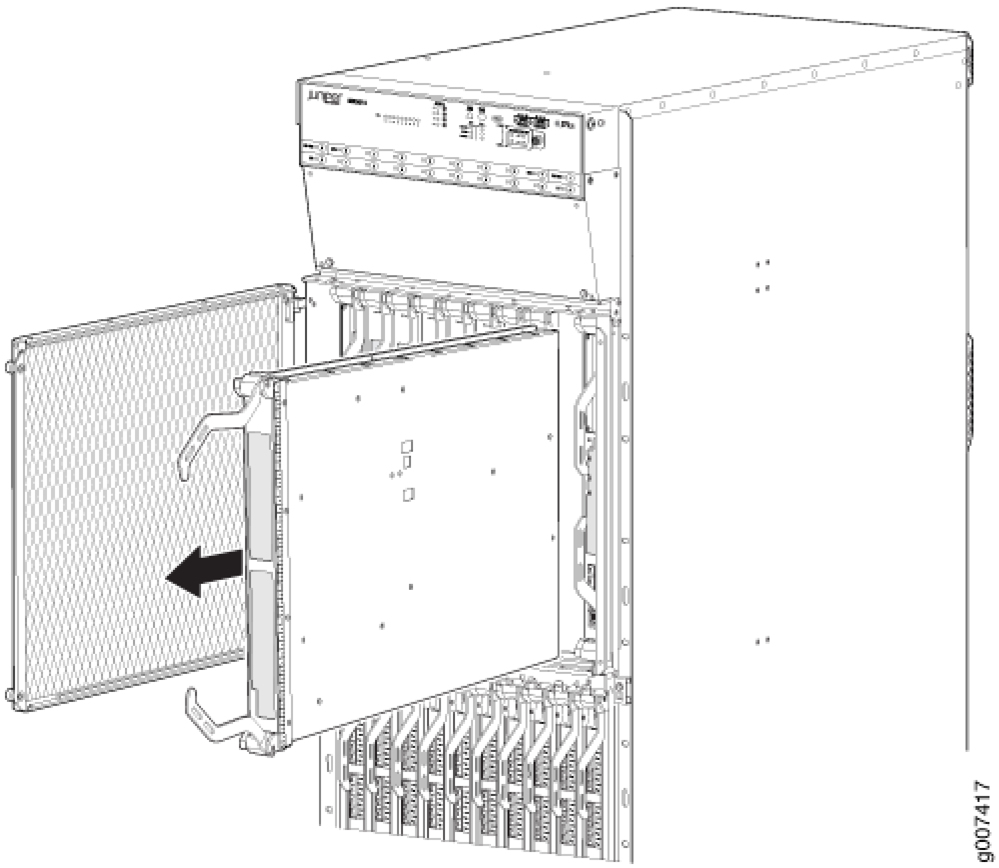
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Open the ejector handles outward simultaneously to unseat the SFB.
4. Grasp the ejector handles, and slide the SFB about halfway out of the chassis.
5. Place one hand underneath the SFB to support it, and slide it completely out of the chassis. Place it on the antistatic mat.

> ⚠ **CAUTION**: The weight of the SFB is concentrated in the back end. Be prepared to accept the full weight—up to 12 lb (5.45 kg)—as you slide the SFB out of the chassis.

> ⚠ **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.

6. Repeat the procedure for each SFB.

Figure 105: Removing an SFB



Removing the MPCs and Adapter Card Before Installing an MX2010 Router

To remove an MPC with an adapter card:

1. Have ready an antistatic mat for the MPC with an adapter card. Also, have ready rubber safety caps when removing MPCs that have optical interfaces.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Open both the ejector handles simultaneously to unseat the both the MPC and the adapter card.
4. Grasp the handles, and slide the MPC along with the adapter card straight out of the card cage halfway.
5. Place one hand around the front of the MPC with the adapter card and the other hand under the MPC to support it. Slide the MPC along with the adapter card completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the MPC with the adapter card is concentrated in the back end. Be prepared to accept the full weight—up to 25 lb (11.34 kg)—as you slide the MPC along with the adapter card out of the chassis.
When the MPC along with the adapter card 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 MPCs with the adapter cards 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.

Removing the MPCs Without Removing an Adapter Card Before Installing an MX2010 Router

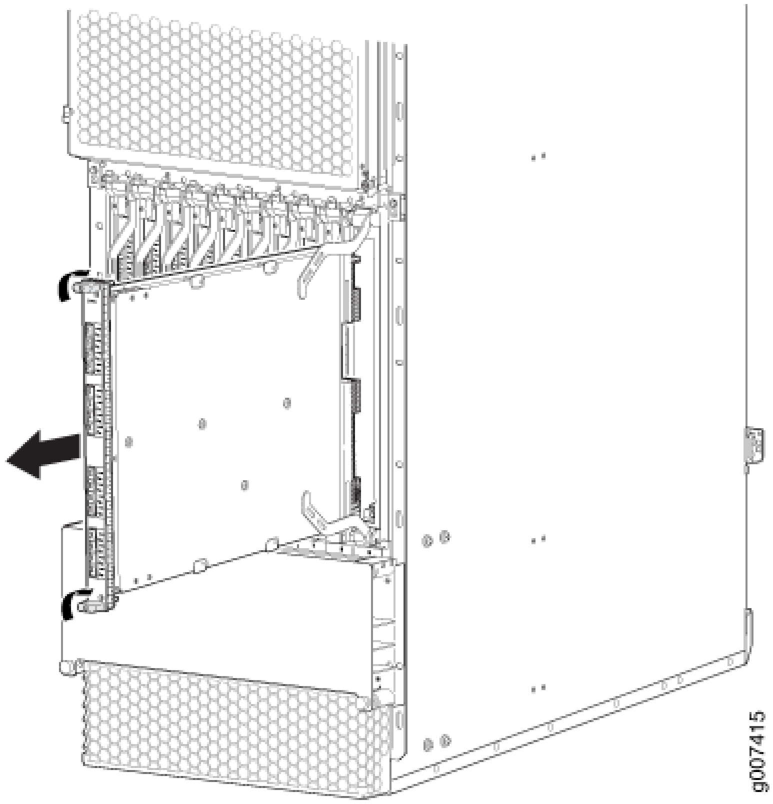
To remove an MPC only, without removing the adapter card (see Figure 106 on page 313):

1. Have ready an antistatic mat for the MPC. Also, have ready rubber safety caps when removing MPCs that have optical interfaces.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Simultaneously turn both the knobs counterclockwise to unseat the MPC from the adapter card.
4. Grasp both knobs, and slide the MPC straight out of the adapter card.
5. Place one hand around the front of the MPC and the other hand under it to support it. Slide the MPC completely out of the adapter card, and place it on the antistatic mat or in the electrostatic bag.

CAUTION: The weight of the MPC is concentrated in the back end. Be prepared to accept the full weight—up to 18.35 lb (8.32 kg)—as you slide the MPC out of the adapter card.
When the MPC is out of the adapter card, do not hold it by the knobs, bus bars, or edge connectors. They cannot support its weight.

Do not stack MPCs 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.

Figure 106: Removing an MPC Without Removing the Adapter Card



Removing the CB-REs Before Installing the MX2010 Router

To remove a CB-RE (see Figure 107 on page 314):

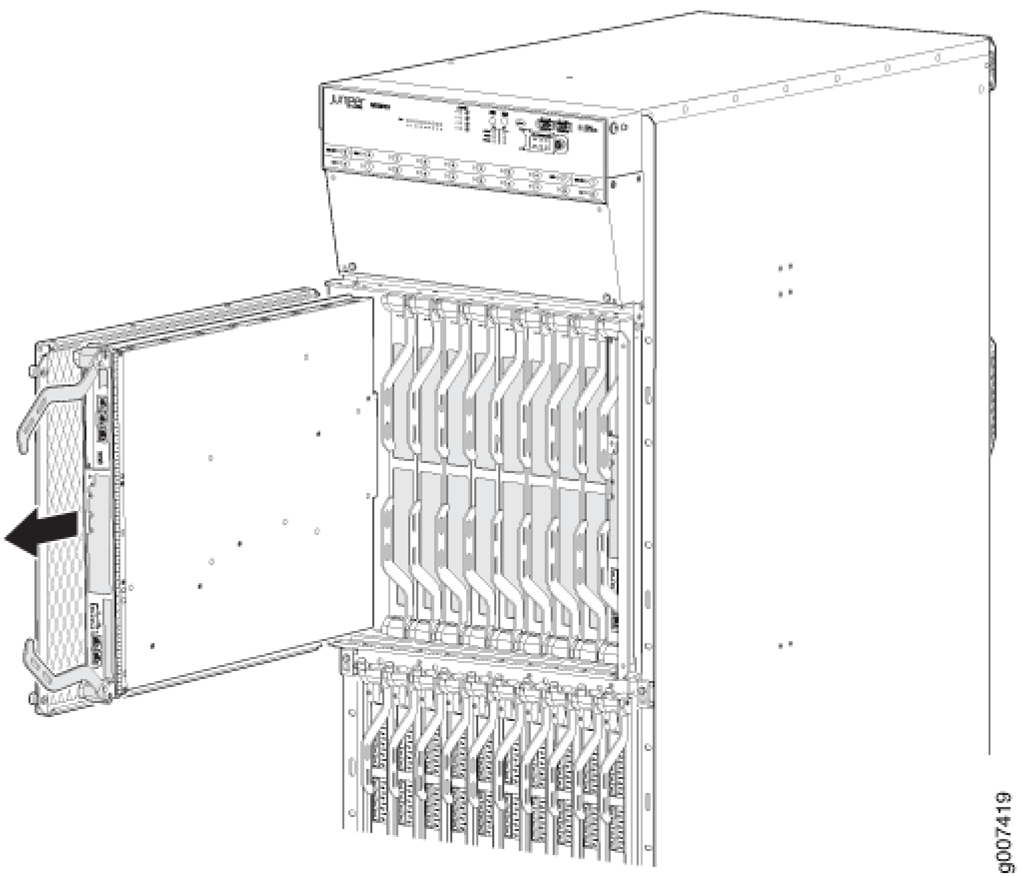
1. Have ready an antistatic mat for the CB-RE. Also have ready rubber safety caps for each SFP transceiver that uses an optical interface on the CB-RE that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Open both ejector handles simultaneously to unseat the CB-RE.
4. Grasp the handles, and slide the CB-RE straight out of the card cage halfway.
5. Place one hand around the front of the CB-RE and the other hand under it to support it. Slide the CB-RE completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

> **CAUTION**: The weight of the CB-RE is concentrated in the back end. Be prepared to accept the full weight—up to 15 lb (6.8 kg)—as you slide the CB-RE out of the chassis.

When the CB-RE is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

CAUTION: Do not stack CB-REs on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 107: Removing a CB-RE



RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

Overview of Preparing the Site for the MX2010 Router | **162**

Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack | **346**

Installing an MX2010 Router Using a Pallet Jack Overview

1. Gather the tools required to install the router. See:

   "Tools Required to Install the MX2010 Router Using a Pallet Jack" on page 278

2. Install the pallet jack attachment. See:

   "Installing the Pallet Jack Attachment" on page 315

3. Install the MX2010. See:

   "Installing the MX2010 Router Using a Pallet Jack with Attachment" on page 316

RELATED DOCUMENTATION

Installing an MX2010 Router Overview | **276**

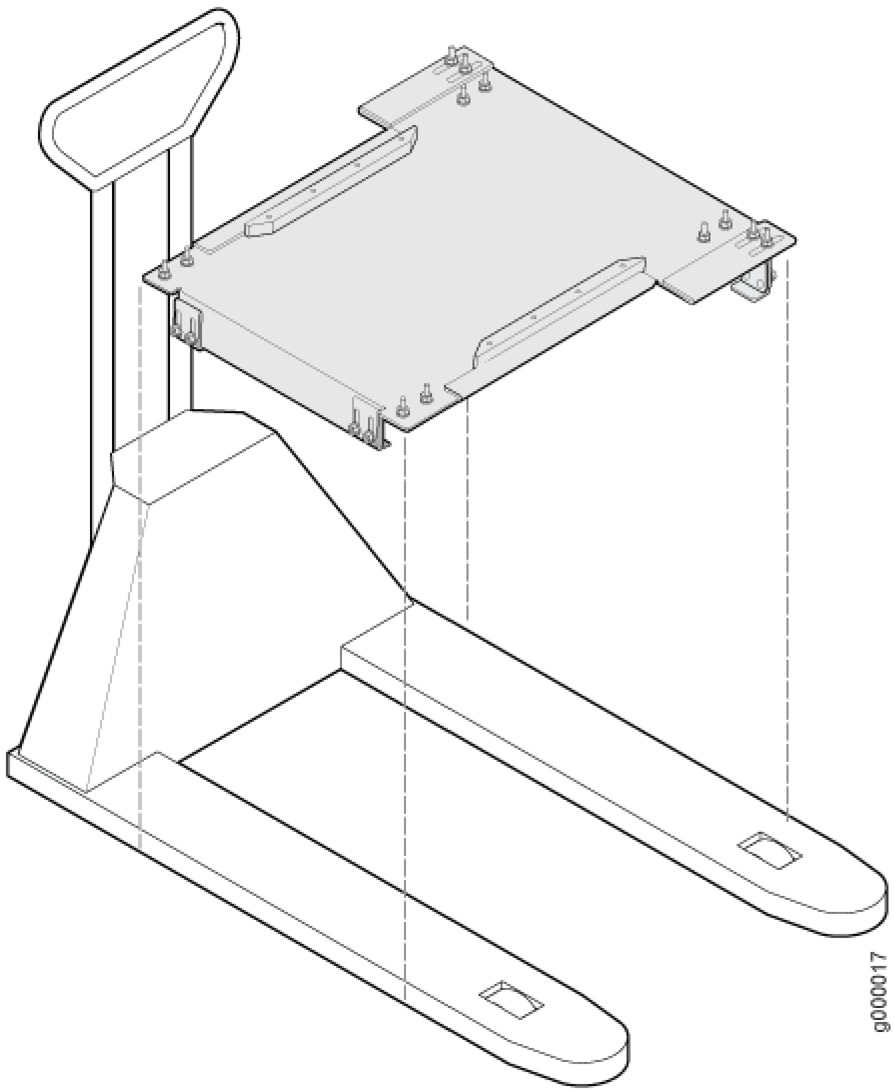
Installing an MX2010 Router Using a Router Transport Kit Overview | **322**

Installing the Pallet Jack Attachment

To install the pallet jack attachment to the pallet jack:

1. Remove the pallet jack attachment from the shipping crate.
2. Place the pallet jack attachment across both pallet jack legs.
3. Using a 9/16-in. (14 mm) socket wrench, loosen and remove the eight shipping bracket support torque fasteners that are located on the top of the pallet jack attachment platform.
4. Using a 9/16-in. (14 mm) socket wrench, loosen the torque fasteners that are located on the four adjustable pallet jack attachment brackets.
5. Adjust the four pallet jack attachment brackets until they fit under the pallet jack legs.
6. Tighten the torque fasteners by using a 9/16-in. (14 mm) socket wrench to secure the brackets on the pallet jack attachment to the pallet jack (see Figure 108 on page 316).

Figure 108: Installing Pallet Jack Attachment onto Pallet Jack



RELATED DOCUMENTATION

Preparing the Site for the MX2008 Router Overview

Installing the MX2010 Router Using a Pallet Jack with Attachment

Before installing the router, you must remove all components (see "Removing Components from the MX2010 Router Chassis Before Installing It in a Rack" on page 299).

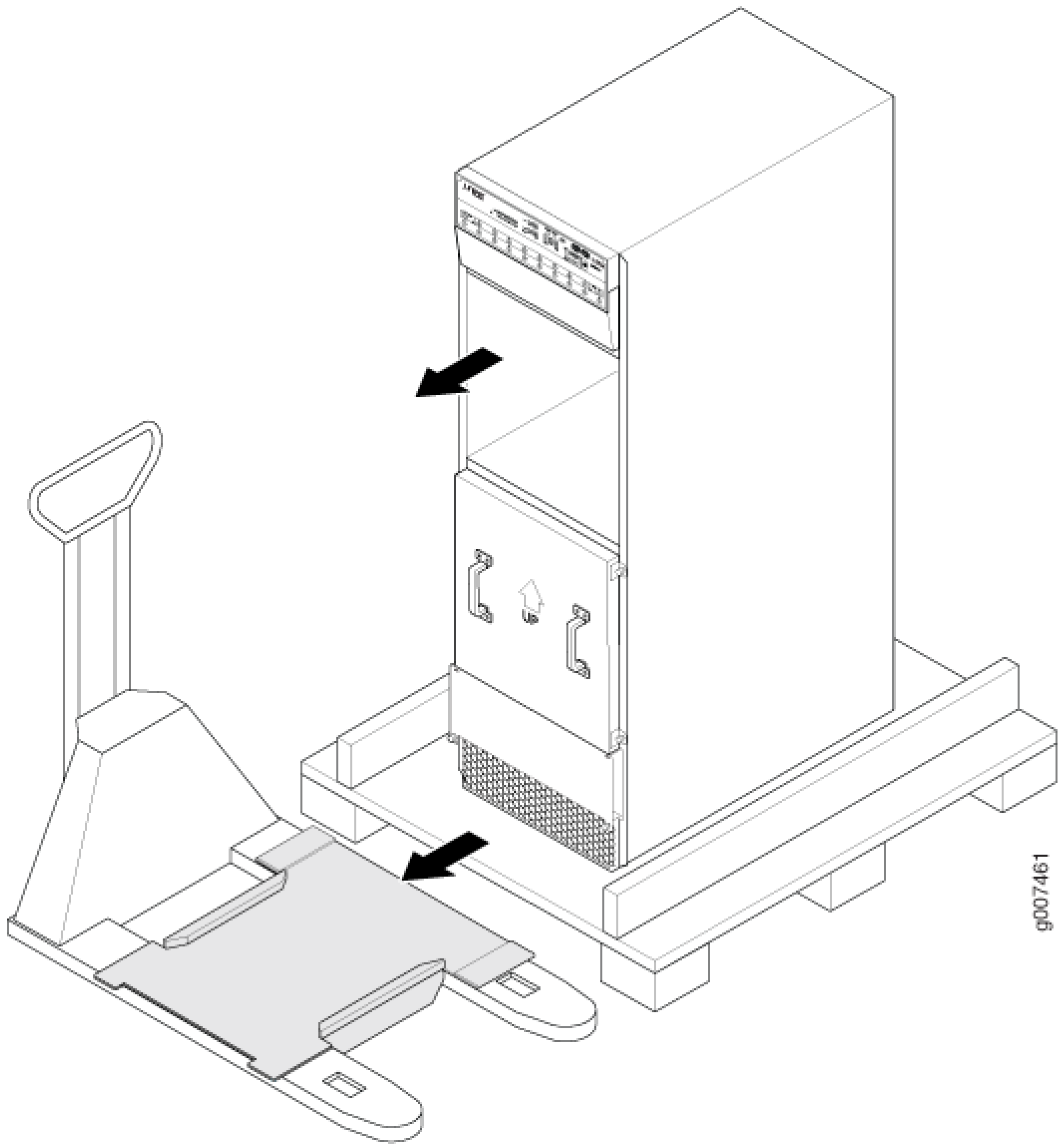
To install the router by using a pallet jack with attachment:

1. 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. See "Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router" on page 188.
2. Reattach the front and rear shipping covers to the chassis to help move the router. The handles on the shipping covers are used to guide the chassis during installation.

   CAUTION: Do not lift the router by using the handles on the shipping covers. Use these handles only to help position the router.

3. Place the pallet jack attachment across both legs and secure the attachment to the pallet jack.
4. Using a four-person team to load the router onto the pallet jack, make sure it rests securely on the pallet jack attachment platform.

Figure 109: Loading the MX2010 Router onto the Pallet Jack



> ⚠ **CAUTION**: Applying force to any other parts of the chassis other than the shipping covers can damage the chassis.

5. Attach the shipping brackets to the pallet jack attachment by using existing bracket screws.
6. On each of the shipping brackets, partially insert screws into the hole to secure the brackets to the chassis. Tighten all screws. These brackets will prevent the chassis from tilting.
7. Lower the pallet jack before moving the chassis. This will help distribute the weight evenly and reduce the risk of tilting or damage to the chassis.

8. Using the pallet jack, position the router in front of the rack or cabinet, centering it in front of the rack.

   > **NOTE**: If you are installing the MX2010 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 34-U rack space from access during installation.

9. Using the pallet jack, lift the chassis approximately 0.75 in. (1.9 cm) above the surface of the mounting shelf (four-post rack) or bottom opening of the rack (open-frame rack), and position it as close as possible.

   > **NOTE**: Due to the short lift capability of the pallet jack, we recommended that you install the router on the bottom of the rack.

10. Remove the shipping brackets that are attached to the pallet jack attachment and chassis, and set them aside.
11. Grasp the handles on the shipping covers and carefully slide the router into the rack (see and Figure 110 on page 320 and Figure 111 on page 321). If you are installing the router into a four-post rack, continue sliding the router onto the mounting shelf so that the bottom of the chassis and the mounting shelf overlap by approximately 2 inches.

Figure 110: Loading the MX2010 Router into the Rack

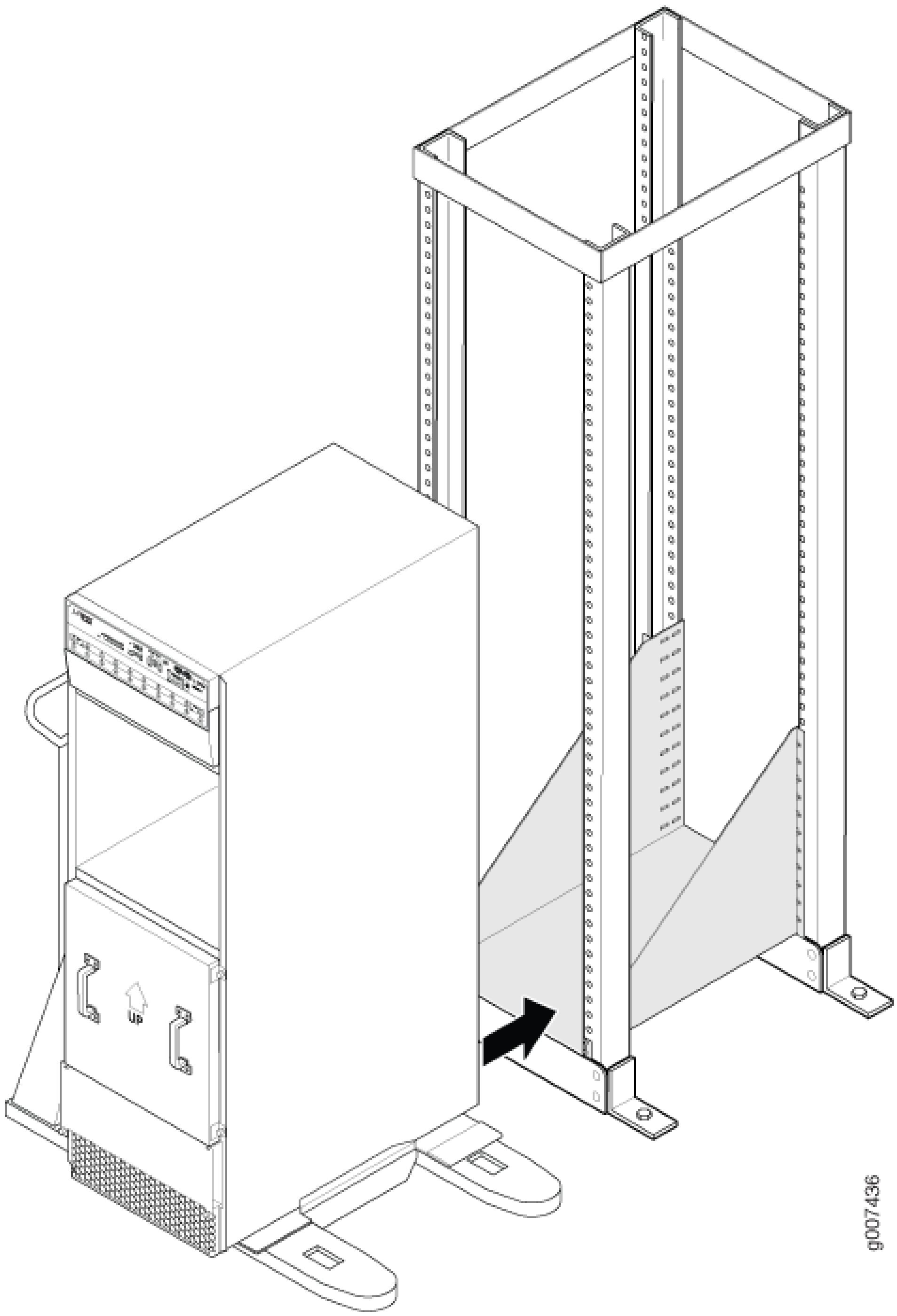
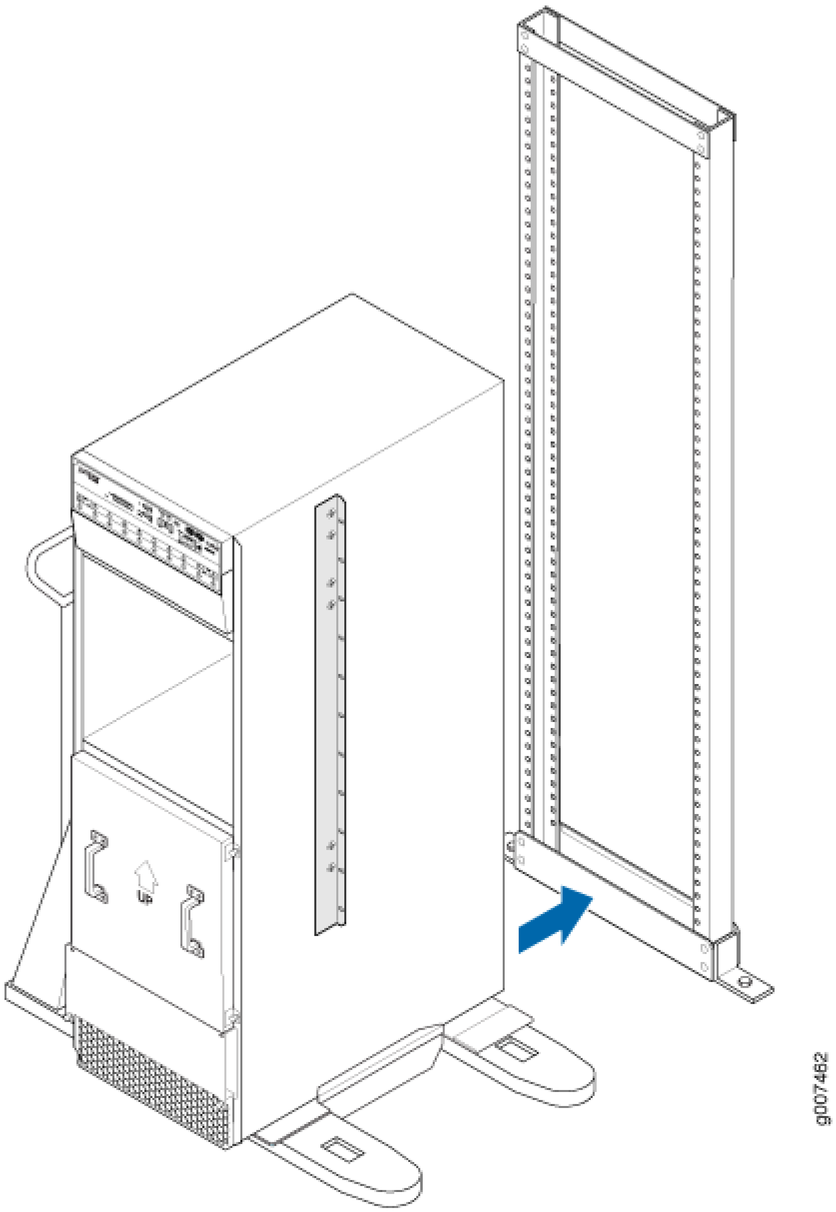


Figure 111: Installing the MX2010 Router on an Open-Frame Rack



12. With four people pushing on the front-mounting flanges, slide the router until the center-mounting brackets (open-frame racks) or front-mounting flanges (four-post racks) contact the rack rails. In a four-post rack, the mounting shelf ensures that the holes in the front-mounting flanges of the chassis align with the holes in the rack rails.
13. Move the pallet jack away from the rack.
14. Insert twelve mounting screws (six on each side) into the mounting holes to secure the router to the rack.

15. Visually inspect the alignment of the router. If the router 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 router should be level.

RELATED DOCUMENTATION

Installing an MX2010 Router Overview | 276

Installing an MX2010 Router Using a Router Transport Kit Overview

1. Gather the tools required to install the router. See:

   "Tools Required to Install the MX2010 Router Using a Router Transport Kit" on page 279

2. Install the router transport kit. See:

   "Installing the Router Transport Kit on the MX2010 Router" on page 322

3. Secure the router to the router transport platform. See:

   "Securing the MX2010 Router to the Router Transport Platform" on page 325

4. Install the router using the router transport kit. See either:

   "Using the Router Transport Kit to Install the MX2010 Router in a Four-Post Rack" on page 328 or "Using the Router Transport Kit to Install the MX2010 Router in an Open-Frame Rack" on page 339

RELATED DOCUMENTATION

Installing an MX2010 Router Overview | 276

Installing the Router Transport Kit on the MX2010 Router

NOTE: The router transport kit can be purchased from Juniper Networks.

The router transport kit includes the following components:

- Router transport platform
- Router transport left and right mounting plates with adjustable wheel assembly
- Router winch mount with winch strap plate

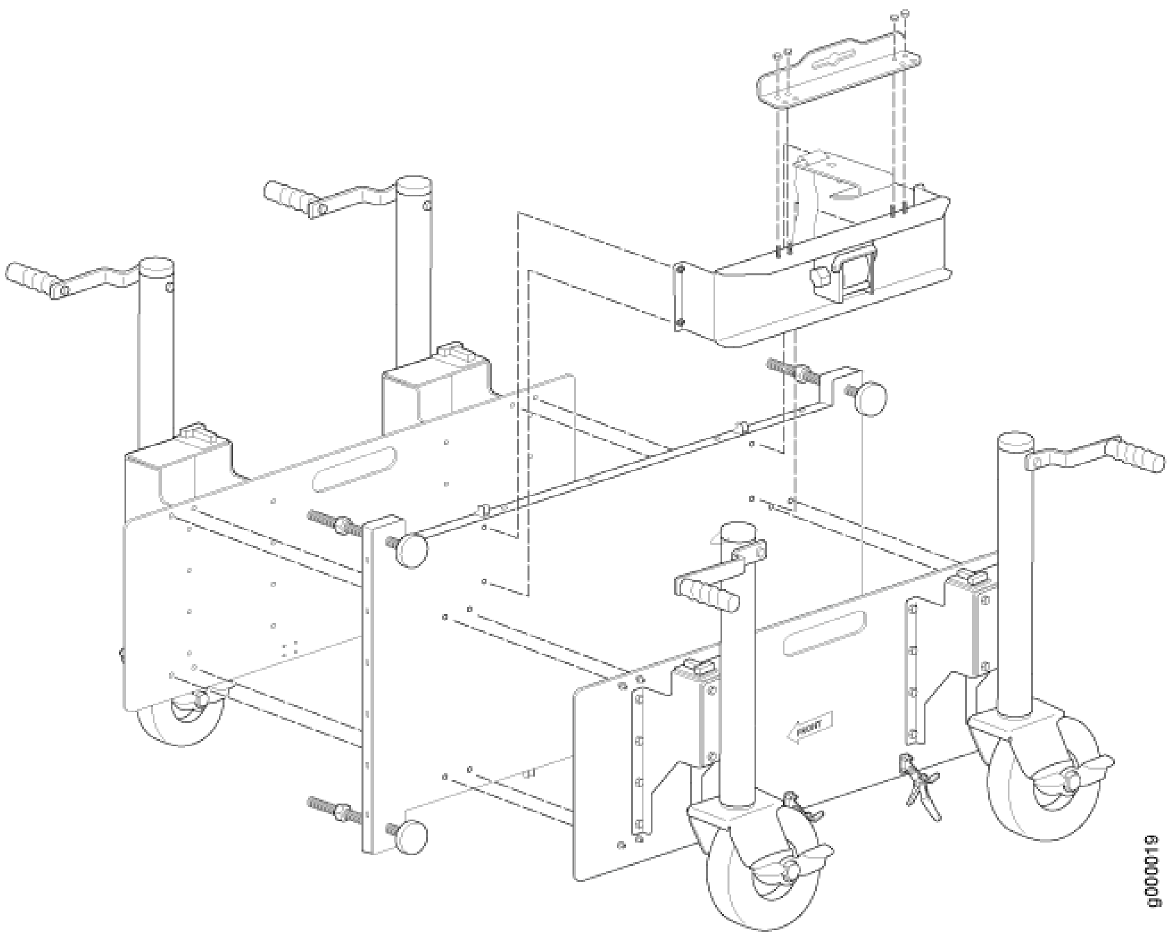
To install the router transport kit:

1. Remove the router transport kit from the shipping crate (see "Unpacking the MX2010 Router Transport Kit" on page 290).

   NOTE: The router transport kit weighs approximately 138.5 lb (62.82 kg).

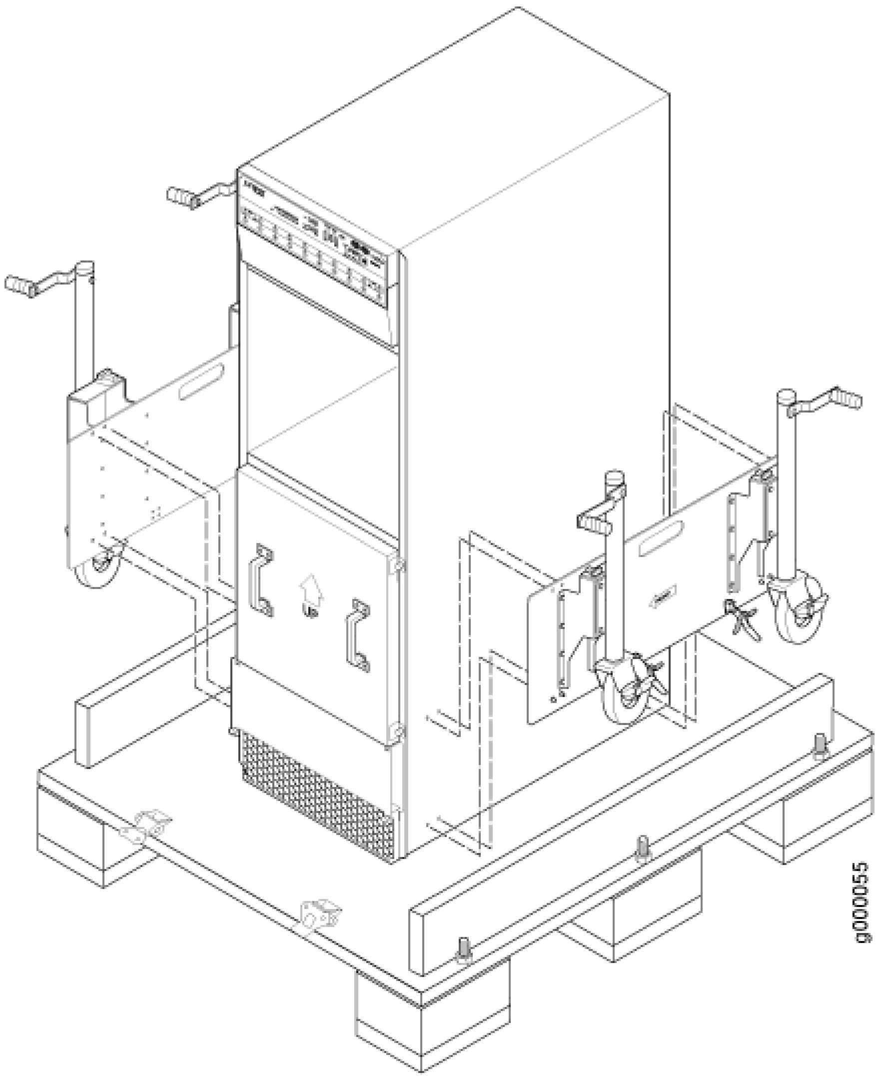
2. Remove the winch strap plate that is secured to the winch mount by using a 9/16-in. (14 mm) socket wrench, and set the plate aside.
3. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the winch mount to the router transport kit, and set the mount aside.
4. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plate and wheel assembly (left and right) to the router transport platform, and set them aside (see Figure 112 on page 324).

Figure 112: Preparing the Router Transport Kit for Installation



5. Remove the four shipping brackets that secure the router to the shipping crate platform using a 9/16-in. (14 mm) socket wrench, and a number 2 Phillips screwdriver, and set the brackets aside.
6. Align the left router transport mounting plate and wheel assembly (indicated by left arrow) with the holes on the left side of the chassis (see Figure 113 on page 325).
7. Using a number 3 Phillips screwdriver, tighten the captive screws to secure the router transport mounting plate and wheel assembly to the chassis.
8. Align the right router transport mounting plate and wheel assembly (indicated by right arrow) with the holes on the right side of the chassis (see Figure 113 on page 325).
9. Using a number 3 Phillips screwdriver, tighten the captive screws to secure the router transport mounting plate and wheel assembly to the chassis.

Figure 113: Installing the Router Transport Kit onto the MX2010 Router



RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2010 Router | 162

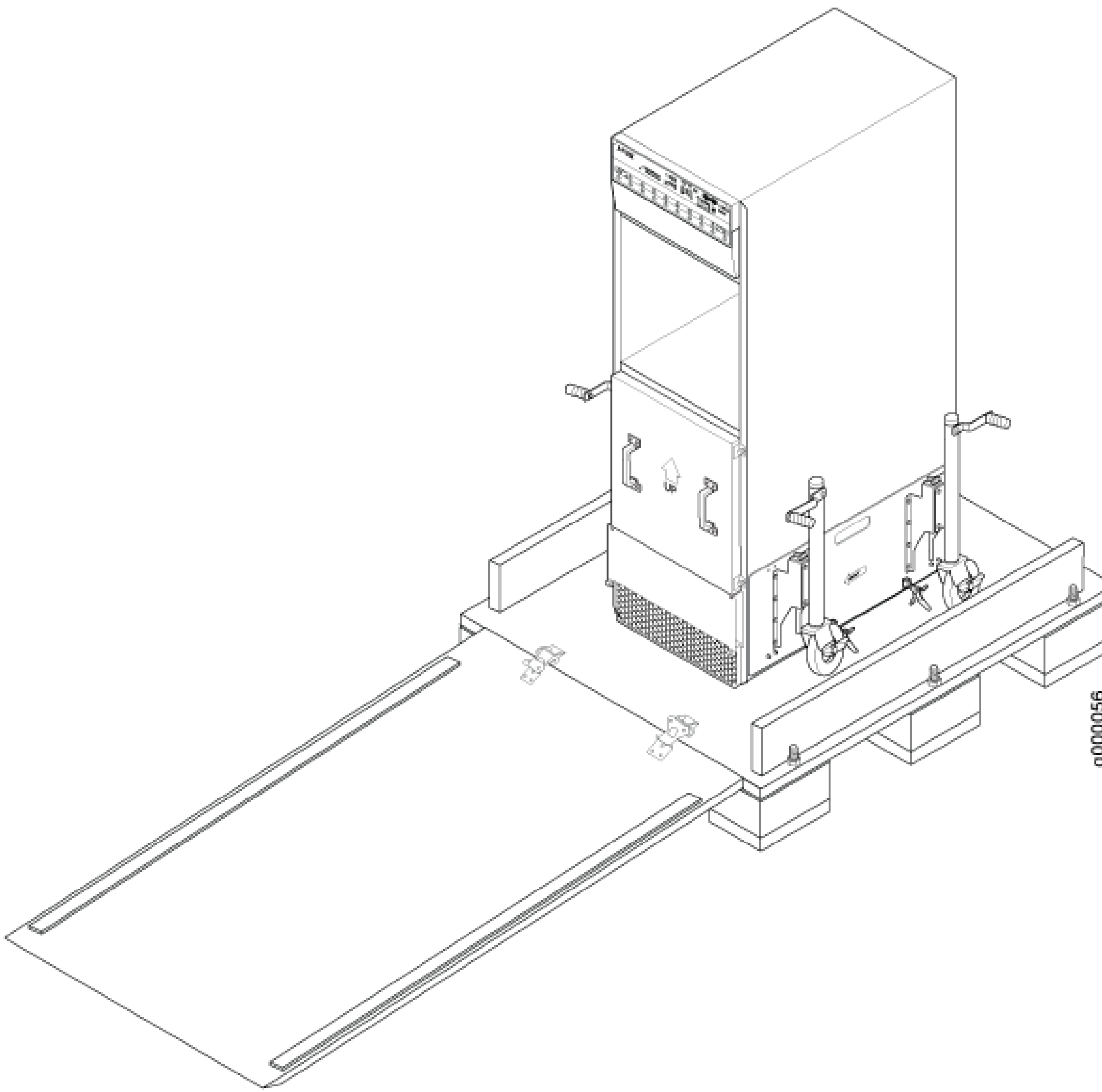
Installing an MX2010 Router Using a Router Transport Kit Overview | 322

Securing the MX2010 Router to the Router Transport Platform

To secure the router to the router transport platform:

1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for router transport kit turn ratios, airflow, and maintenance.
2. Using the shipping crate door as a ramp, secure the door to the crate platform by using the two metal latches (see Figure 114 on page 326).

Figure 114: Securing the Crate Door to the Shipping Crate Platform



NOTE: An empty MX2010 weighs approximately 324 lb (146.96 kg).

3. Using a two-person team on either side of the chassis, turn the handles on the router transport four or five times until the chassis is raised approximately 1 in. (2.54 cm), making sure that the chassis is level.

 NOTE: The router transport kit is equipped with four T-shaped levels on top of each of the four router transport mounting brackets. Make sure the bubbles within the T-shaped levels are between the lines, indicating the chassis is level.

 CAUTION: Do not raise the chassis above 1 in. (2.54 cm). This ensures that the router will not tilt when transporting, which can result in injury or damage to the router.

4. Turn the four wheels on the router transport kit toward the rear of the chassis.
5. Grasping the handles on the shipping covers, carefully guide the chassis down the crate ramp to the rack location.

 WARNING: Do not push or pull the router fast during transporting. Using excessive speed can cause the wheels to turn abruptly and tilt the router over.

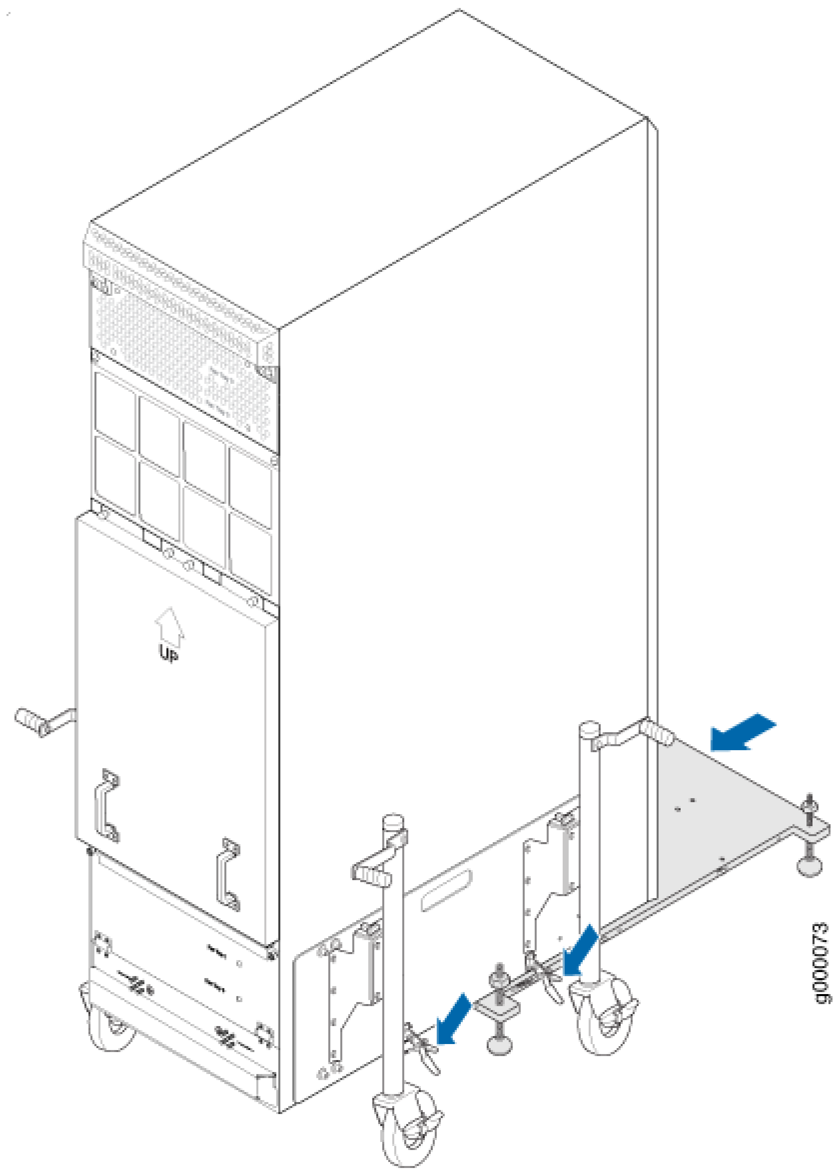
 CAUTION: Do not lift the router by using the handles on the shipping covers. Use these handles only to help position the router.

6. Position the router transport platform directly under the router, aligning the router transport platform with the bottom of the chassis by adjusting the four leveling mounts.

 NOTE: The router transport platform height can be adjusted between 0.25 in. (0.6 cm) and a maximum of 4 in. (10.16 cm).

7. Secure the router transport platform to the router transport mounting plates by using the four latch locks (see Figure 115 on page 328).

Figure 115: Securing the Router Transport Platform



Using the Router Transport Kit to Install the MX2010 Router in a Four-Post Rack

Because of the router's size and weight—up to 985 lb (446.79 kg) depending on the configuration—we recommend that you use a router transport kit to install the router.

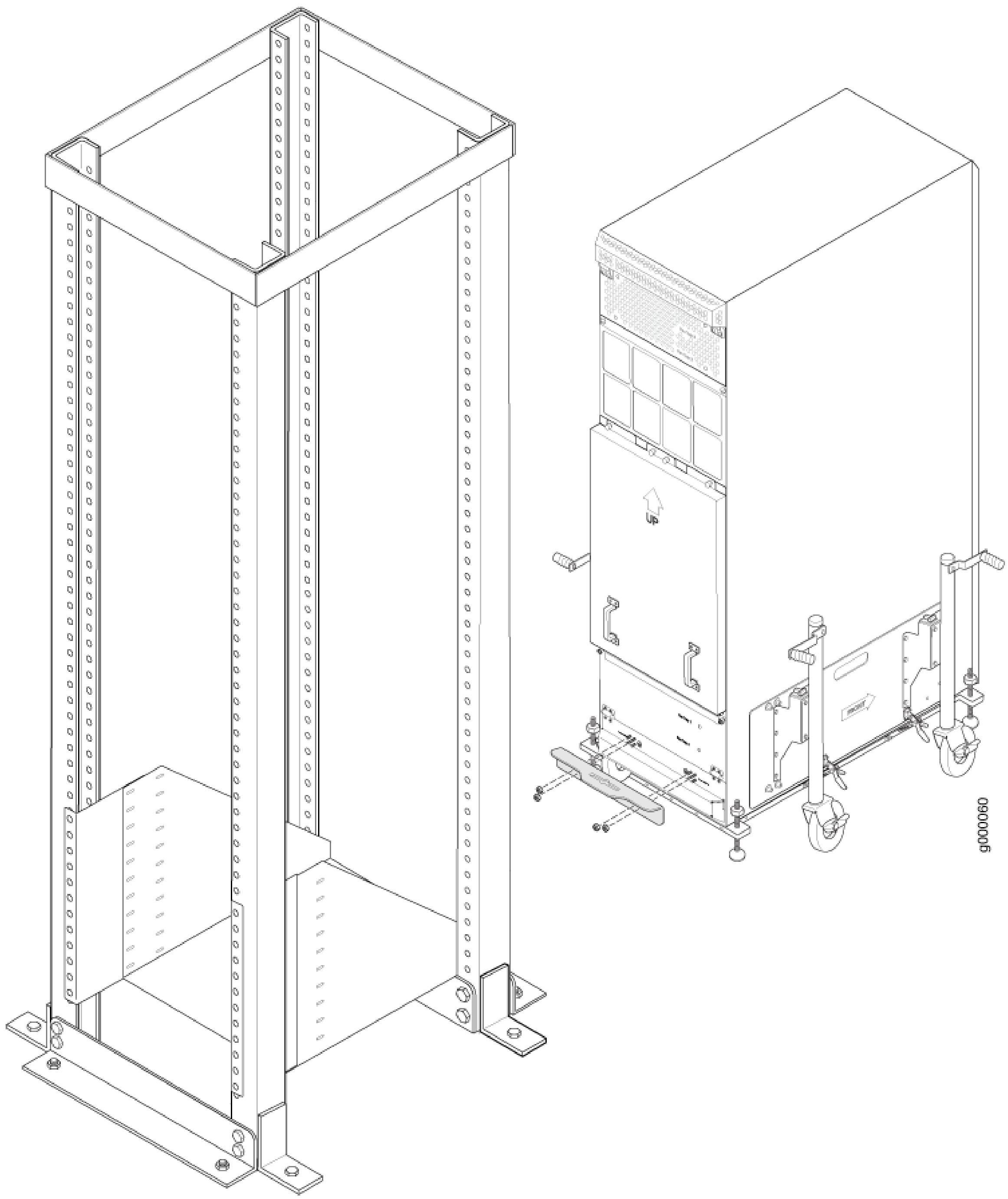
NOTE: Four people are needed to install the router into a rack.

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

To install the router in a four-post rack by using the router transport kit:

1. Install the winch strap plate to the rear of the router by tightening the four captive screws (see Figure 116 on page 330).

Figure 116: Installing Winch Strap Plate (Four-Post Rack)



2. Using a four-person team, transport the router to the rack installation location and center it in front of the mounting shelf.

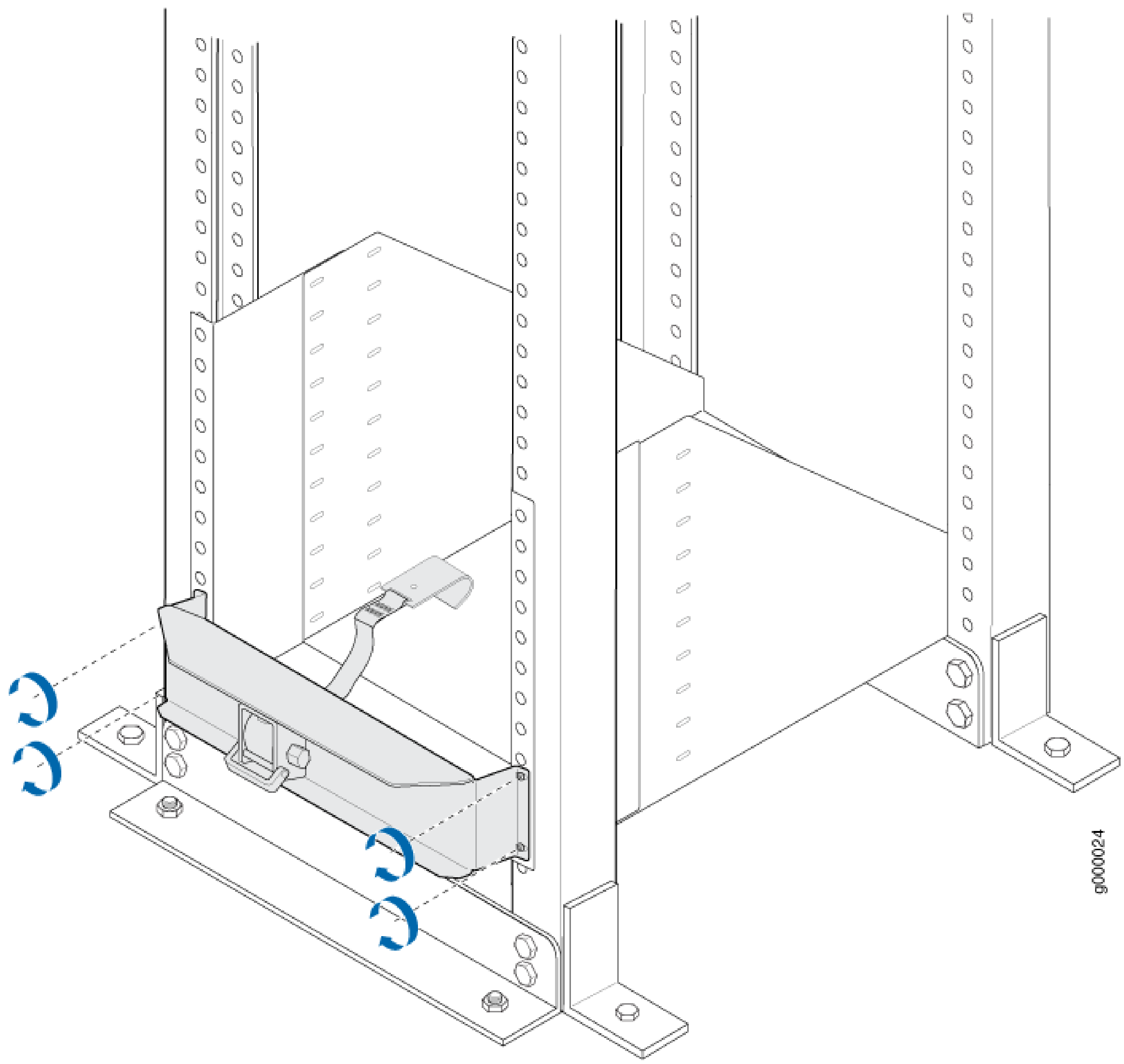
   NOTE: A minimum of 38 in. (96.5 cm) of clearance is required to roll the chassis sideways.

   NOTE: A minimum of 42 in. (106.7 cm) of circular space is required to rotate the chassis.

   NOTE: The router transport kit handles can be removed to accommodate aisle width.

3. Install the winch mount bracket to the rear rack rails by using the six captive screws, and tighten the screws (see Figure 117 on page 332).

Figure 117: Installing Winch Mount Bracket to Rack Rails

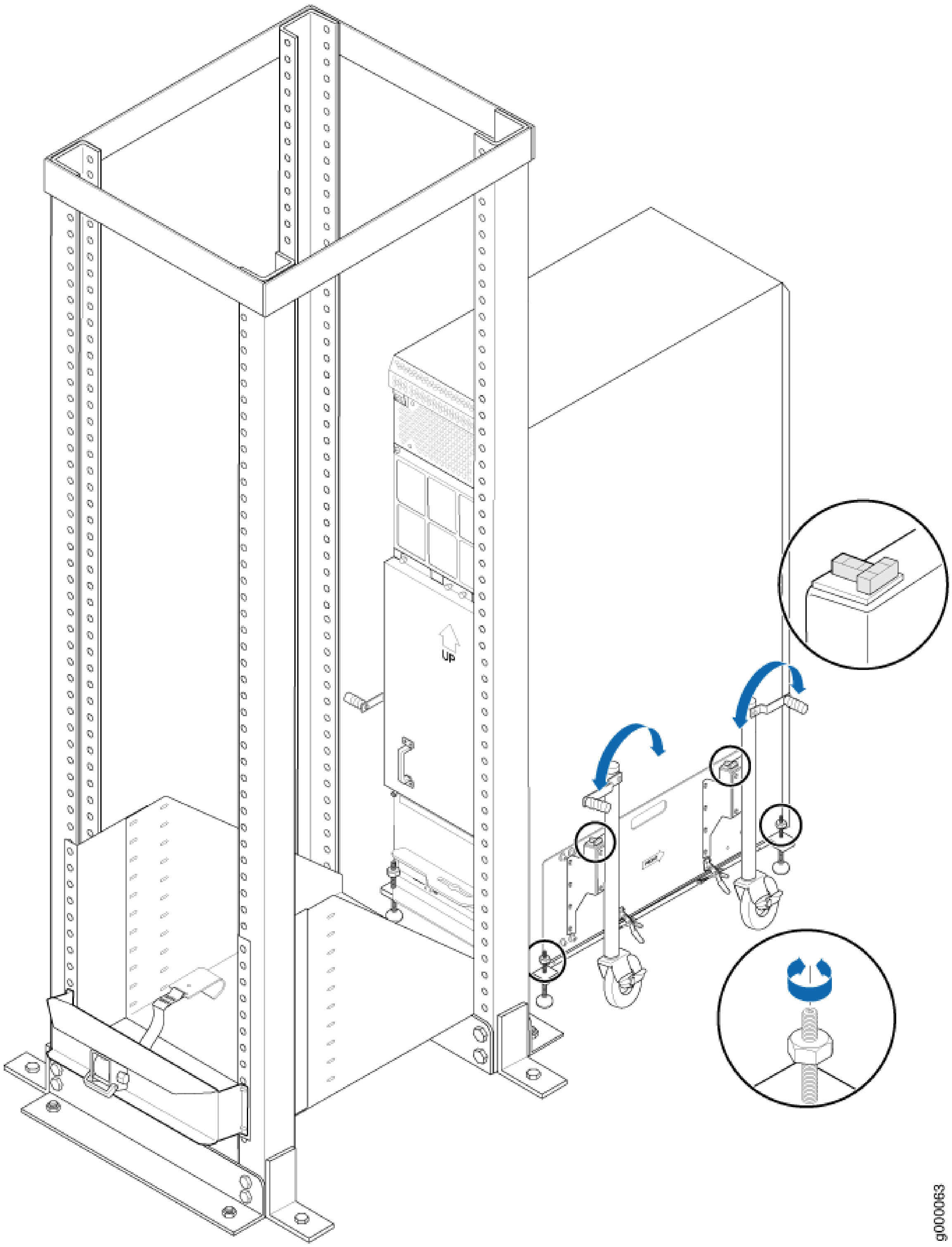


4. Adjust the height of the router by turning the handles clockwise until the router transport platform is aligned with the surface of the mounting shelf and slightly higher than the mounting shelf (see Figure 118 on page 333).

> **NOTE**: Make sure the bubbles within the T-shaped levels are between the lines, indicating that the router is level.

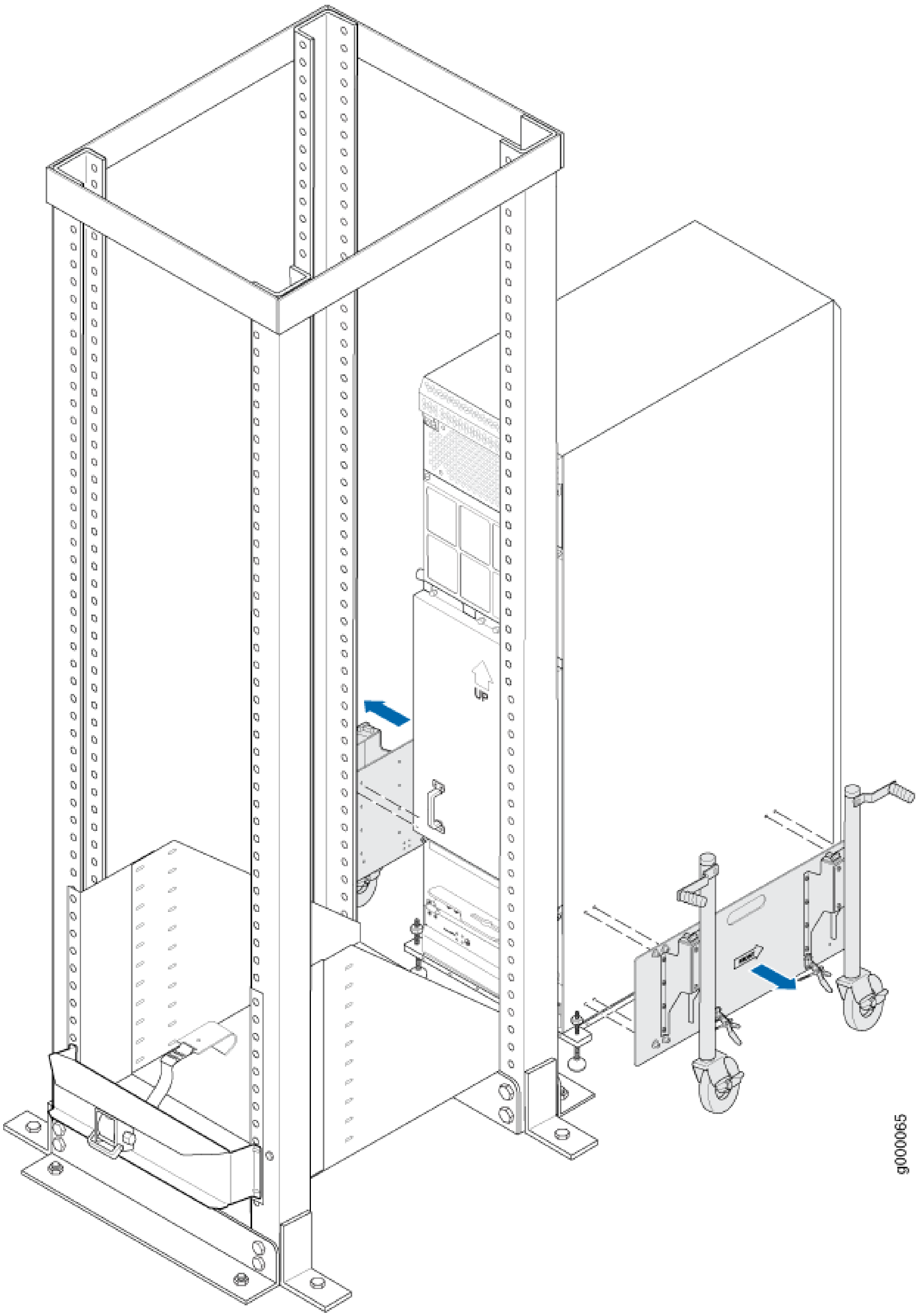
5. Adjust the four leveling mounts on the router transport platform until all four leveling mounts rest firmly on the ground (see Figure 118 on page 333).

Figure 118: Align the MX2010 Router with Rack Mounting Shelf



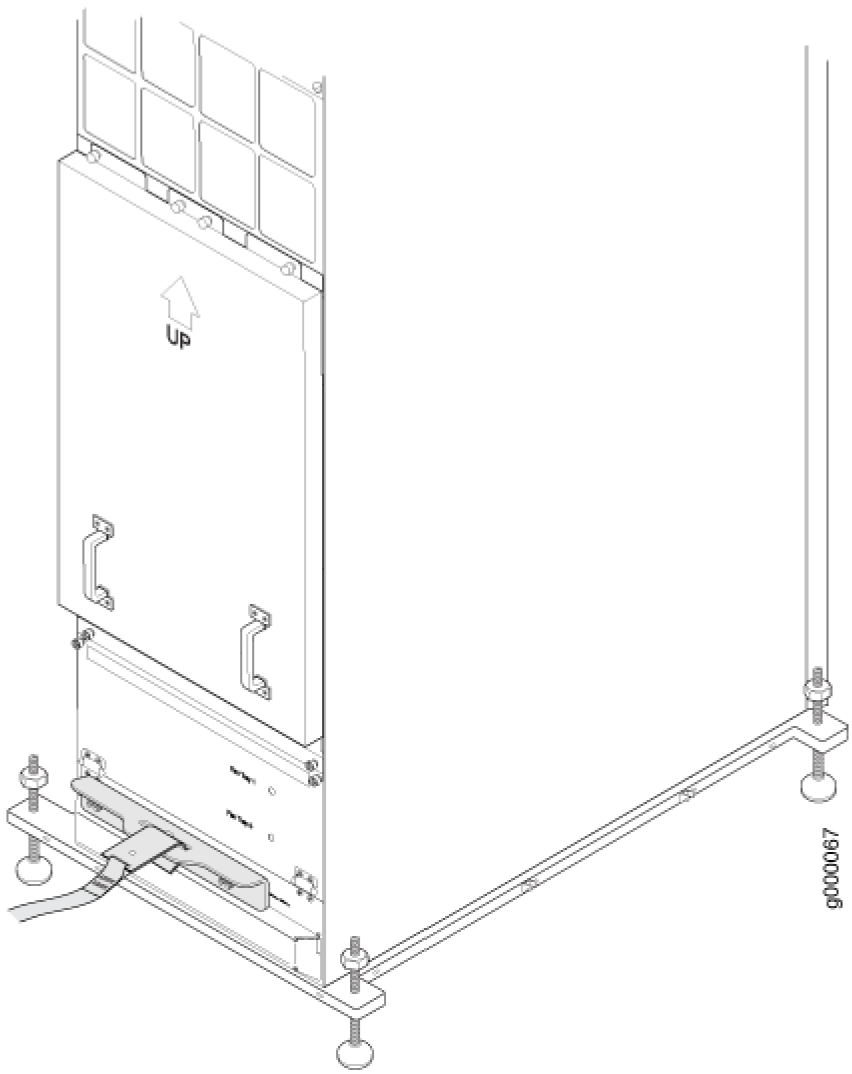
6. Unlock the four toggle latches that secure the router transport platform to the router transport mounting plate and wheel assembly.
7. Lift the wheels up by turning the handles counterclockwise so that the weight of the router is on the router transport platform.
8. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plates and wheel assembly to the chassis, and set them aside (see Figure 119 on page 335).

Figure 119: Remove Router Transport Mounting Plate and Wheel Assembly



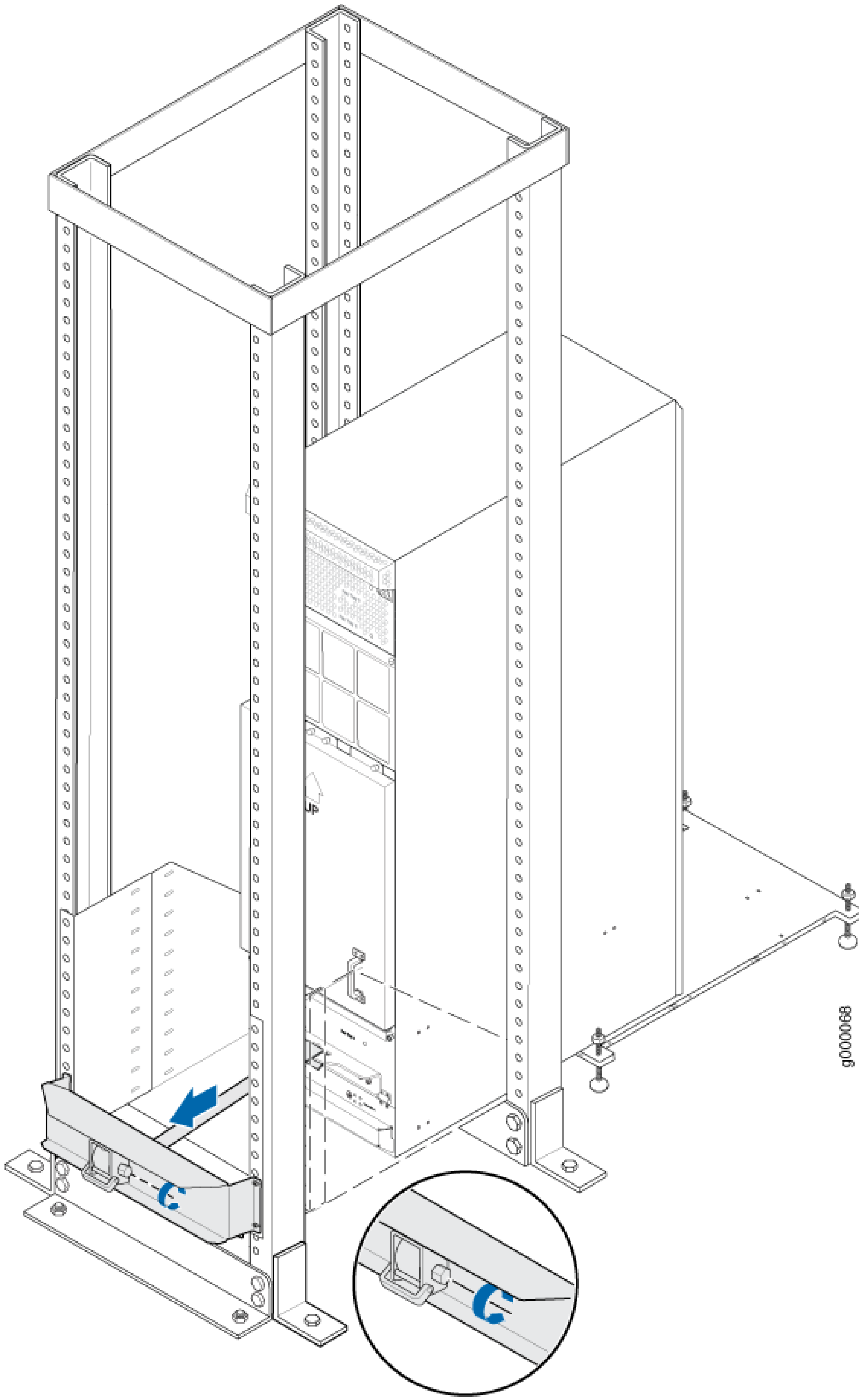
9. Attach the winch strap to the winch strap plate at the rear of the router (see Figure 120 on page 336).

Figure 120: Attaching Winch Strap to Winch Strap Plate



10. Attach a 1-1/8 in. (28.57 mm) socket wrench to the winch mechanism and turn clockwise to start pulling the chassis into the rack (see Figure 121 on page 337).

Figure 121: Pulling the MX2010 into the Rack



NOTE: A four-person team is needed to carefully guide the router into the rack while operating the winch.

NOTE: If the router is not pulled all the way into the rack by the winch mechanism, grasp the handles on the shipping covers and carefully slide the router onto the mounting shelf until the front-mounting flanges contact the rack rails. You must remove the winch bracket to perform this procedure.

NOTE: There must be a minimum of 45-U of usable rack space when installing the MX2010 into a 45-U rack.

11. Remove the router transport platform, and set the platform aside.
12. Remove the winch mount and winch strap plate, and set them aside.
13. Insert twelve mounting screws (six on each side) into the mounting holes to secure the router to the rack.
14. Visually inspect the alignment of the router. To verify that the router is installed properly in the rack, see that all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side and the router is level.
15. Reassemble the router transport kit, and set it aside.

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2010 Router | **162**

Tools Required to Install the MX2010 Router Using a Router Transport Kit | **279**

MX2010 Router Transport Kit Moving Requirements and Guidelines | **178**

Removing Components from the MX2010 Router Chassis Before Installing It in a Rack | **299**

Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack | **346**

Using the Router Transport Kit to Install the MX2010 Router in an Open-Frame Rack

NOTE: Four persons are needed to install the router into a rack.

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

To install the MX2010 in an open-frame rack by using a router transport kit:

1. Using the router transport platform, position the router in front of the rack or cabinet, centering it in front of the rack.
2. Using a four-person team, transport the router to the rack installation location and center it in front of the rack.

   NOTE: A minimum of 38 in. (96.5 cm) of clearance is required to roll the chassis sideways.

   NOTE: A minimum of 42 in. (106.7 cm) of circular space is required to rotate the chassis.

   NOTE: The router transport kit handles can be removed to accommodate aisle width.

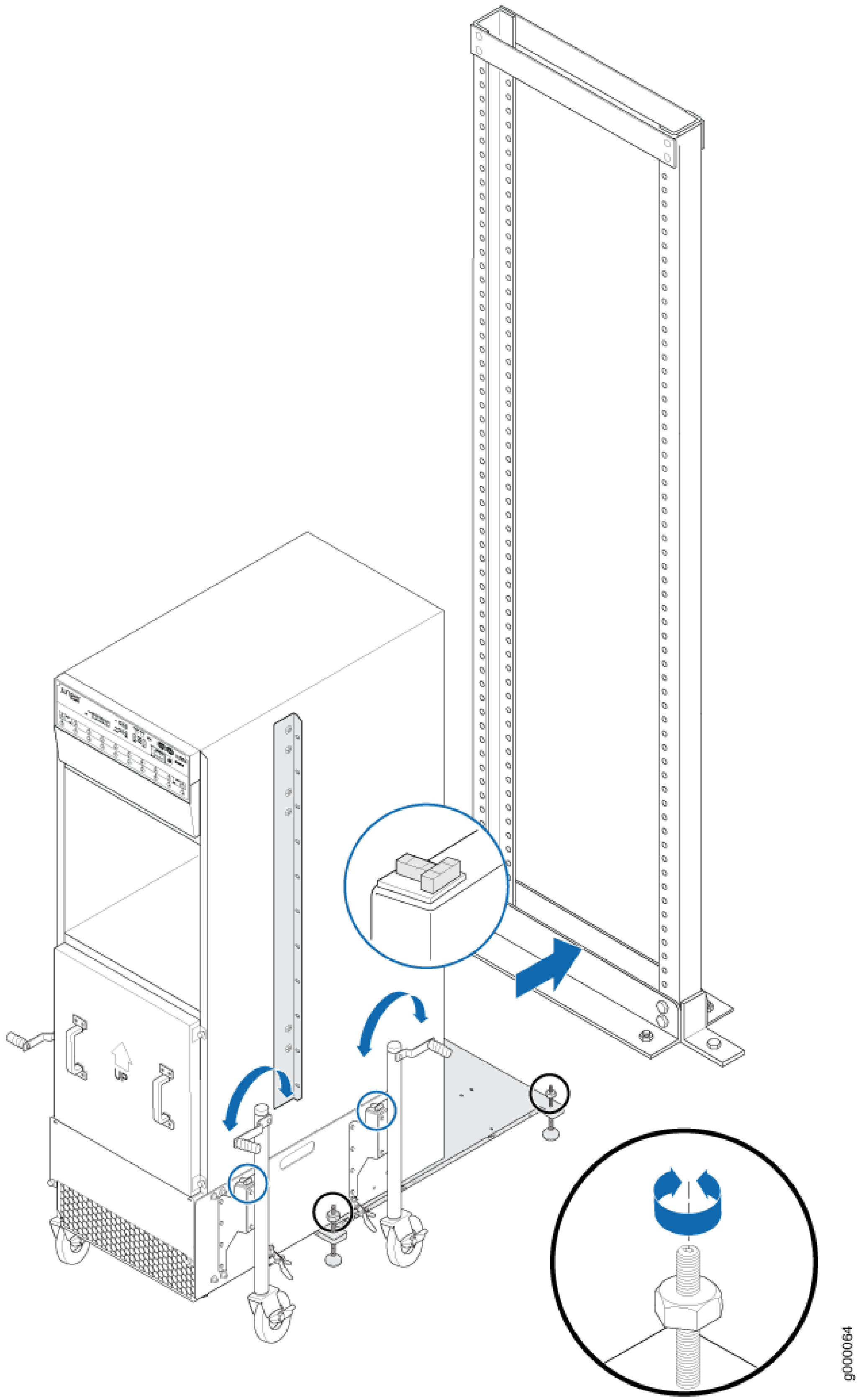
3. Adjust the height of the router by turning the handles clockwise until the router transport platform is approximately 0.75 in. above the bottom of the rack opening (see Figure 122 on page 341).

   NOTE: Because of the short lift capability of the router transport kit, we recommend that you install the router on the bottom of the rack.

   NOTE: Make sure that the bubbles within the T-shaped levels are between the lines, indicating that the router is level.

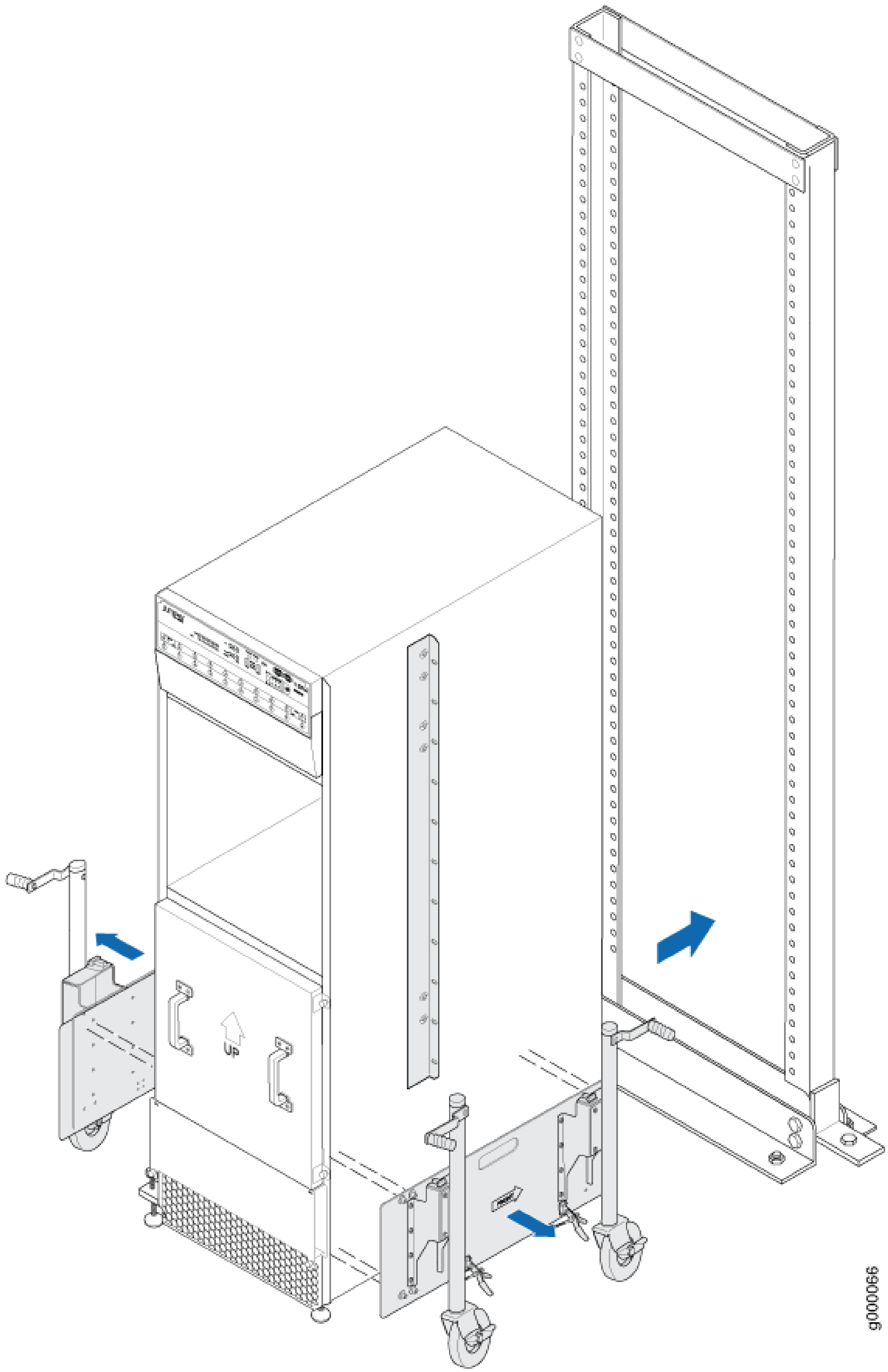
4. Adjust the four leveling mounts on the router transport platform until all four leveling mounts rest firmly on the ground (see Figure 122 on page 341).

Figure 122: Align the MX2010 Router with the Rack



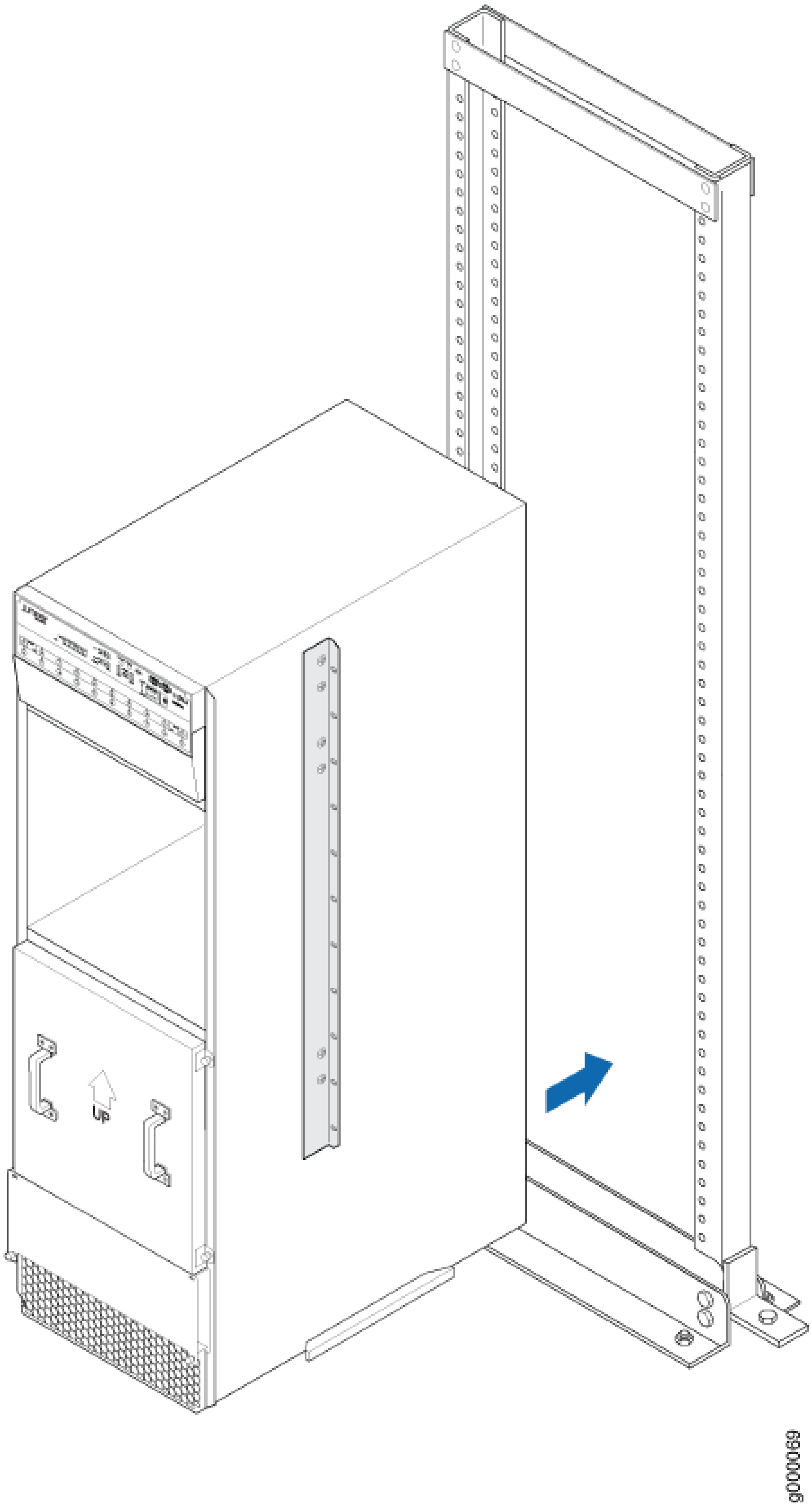
5. Unlock the four toggle latches that secure the router transport platform to the router transport mounting plate and wheel assembly.
6. Lift the wheels up by turning the handles counterclockwise so that the weight of the router is on the router transport platform.
7. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plates and wheel assembly to the chassis, and set them aside (see Figure 123 on page 343).

Figure 123: Remove Router Transport Mounting Plate and Wheel Assembly



8. Grasping the handles on the shipping covers, carefully slide the router into the rack until the center-mounting brackets contact the rack rails (see Figure 124 on page 345).

Figure 124: Sliding the MX2010 into the Open-Frame Rack



NOTE: A four-person team is needed to carefully guide the router into the rack.

NOTE: There must be a minimum of 45-U of usable rack space when installing the MX2010 into a 45-U rack.

9. Remove the router transport platform, and set the platform aside.
10. Insert twelve mounting screws (six on each side) into the mounting holes to secure the router to the rack.
11. Visually inspect the alignment of the router. To verify that the router is installed properly in the rack, see that all the mounting screws on one side of the rack are aligned with the mounting screws on the opposite side and the router is level.
12. Reassemble the router transport kit, and set aside.

RELATED DOCUMENTATION

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MX2010 Router Transport Kit Moving Requirements and Guidelines | 178
Installing an MX2010 Router Using a Router Transport Kit Overview | 322
Grounding an MX2000 Router | 362

Reinstalling Components in the MX2000 Router After Initially Installing the Router in a Rack

IN THIS SECTION

- Reinstalling the Power Distribution Modules | 347
- Reinstalling the Power Supply Modules | 351
- Reinstalling the Fan Trays | 355
- Reinstalling the SFBs | 356
- Reinstalling the Adapter Card | 358
- Reinstalling the MPCs | 359

- Reinstalling the CB-REs | **360**

After the router is installed in the rack, remove the shipping covers, and reinstall the removed components before booting and configuring the router. You reinstall components first in the rear of the chassis, and then in the front:

Reinstalling the Power Distribution Modules

To reinstall the AC, DC, or universal PDMs, follow this procedure for each PDM (see Figure 125 on page 348, Figure 126 on page 349,Figure 127 on page 350, and Figure 128 on page 351):

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. For an AC-powered router, move the AC circuit breaker on the power source to the off (**O**) position. For a DC-powered router, move the DC circuit breaker on the power source to the off (**O**) position.

   We recommend this precaution even though the PDMs are not connected to power sources.
3. Take each PDM to be installed out of its electrostatic bag, and identify the slot on the PDM where it will be connected.
4. Turn the DC power switch to the off (**O**) position on all PSMs that are associated with the PDM being reinstalled.
5. Using both hands, grasp the two handles and slide the PDM partway into the chassis.
6. Align both locking levers with the openings in the chassis, and simultaneously close them to fully seat the PDM.
7. Tighten both captive screws on the locking levers.

NOTE: The three-phase delta or wye AC PDM terminal blocks will be flipped depending on which slot the PDMs gets plugged into.

Figure 125: Reinstalling an AC Power Distribution Module

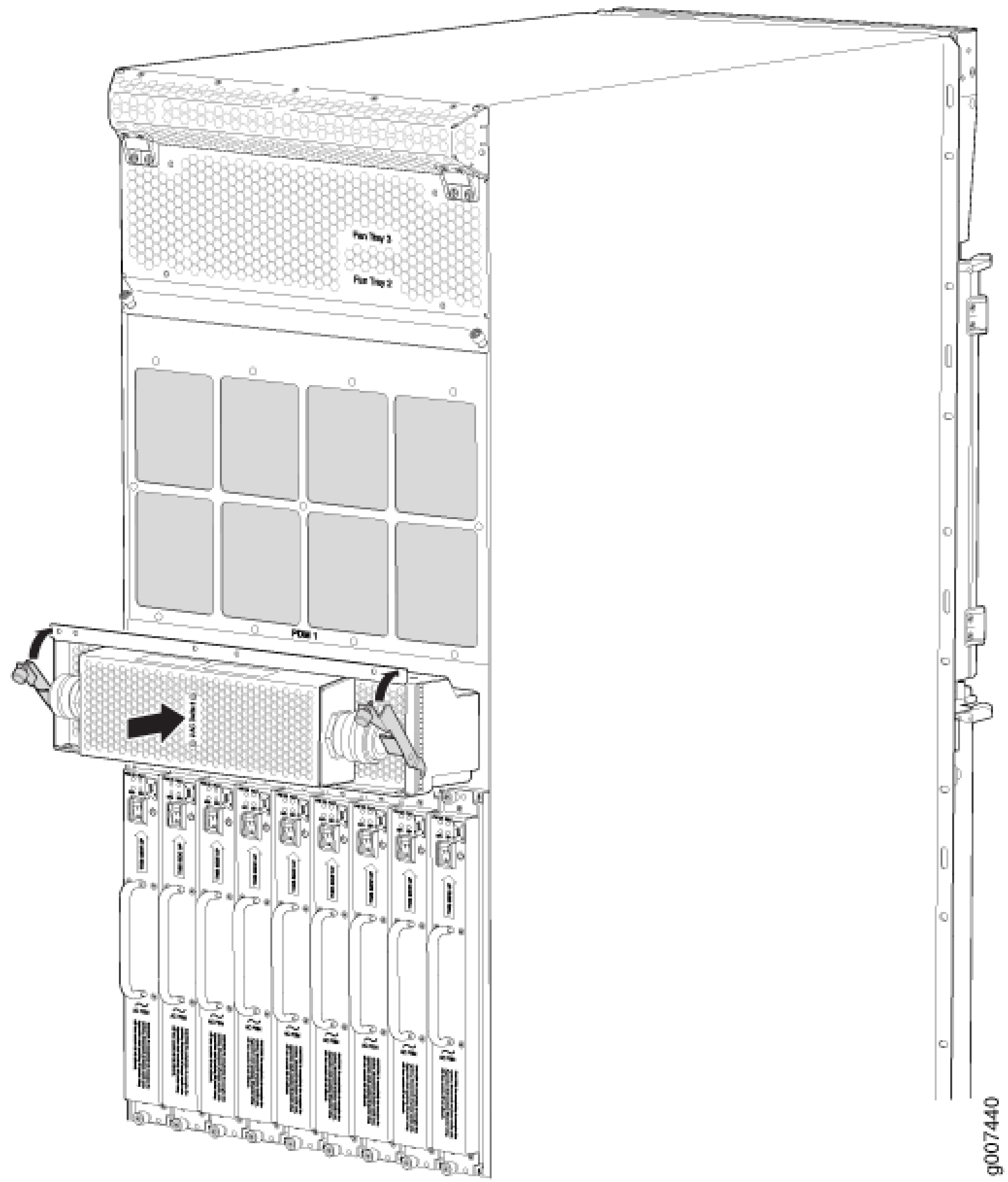


Figure 126: Reinstalling a DC Power Distribution Module (-48 V)

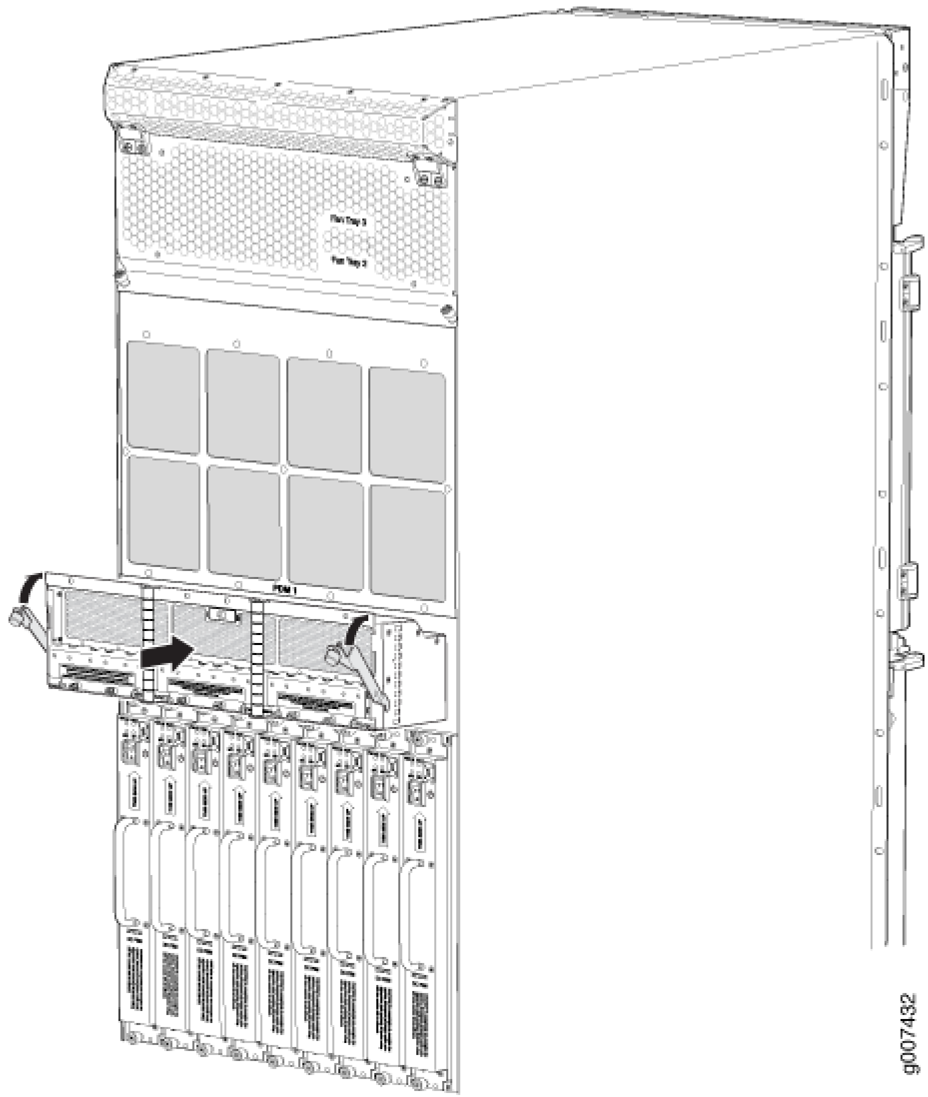


Figure 127: Reinstalling a DC Power Distribution Module (240 V China)

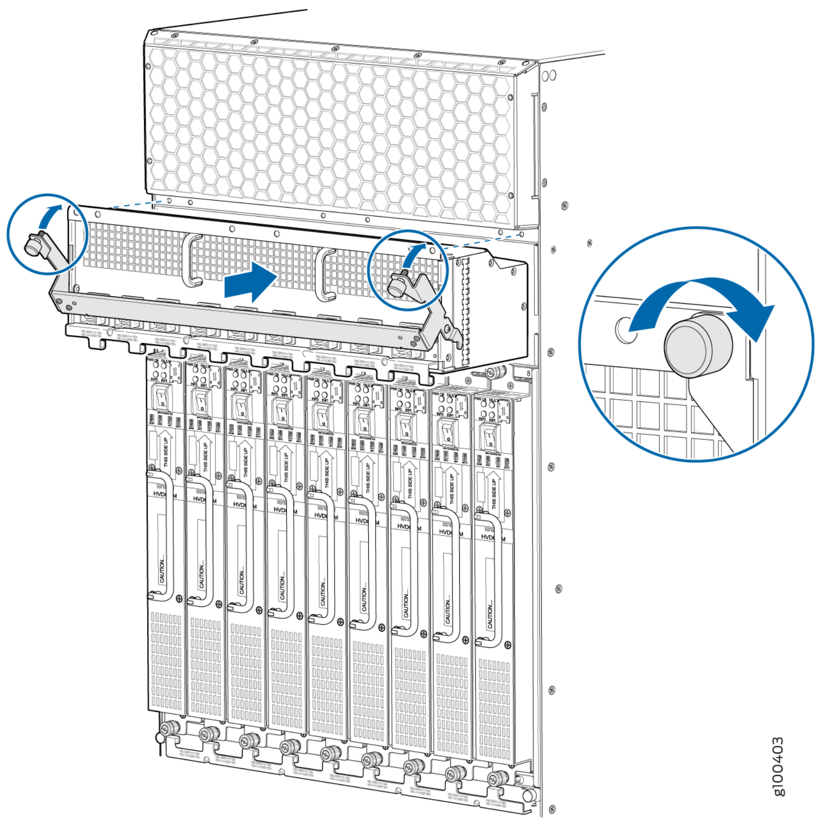
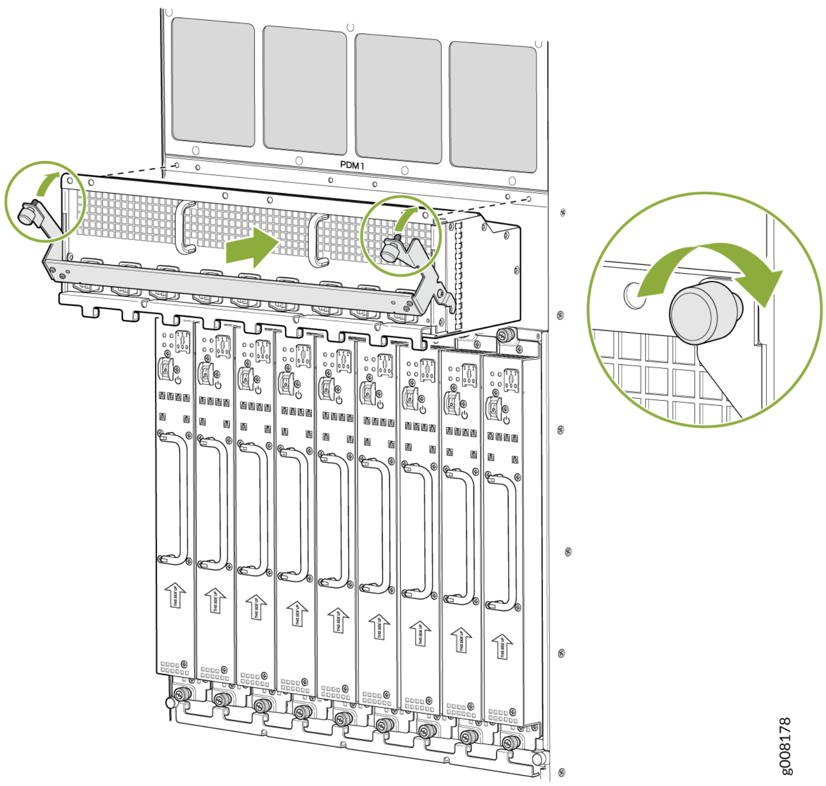


Figure 128: Reinstalling a High-Voltage Universal (HVAC/HVDC) Power Distribution Module



NOTE: For the DC-powered router, make sure the switch is set to 60 A, or 80 A to match the DC circuit input feed. This does not apply to the 240 V China DC PDM or the universal (HVAC/HVDC) PDM.

Reinstalling the Power Supply Modules

To reinstall the AC, DC, or universal (HVAC/HVDC) PSMs, follow this procedure for each PSM (see Figure 129 on page 352, Figure 130 on page 353, Figure 131 on page 354, and Figure 132 on page 355).

1. Remove the PSM to be installed out of the ESD bag, and identify the slot where it will be installed; **0** through **8**.

   NOTE: The MX2000 PSMs can be installed in any order in the chassis.

2. For an AC-powered router, move the AC power switch on the PSMs to the off (**O**) position. For a DC-powered router, move the DC power switch on the PSMs to the off (**O**) position.

3. While holding the handle, using both hands, slide the PSM straight in until the PSM is fully seated into the chassis slot.
4. The PSM faceplate should be flush with adjacent PSMs.

Figure 129: Reinstalling an AC Power Supply Module

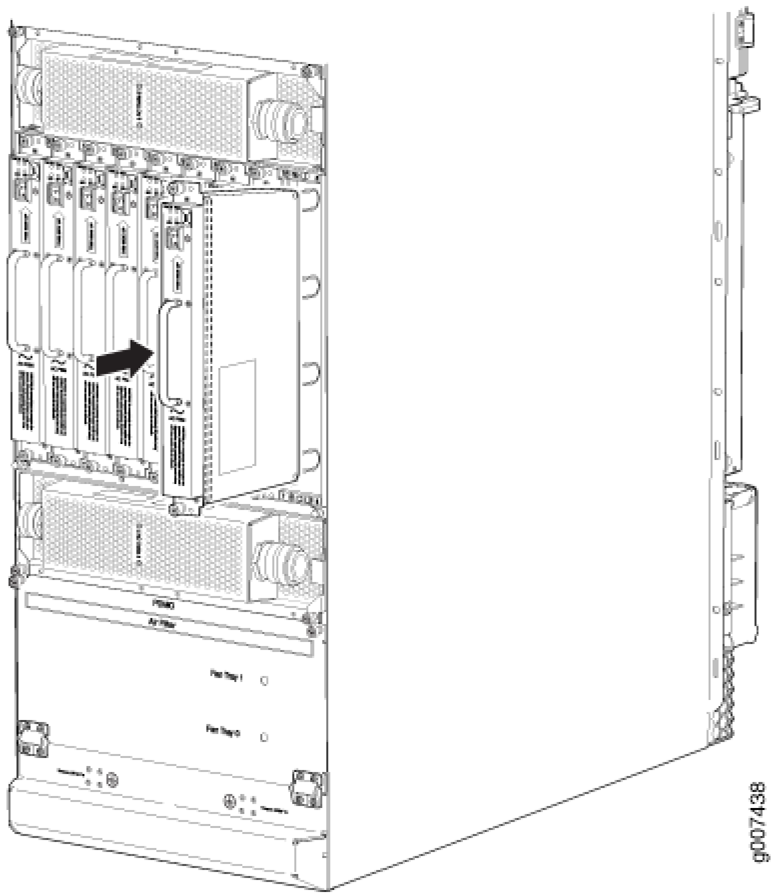


Figure 130: Reinstalling a DC Power Supply Module (-48 V)

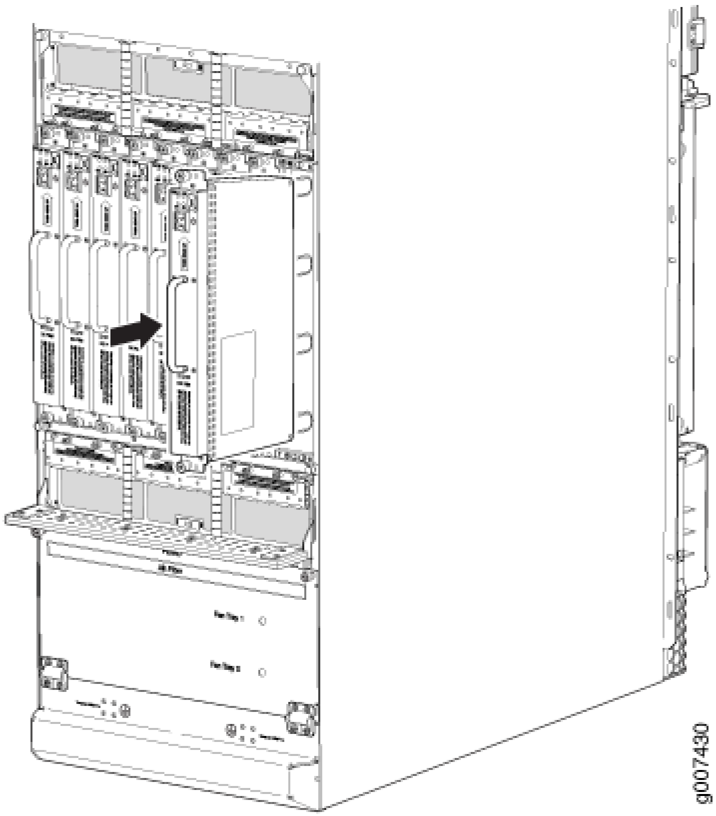


Figure 131: Reinstalling a DC Power Supply Module (240 V China)

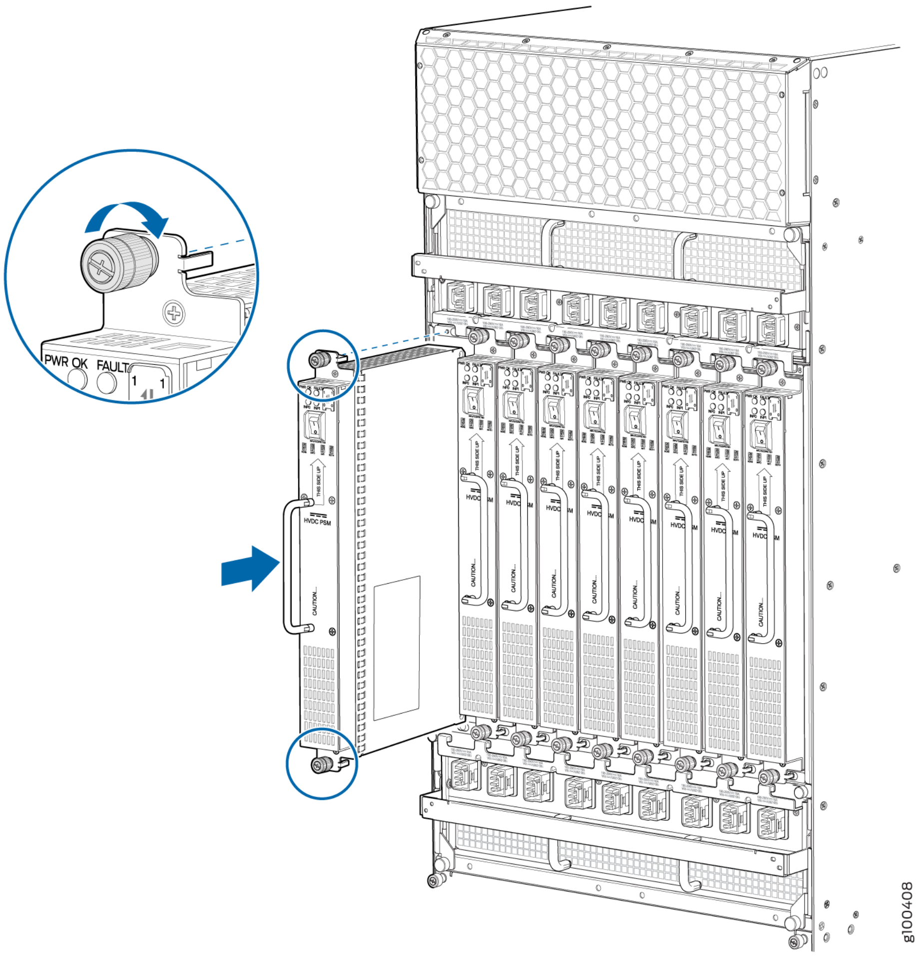
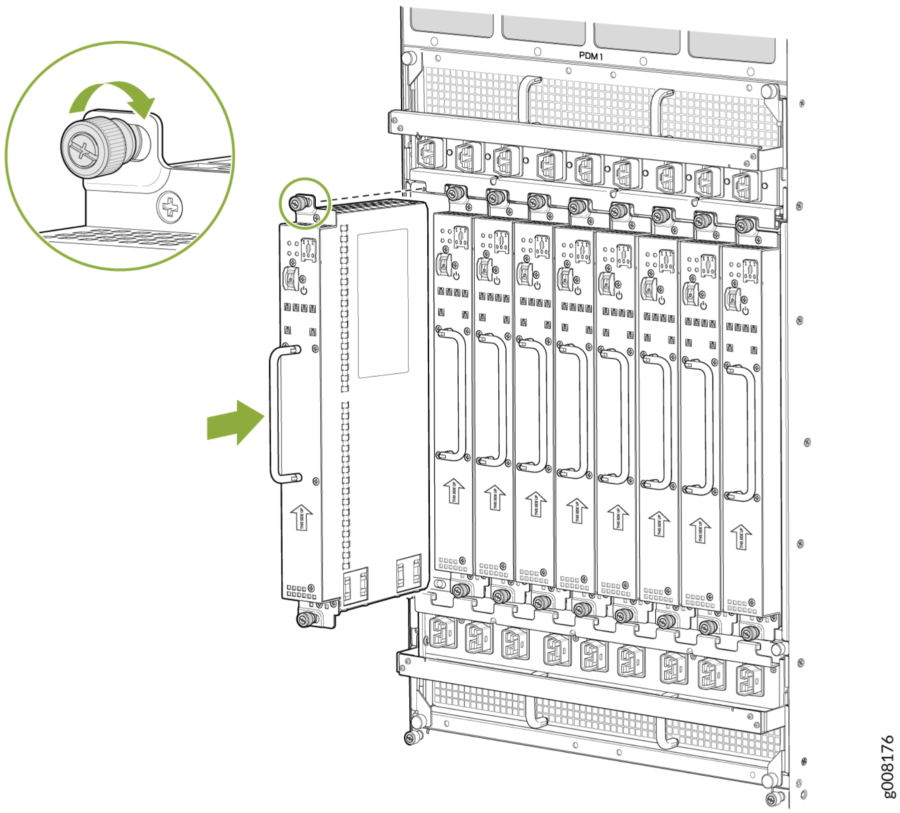


Figure 132: Reinstalling a High-Voltage Universal (HVAC/HVDC) Power Supply Module



Reinstalling the Fan Trays

To reinstall the upper or lower fan trays, (see Figure 133 on page 356 and Figure 134 on page 356):

1. Loosen the two captive screws on each side of the fan tray access panel, and open the panel.
2. Take each fan tray to be installed out of its electrostatic bag, and identify the slot on the fan tray where it will be connected.
3. While grasping the handle, place one hand under the fan tray for support, and align it into the slot.
4. Press and hold the latch while guiding the fan tray half way in until it stops.

> **NOTE**: The fan tray has a safety mechanism so that the fan tray cannot be removed in one motion.

5. Press and hold the latch a second time while inserting the fan tray completely into the router.
6. Tighten the two captive screws on the fan tray faceplate.
7. Close the fan tray access panel, and tighten the captive screws to secure it in place.

Figure 133: Reinstalling Upper Fan Trays

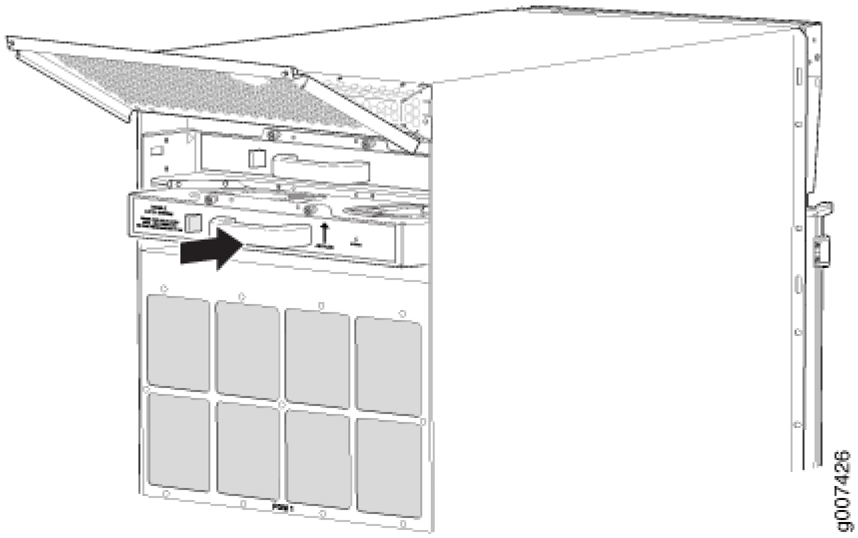
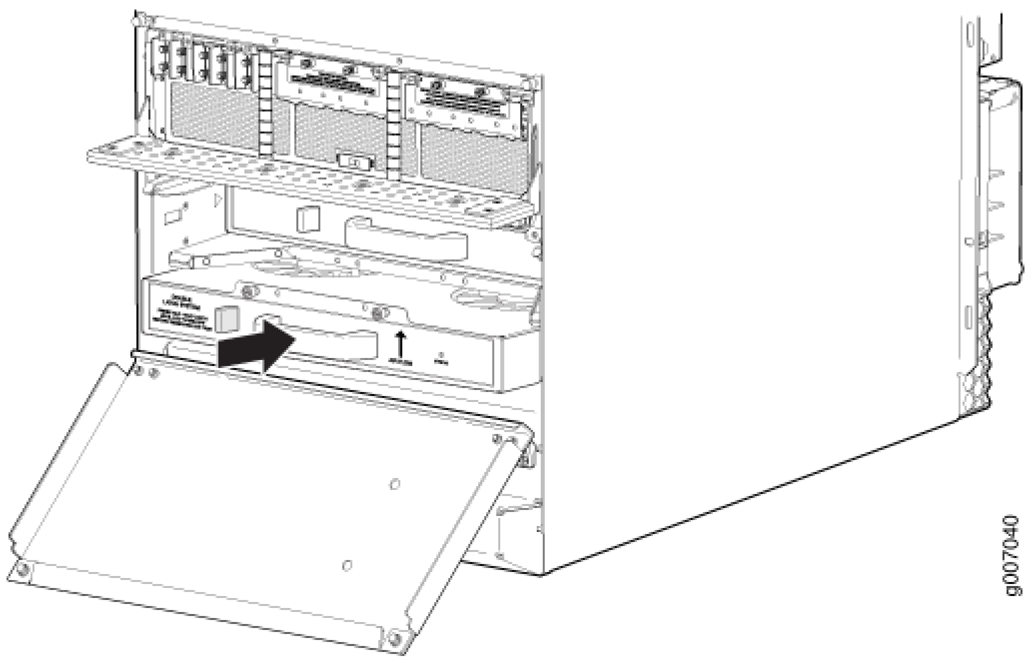


Figure 134: Reinstalling Lower Fan Trays



Reinstalling the SFBs

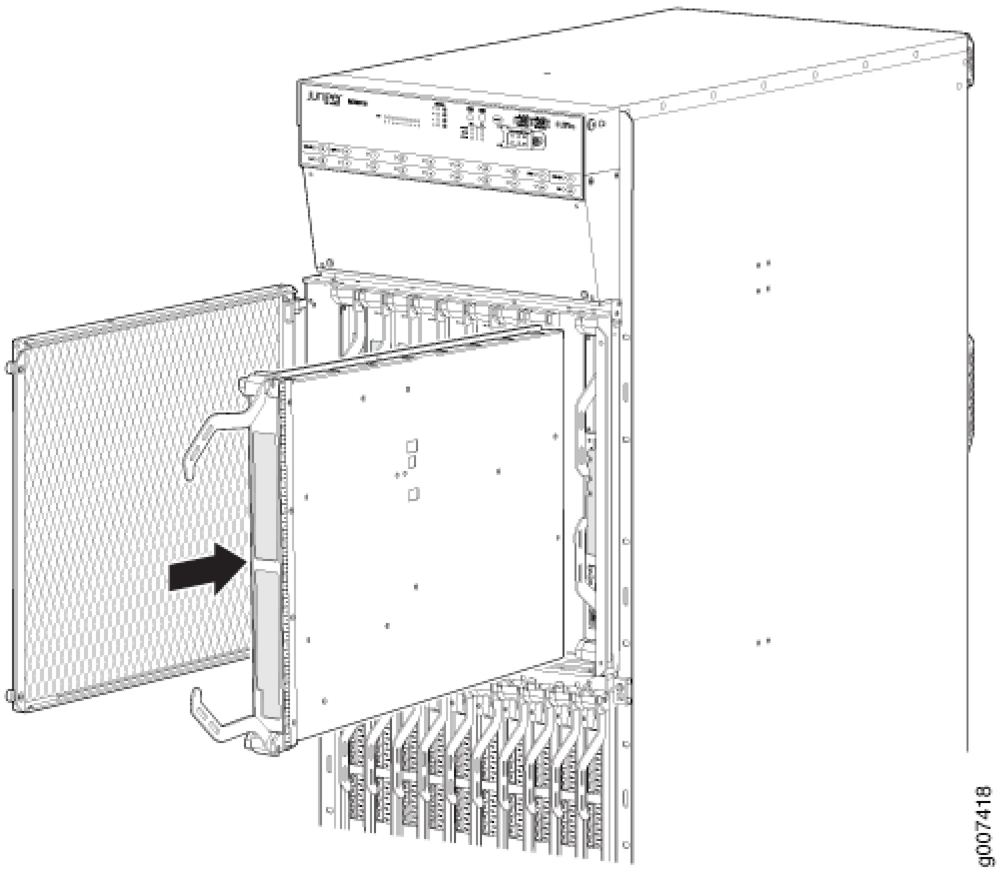
To reinstall an SFB (see Figure 135 on page 358):

CAUTION: Before removing or replacing an SFB, ensure that the ejector handles are stored horizontally and pressed toward the center of the SFB.

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. Take each SFB to be installed out of its electrostatic bag, and identify the slot on the SFB where it will be connected.
3. Carefully align the sides of the SFB with the guides inside the chassis.
4. Slide the SFB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles, and gently close them inward simultaneously until the SFB is fully seated.
6. Place the ejector handles in their proper position, vertically, and toward the center of the board.

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

Figure 135: Reinstalling an SFB

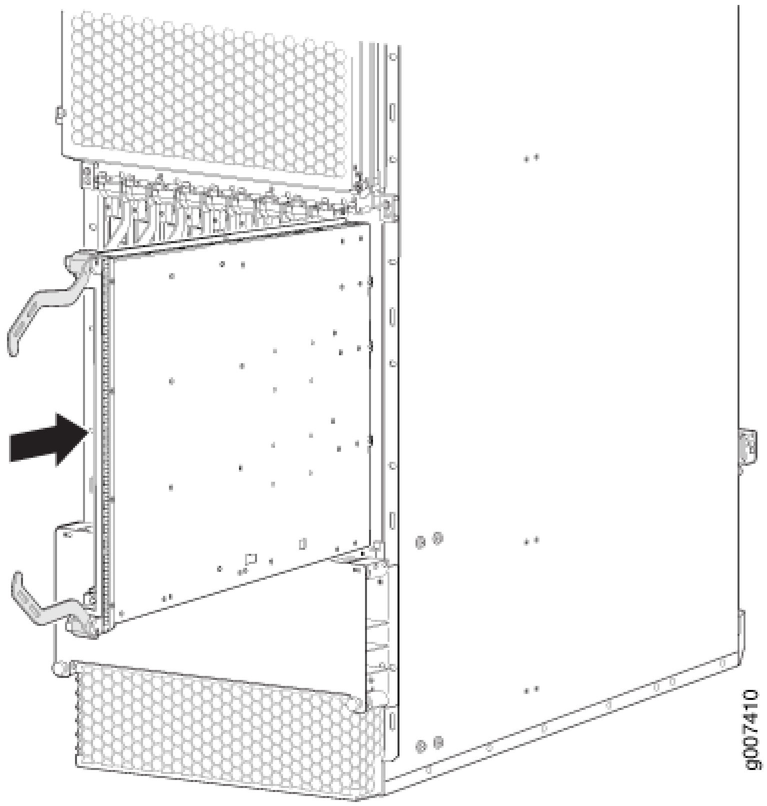


Reinstalling the Adapter Card

To reinstall an adapter card (see Figure 136 on page 359):

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. Take each adapter card to be installed out of its electrostatic bag, and identify the slot where it will be installed.
3. Locate the slot in the card cage in which you plan to install the adapter card.
4. Ensure that the adapter card is right-side up, with the text on the faceplate facing upward.
5. Lift the adapter card into place, and carefully align first the bottom, and then the top of the adapter card with the guides inside the card cage.
6. Slide the adapter card all the way into the card cage until you feel resistance.
7. Grasp both ejector handles, and gently close them inward simultaneously until the adapter card is fully seated.

Figure 136: Reinstalling an Adapter Card

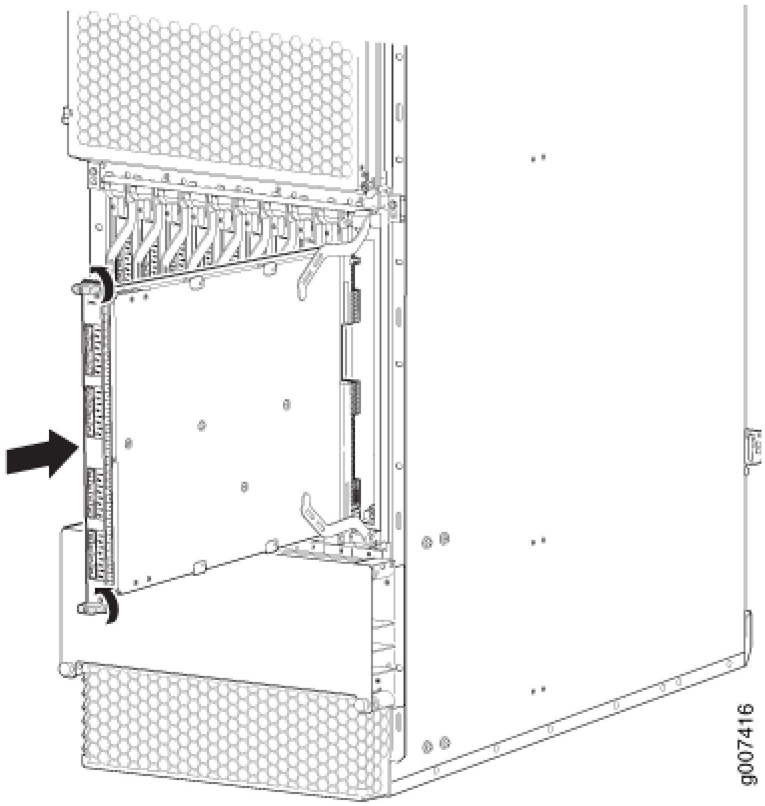


Reinstalling the MPCs

To reinstall an MPC (see Figure 137 on page 360):

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. Take each MPC to be installed out of its electrostatic bag, and identify the slot where it will be connected.
3. Verify that each fiber-optic MPC has a rubber safety cap covering the transceiver. If it does not, cover the transceiver with a safety cap.
4. Locate the slot in the adapter card in which you plan to install the MPC.
5. Ensure that the MPC is right-side up, with the text on the faceplate facing upward.
6. Lift the MPC into place, and carefully align first the bottom, and then the top of the MPC with the guides inside the adapter card.
7. Slide the MPC all the way into the adapter card until you feel resistance.
8. Turn both knobs and rotate them simultaneously clockwise until the MPC is fully seated into the adapter card.

Figure 137: Reinstalling an MPC

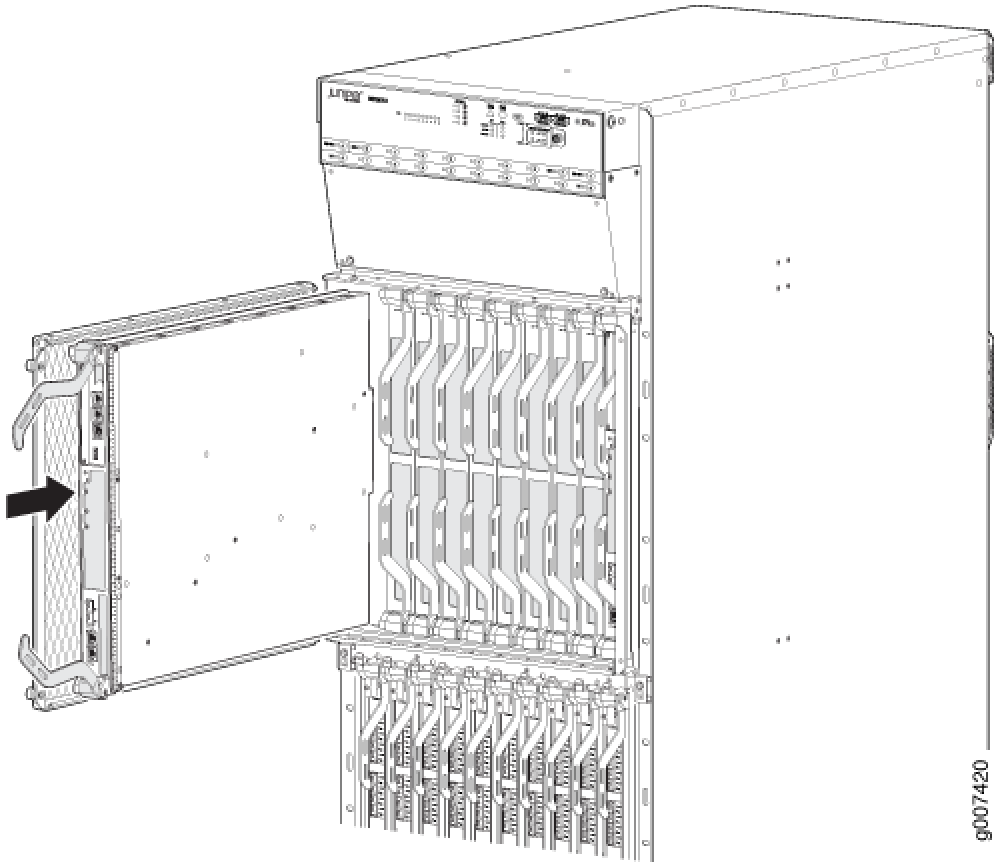


Reinstalling the CB-REs

To reinstall a CB-RE (see Figure 138 on page 361):

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. Take each CB-RE to be installed out of its electrostatic bag, and identify the slot on the CB-RE where it will be connected.
3. Verify that each fiber-optic CB-RE has a rubber safety cap covering the transceiver. If it does not, cover the transceiver with a safety cap.
4. Locate the slot in the CB-RE card cage in which you plan to install the CB-RE.
5. Ensure that the CB-RE is right-side up, with the text on the faceplate of the CB-RE facing upward.
6. Lift the CB-RE into place, and carefully align first the bottom, then the top of the CB-RE with the guides inside the card cage.
7. Slide the CB-RE all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.

Figure 138: Reinstalling a CB-RE



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Installing the MX2010 Router Using a Pallet Jack with Attachment | 316

CHAPTER 19

Connecting the Router to Power

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- Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364
- Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | 368
- Connecting Power to an MX2000 Single-Phase AC Power Distribution Module | 372
- Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers | 374
- Connecting Power to a DC-Powered MX2010 Router with Power Distribution Modules (-48 V) | 377
- Connecting Power to a DC-Powered MX2000 Router with DC Power Distribution Modules (240 V China) | 382
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Grounding an MX2000 Router

To ground the router, you need the following tools:

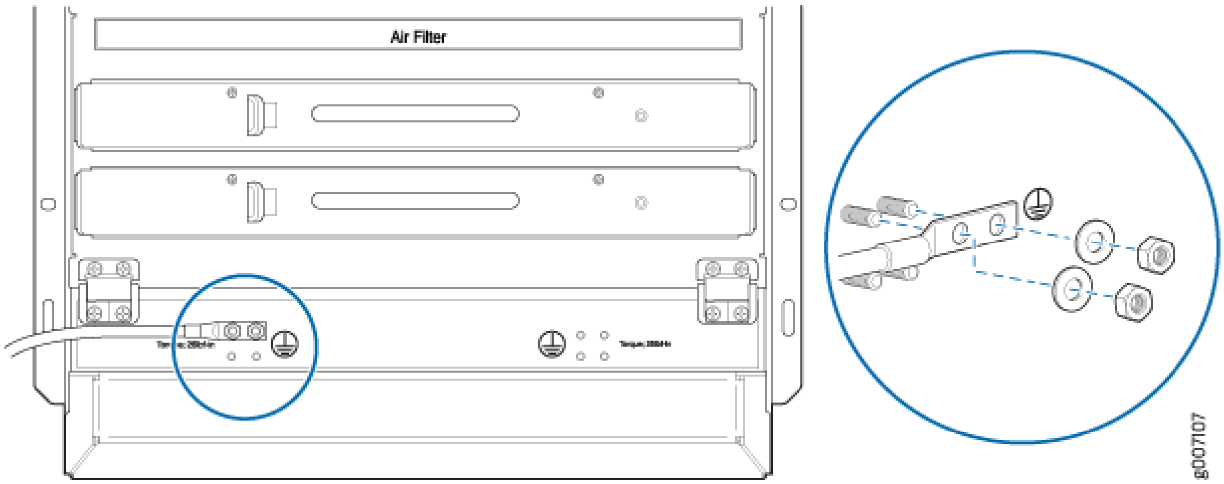
- Phillips (+) screwdriver, number 2
- ESD grounding wrist strap
- Two UNC 1/4–20 nuts and washers
- Grounding lug, 4-AWG for 80-A input or 60-A input

NOTE: You must install the MX2020 router in a restricted-access location and ensure the chassis is properly grounded at all times. The chassis has a 2-hole protective grounding terminal provided on the chassis, see Figure 139 on page 364. 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 2-hole lug ground connection. This tested system meets or exceeds all applicable EMC regulatory requirements with the 2-hole protective grounding terminal.

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points by using two screws. To connect the grounding cable (see Figure 139 on page 364):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Ensure that all grounding surfaces are clean and brought to a bright finish before you make grounding connections.
3. Connect the grounding cable to a proper earth ground.
4. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
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. Place the grounding cable lug over one of the grounding points on the rear of the chassis. The upper pair is sized for UNC 1/4-20 nuts, and the lower pair is sized for M6 nuts.
7. Secure the grounding cable lug to the grounding points, first with the washers, and then with the nuts.
8. Verify that the grounding cabling is correct, that the grounding cable does not touch or block access to router components, and that it does not drape where people could trip on it.

Figure 139: Connecting the Grounding Cable



RELATED DOCUMENTATION

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Prevention of Electrostatic Discharge Damage

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules

CAUTION: Do not mix AC and DC power modules within the same router.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

WARNING: Power connections must be performed by a licensed electrician only.

You connect AC power to the router with three-phase delta AC power distribution modules (PDMs) by connecting the AC power cord from an AC PDM to an AC power source.

To connect an AC power cord to an AC power source:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Switch off the dedicated customer-site circuit breakers. Ensure that the voltage across the AC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Detach the ESD grounding strap from the approved site ESD grounding point, and connect the strap to one of the ESD points on the chassis.
4. Move the power switches on all the power supply module (PSM) faceplates to the off (**O**) position.
5. Verify that the correct three-phase delta PDMs are installed and secured in the chassis before connecting power cables.

   > **NOTE**: The power cables must be uninstalled and removed from the three-phase delta PDM before removal of the PDM from the chassis.

6. Using a number 2 Phillips (+) screwdriver, unscrew the four captive screws located on either side of the metal AC wiring compartment (four screws total per PDM).
7. Remove the metal cover of the metal AC wiring compartment.
8. Unscrew the retaining nut from the AC power cord.
9. Place the retaining nut inside the metal wiring compartment.
10. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
11. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
12. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 140 on page 366). Loosen the input terminal or grounding point screw, insert each wire into the grounding point input terminal, and tighten the screw (see Table 95 on page 367 for approved AC wire gauge).

    > **NOTE**: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

    To connect wires to the terminal block that serves six PSMs:

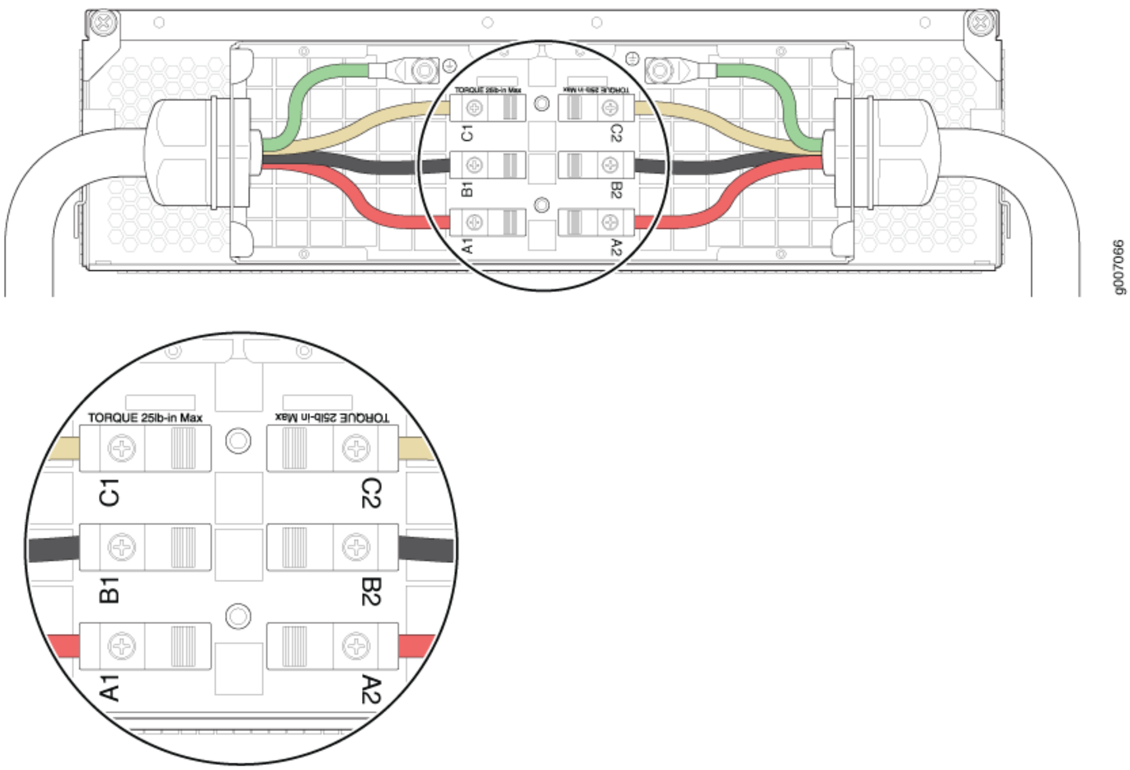
    a. Insert the grounding wire into the grounding point labeled **GND**.

    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

Figure 140: Connecting Power to a Three-Phase Delta AC Power Distribution Module



NOTE: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure you use the proper connections.

To connect wires to the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

> **WARNING**: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment apply AC voltage to the PDM (with disengaged PSM) make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-B1, B1-C1, C1-A1, A2-B2, B2-C2, and C2-A2 for three-phase delta PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker, de-energizing the PDM, and install the metal cover and engage all AC PSMs.

> **NOTE**: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws

> **NOTE**: Three-phase delta AC wire assembly kits can be purchased from Juniper Networks.

Table 95: Supported Three-Phase Delta AC Wire Gauge

Wire Gauge	Description
4 x 6-AWG or equivalent	4 conductor wires, each wire is 6-AWG

> **NOTE**: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring results in the cable clamps not tightening properly.

> **WARNING**: Power connections must be performed by a licensed electrician only.

13. Verify that the power cable connections are correct.
14. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.

15. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
16. Use the provided plastic cable tie to fasten the AC power cord to the PDM.
17. 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.
18. Repeat the procedure for the other three-phase delta AC PDMs.

RELATED DOCUMENTATION

MX2000 Three-Phase Delta AC Power Distribution Module Description | **129**

MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | **136**

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers | **229**

Powering On a Three-Phase AC-Powered MX2000 Router

MX2000 AC Power System Electrical Specifications | **218**

MX2000 AC Power Cord Specifications | **214**

Prevention of Electrostatic Discharge Damage

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules

CAUTION: Do not mix AC and DC power distribution modules (PDMs) within the same router.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

WARNING: Power connections must be performed by a licensed electrician only.

To connect an AC power cord to an AC power source:

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

2. Switch off the dedicated customer-site circuit breakers. Ensure that the voltage across the AC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Detach the ESD grounding strap from the approved site ESD grounding point, and connect the strap to one of the ESD points on the chassis.
4. Move the power switches on all the power supply module (PSM) faceplates to the off (**O**) position.
5. Verify that the correct three-phase wye PDMs are installed and secured in the chassis before connecting power cables.

   NOTE: The power cables must be uninstalled and removed from the three-phase wye PDM before removal of the PDM from the chassis.

6. Using a number 2 Phillips (+) screwdriver, unscrew the four captive screws located on the either side of the metal AC wiring compartment (four screws total on each PDM).
7. Remove the metal cover of the metal AC wiring compartment.
8. Unscrew the retaining nut from the AC power cord.
9. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
10. Insert the wires of the AC power cord through the hole of the metal compartment.
11. Connect the wires to the AC terminal block on the three-phase wye AC PDM (see Figure 141 on page 370). Loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw (see Table 96 on page 371 for approved AC wire gauge).

    NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

    To connect wires to the terminal block that serves six PSMs:

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

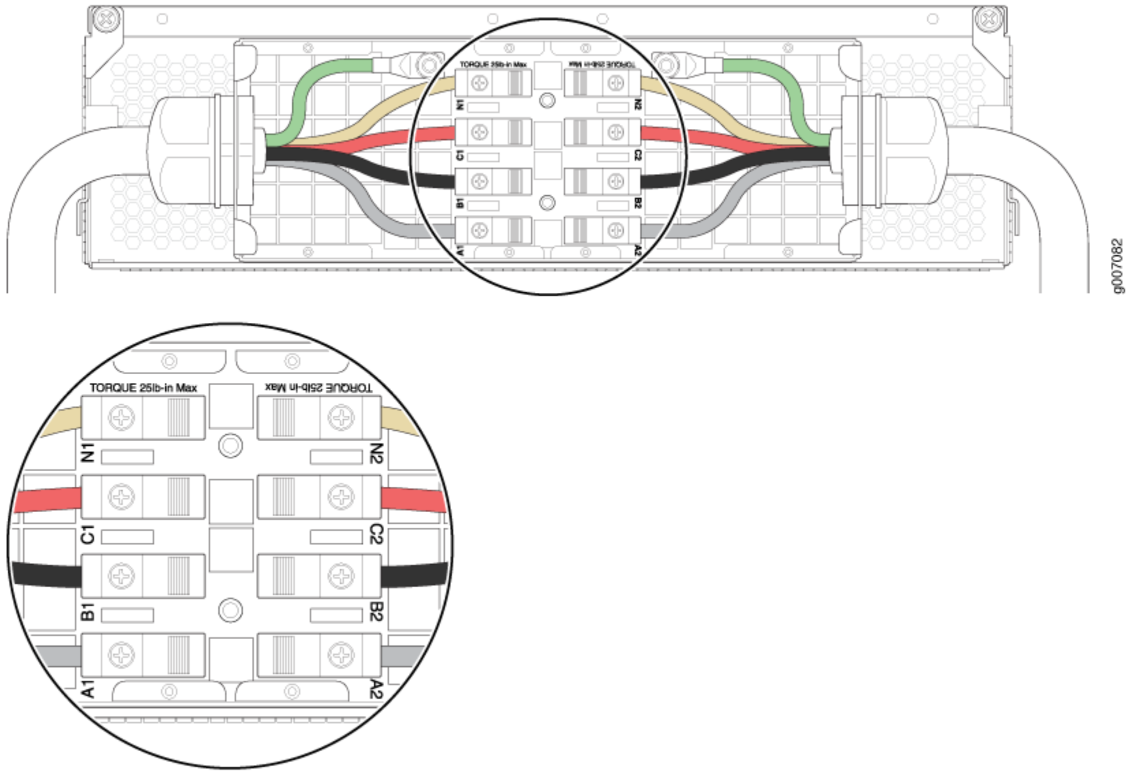
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

    e. Insert the wire labeled **N** into the input terminal labeled **N1**.

Figure 141: Connecting Power to a Three-Phase Wye AC Power Distribution Module



> **NOTE**: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

> **NOTE**: The color of each AC power wire might vary. The MX2000 series chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

> **CAUTION**: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure you use the proper connections.

To connect wires to the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

e. Insert the wire labeled **N** into the input terminal labeled **N2**.

> **WARNING**: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with disengaged PSM) and make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker, de-energizing the PDM, and install the metal cover and engage all AC PSMs.

> **NOTE**: Three-phase wye AC wire assembly kits can be purchased from Juniper Networks.

Table 96: Supported Three-Phase Wye AC Wire Gauge

Wire Gauge	Description
5 x 10-AWG or equivalent	5 conductor wires, each wire is 10-AWG

> **NOTE**: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring results in the cable clamps not tightening properly.

> **WARNING**: Power connections must be performed by a licensed electrician only.

12. Verify that the power cable connections are correct.
13. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.
14. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
15. Use the provided plastic cable tie to fasten the AC power cord to the PDM.

16. 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.
17. Repeat the procedure for the other three-phase wye AC PDMs.

RELATED DOCUMENTATION

MX2000 Three-Phase Wye AC Power Distribution Module Description | 131
MX2000 Three-Phase Delta AC Power Distribution Module Description | 129
MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | 136
Powering On a Three-Phase AC-Powered MX2000 Router
MX2000 AC Power System Electrical Specifications | 218
MX2000 AC Power Cord Specifications | 214
Prevention of Electrostatic Discharge Damage

Connecting Power to an MX2000 Single-Phase AC Power Distribution Module

CAUTION: Do not mix AC and DC power distribution modules (PDMs) within the same router.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

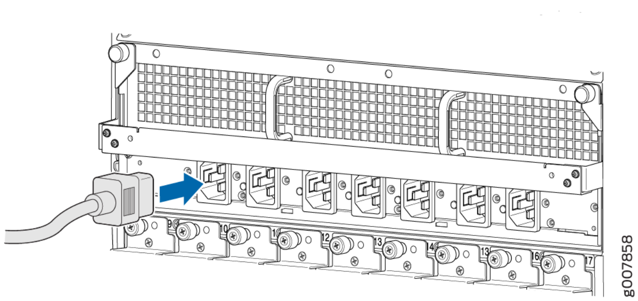
To connect an AC power cord to a single-phase seven-feed or nine-feed AC power distribution module (PDM):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Switch off the dedicated customer-site circuit breakers. Ensure that the voltage across the AC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Detach the ESD grounding strap from the approved site ESD grounding point, and connect the strap to one of the ESD points on the chassis.
4. Move the power switch to the off (**O**) position on the PSM(s) that will be powered by the AC PDM.

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

5. If a power cord retainer is installed on the PDM, remove the two thumb screws holding it in place and remove the power cord retainer.
6. Plug the power cords into the power sockets on the PDM. Refer to Figure 142 on page 373. Apply slight pressure so that the power cords are firmly seated in the power socket. As you plug in each power cord, the power LED for the socket lights up green.

Figure 142: Plugging into the MX2000 Single-Phase AC Power Distribution Module



7. Replace the power cord retainer, making sure the power cords do not touch or block access to router components.
8. Flip the power switch on each PSM to the on (|) position to provide power to the router components.
9. Verify that the LEDs on the PDM faceplate are lit steadily green, indicating that the AC terminal block is receiving power.
10. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.

WARNING: Do not touch the power connectors on the PDM. They can contain dangerous voltages.

RELATED DOCUMENTATION

Installing an MX2000 Single-Phase AC Power Distribution Module | 494

Removing an MX2000 Single-Phase AC Power Distribution Module

MX2000 Single-Phase AC Power Distribution Module Electrical Specifications | 224

Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router | 812

MX2000 AC Power Cord Specifications | 214
MX2000 AC Power System Electrical Specifications | 218
MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description | 134
MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description | 135

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers

You connect AC power to the router by connecting two AC power cords to each AC PDM. One feed maps to six PSMs and the other maps to three PSMs. Figure 143 on page 374 shows the mapping for the MX2010 and Figure 144 on page 375 shows the mapping for the MX2020. The arrangement matches the internal components of the PDM. Table 97 on page 376 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1** (MX2010 and MX2020). Table 98 on page 376 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1** (MX2020 only).

Figure 143: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2010)

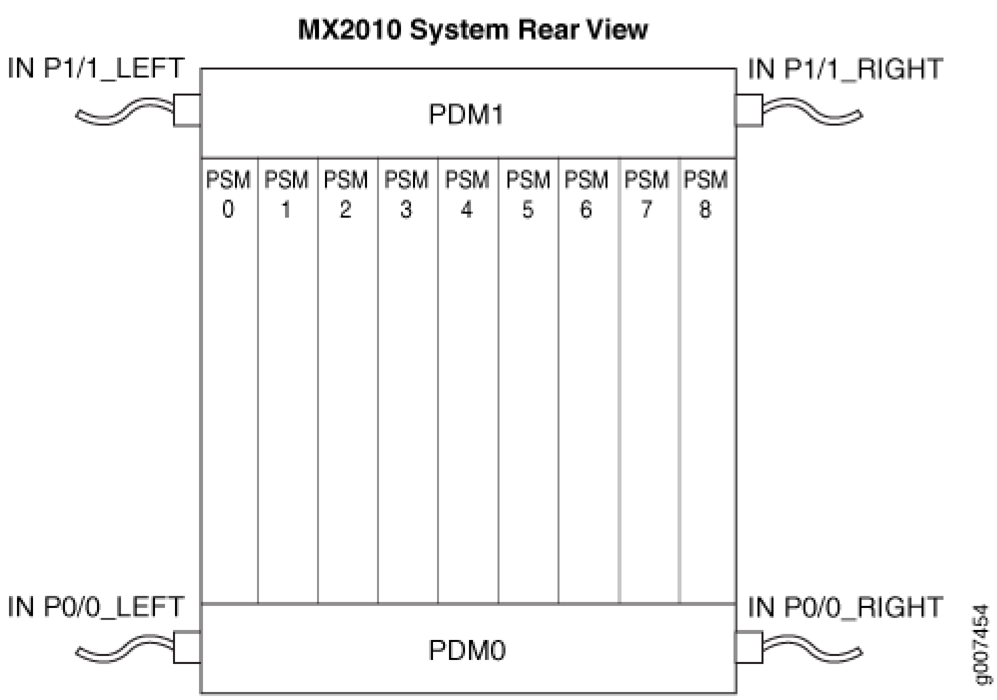


Figure 144: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2020)

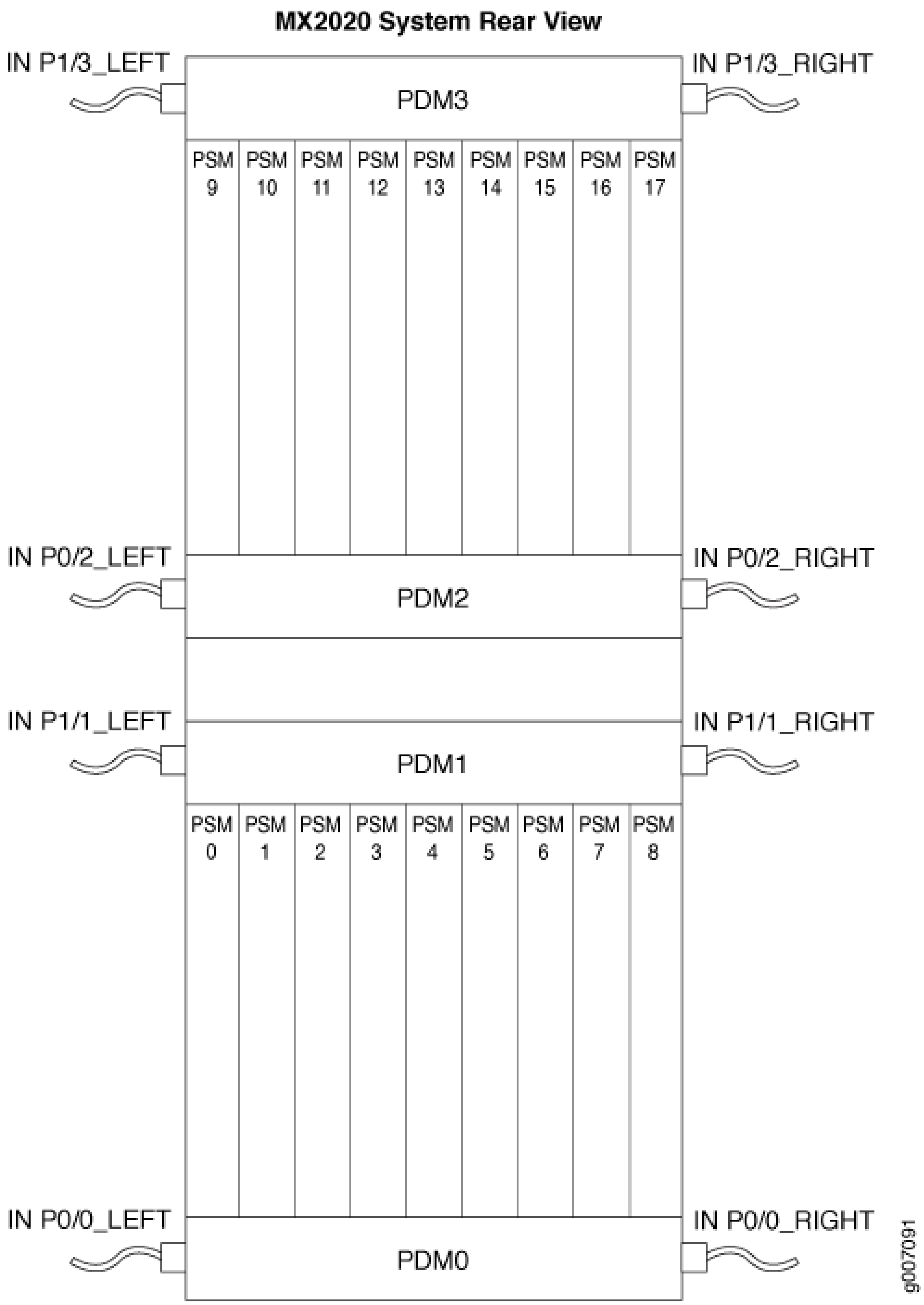


Table 97: Input AC Power Mapping for PDM0 and PDM1

PDM0/Input0 (Left)	PDM0/Input0 (Right)	PDM1/Input1 (Left)	PDM1/Input1 (Right)
PSM0	PSM3	PSM0	PSM6
PSM1	PSM4	PSM1	PSM7
PSM2	PSM5	PSM2	PSM8
–	PSM6	PSM3	–
–	PSM7	PSM4	–
–	PSM8	PSM5	–

Table 98: Input AC Power Mapping for PDM2 and PDM3

PDM2/Input0 (Left)	PDM2/Input0 (Right)	PDM3/Input1 (Left)	PDM3/Input1 (Right)
PSM9	PSM12	PSM9	PSM15
PSM10	PSM13	PSM10	PSM16
PSM11	PSM14	PSM11	PSM17
–	PSM15	PSM12	–
–	PSM16	PSM13	–
–	PSM17	PSM14	–

BEST PRACTICE: To achieve complete redundancy when you have two power sources, such as Source A and Source B, we recommend that you connect them as follows:

- Connect Source A to PDM0-left and PDM0-right
- Connect Source B to PDM1-left and PDM1-right

RELATED DOCUMENTATION

Powering On a Three-Phase AC-Powered MX2000 Router

Connecting Power to a DC-Powered MX2010 Router with Power Distribution Modules (-48 V)

WARNING: Before performing 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 switch handle of the circuit breaker in the **OFF** position.

You connect DC power to the router by attaching power cables from the external DC power sources to the terminal studs on the PDM faceplates. You must provide the power cables (the cable lugs are not supplied with the router).

To connect the DC source power cables to the router:

1. Switch off the dedicated customer-site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

   NOTE: If the PSMs are installed in the router, make sure that the power switches on all PSMs are turned to the off (**O**) position.

3. Move the DC circuit feed switch on the PDM faceplate to match the current rating amperage—**60 A** or **80 A**—for each feed.

NOTE: The switch position applies to all inputs of this PDM. Selecting the 60 A position might reduce power output capacity available from each PSM.

NOTE: The type of feed that you use on the DC PDM (60 A or 80 A) depends on the distribution scheme and distribution equipment. With a 60-A feed, the maximum power supply output power is limited to 2100 W while the maximum power supply input power is limited to 2400 W. With an 80-A feed, the maximum power supply output is limited to 2500 W while maximum power supply input power is limited to 2800 W. The system power management software calculates the available and used power based on DIP switch positions in the PDM.

4. Loosen the captive screws on the plastic cable restraint on the lower edge of the power faceplate. The cable restraint is set on hinges that hold the cover in place during cable installation.

   NOTE: You can remove the plastic cover for DC power cable installation by bending the plastic cable restraint cover until the two plastic pins on both sides of the housing unhinge.

5. Verify that the DC power cables are correctly labeled before making connections to the PDM. In a typical power distribution scheme where the return is connected to chassis ground at the battery plant, you can use a multimeter to verify the resistance of the **–48V** and **RTN** DC cables to chassis ground:

   - The cable with very large resistance (indicating an open circuit) to chassis ground is **–48V**.
   - The cable with very low resistance (indicating a closed circuit) to chassis ground is **RTN**.

   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 DC PDM.

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

   To install heat-shrink tubing:

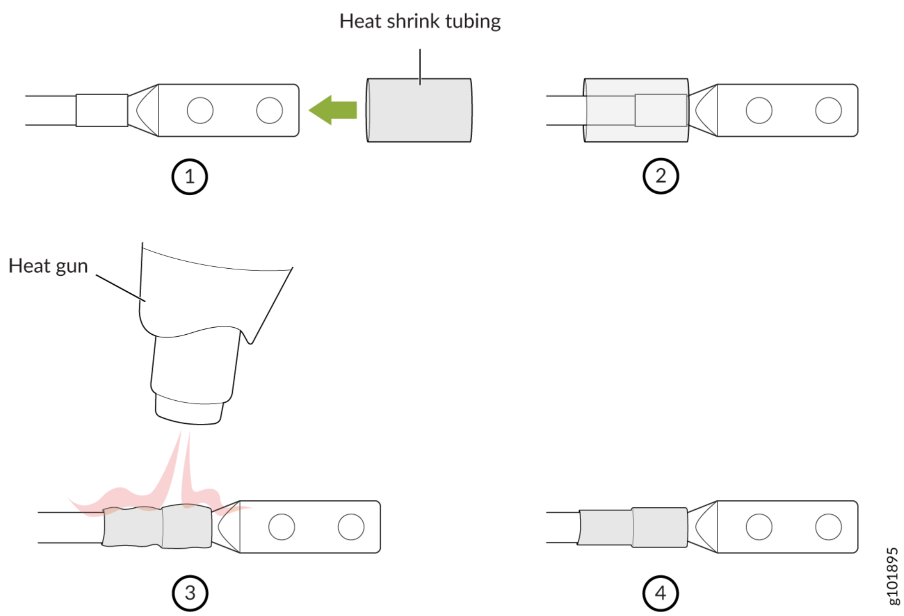
   a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

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 145 on page 379 is a representational diagram that shows the steps to install heat-shrink tubing.

NOTE: Do not overheat the tubing.

Figure 145: How to Install Heat-Shrink Tubing



7. Remove the cover protecting the terminal studs on the faceplate.
8. Remove the nut and washers from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)
9. Secure each power cable lug to the terminal studs, first with the flat washer, then with the split washer, and then with the nut (see Figure 146 on page 381). Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)

NOTE: The input positions for the **RTN** (return) DC terminal studs and the **-48V** (input) DC terminal studs correspond to the DC Power Supply Module (PSM) directly above and below.

The DC PSM slot positions are labeled, but the DC PDM cable positions that correlate to the PSM positions are not labeled.

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

b. Secure each negative (–) DC source power cable lug to the **–48V** (input) terminal.

CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when the nut is improperly threaded might result in damage to the terminal stud.

CAUTION: The maximum torque rating of the terminal studs on the DC PDM is 25 lb-in. (33.89 Nm). The terminal studs might be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC PDM terminal studs.

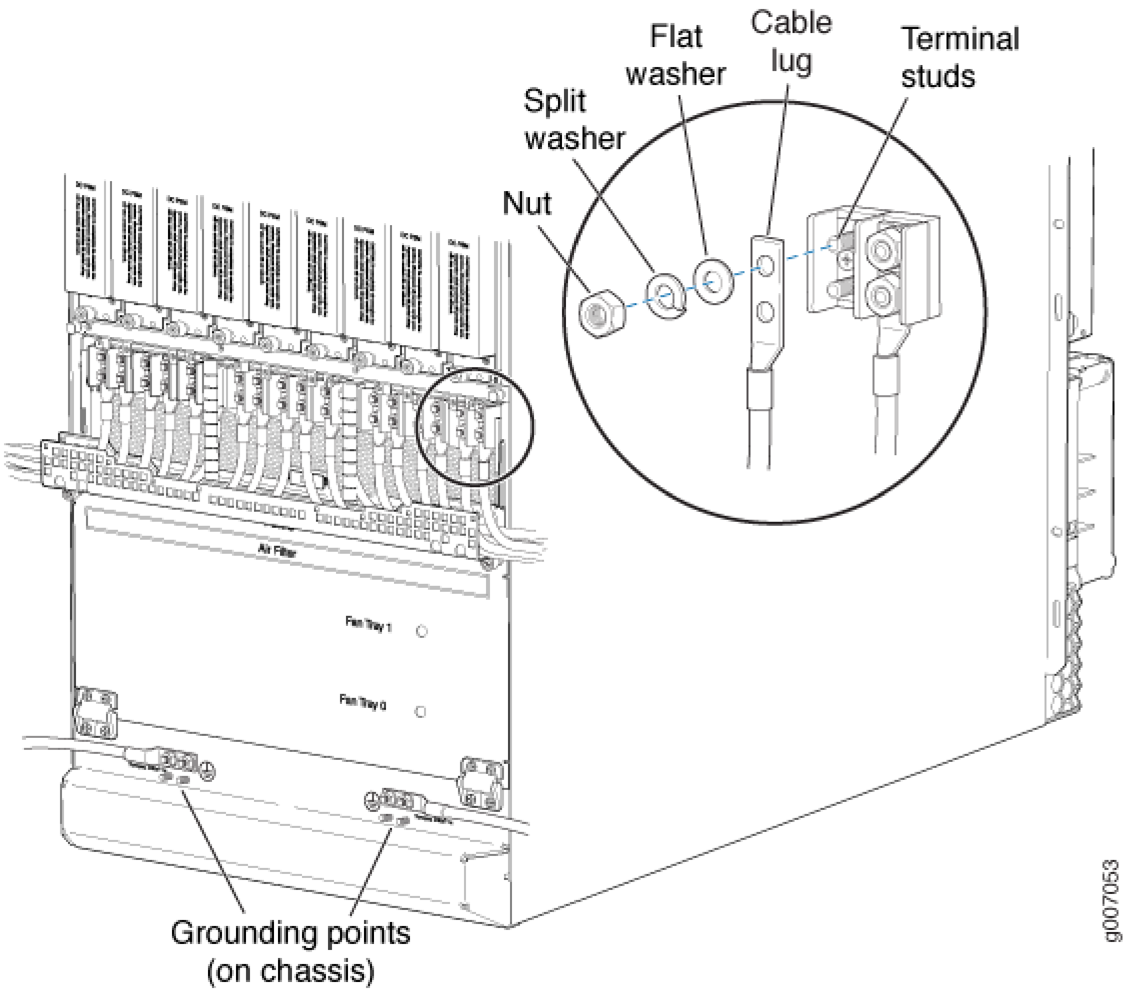
NOTE: The DC PDMs in slots **PDM0/Input0** and **PDM1/Input1** can be powered by dedicated power feeds derived from feed **A**or feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system to balance the power draw.

10. Close the plastic cable restraint cover over the terminal studs on the faceplate.
11. Route the positive and negative DC power cables through the left and right sides of the cable restraint.
12. Tighten the cable restraint captive screw to hold the power cables in place.

CAUTION: The maximum torque rating of the cable restraint screws on the DC PDM is 25 lb-in. (33.89 Nm). Use only a torque-controlled screwdriver to tighten screws on the DC PDM cable restraint.

13. Verify that the power cables are connected correctly, that they are not touching or blocking access to router components, and that they do not drape where people could trip on them.
14. Repeat Steps 3 through 13 for the remaining PDMs.

Figure 146: Connecting DC Power to the MX2010 Router



> ⚠ **CAUTION**: The MX2010 router has more than one connection to power after it is fully connected. Disconnect all power sources before servicing the PSMs or PDMs to avoid electrical shock.

RELATED DOCUMENTATION

DC Power Cable Specifications for the MX2010 Router | 255

Preventing Electrostatic Discharge Damage to an MX Series Router

Powering On the DC-Powered MX2010 Router | 390

Connecting Power to a DC-Powered MX2000 Router with DC Power Distribution Modules (240 V China)

WARNING: Before performing 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 switch handle of the circuit breaker in the **OFF** position.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

You connect DC (240 V China) power to the router by attaching power cables from the external DC power sources to the DC power cable that is connected to the PDM. The power cables are orderable (CBL-PWR-240V-CH).

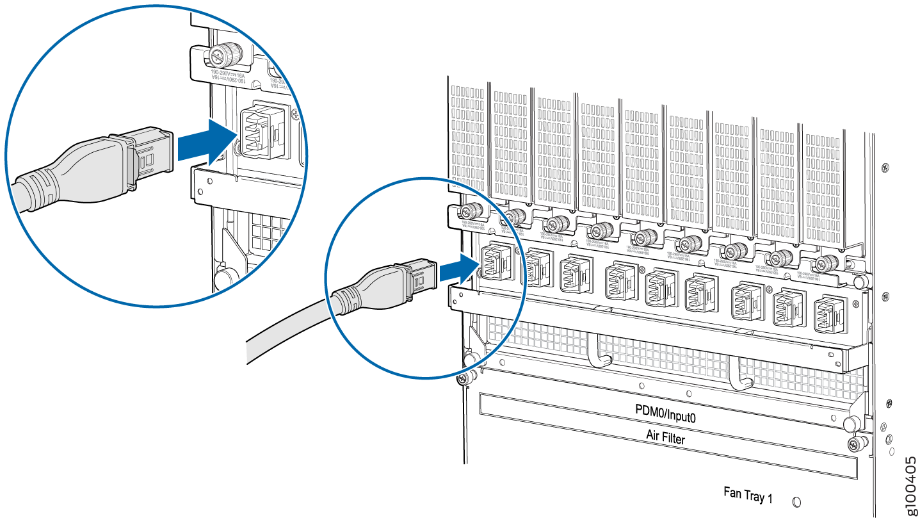
To connect the DC (240 V China) source power cables (CBL-PWR-240V-CH) to the router:

1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

   NOTE: If the DC PSMs (240 V China) are installed in the router, make sure the power switches on all PSMs are turned to the off (**O**) position.

3. Plug the power cord into the power sockets on the DC PDM (240 V China). Refer to Figure 1. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green.

Figure 147: Connecting Power



4. Connect the power cords for the remaining PDMs.

Connecting Power to a High Voltage-Powered MX2000 Router with Power Distribution Modules

> **WARNING**: Before performing 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 switch handle of the circuit breaker in the **OFF** position.

> **NOTE**: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

You connect AC or DC power to the router by connecting the power cord from a universal (HVAC/HVDC) PDM to an AC or DC power source. See *MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications* for the list of supported power cords.

To connect the DC or AC source power cables to the router:

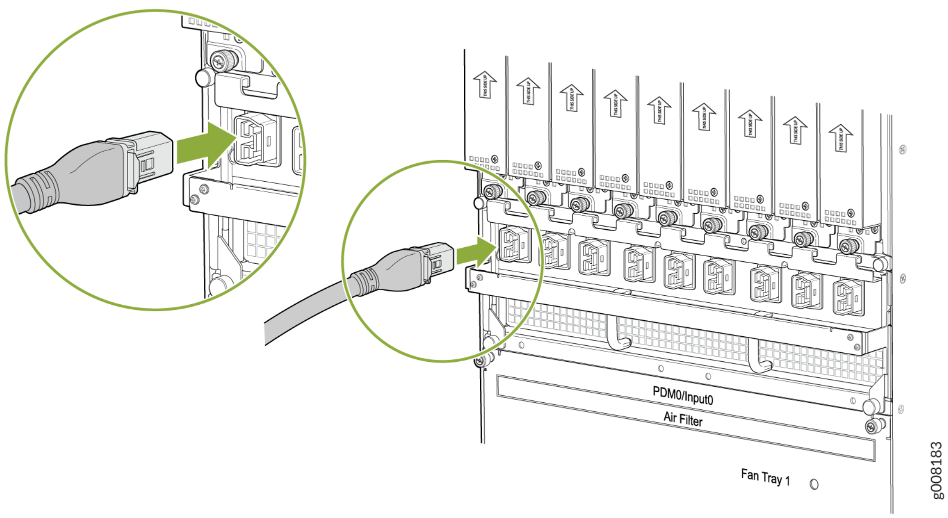
1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the AC or DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.

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

> **NOTE**: If the PSMs are installed in the router, make sure the power switches on all PSMs are turned to the off (**O**) position.

3. Plug the power cord into the power sockets on the high-voltage second-generation universal (HVAC/ HVDC) PDM . See Figure 1. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green.

Figure 148: Connecting Power to the Universal (HVAC/HVDC) PDM



4. Connect the power cords for the remaining PDMs.

Connecting an MX2000 DC Router Power Distribution Module (-48 V) Cable

> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

To connect a power cable for a DC PDM:

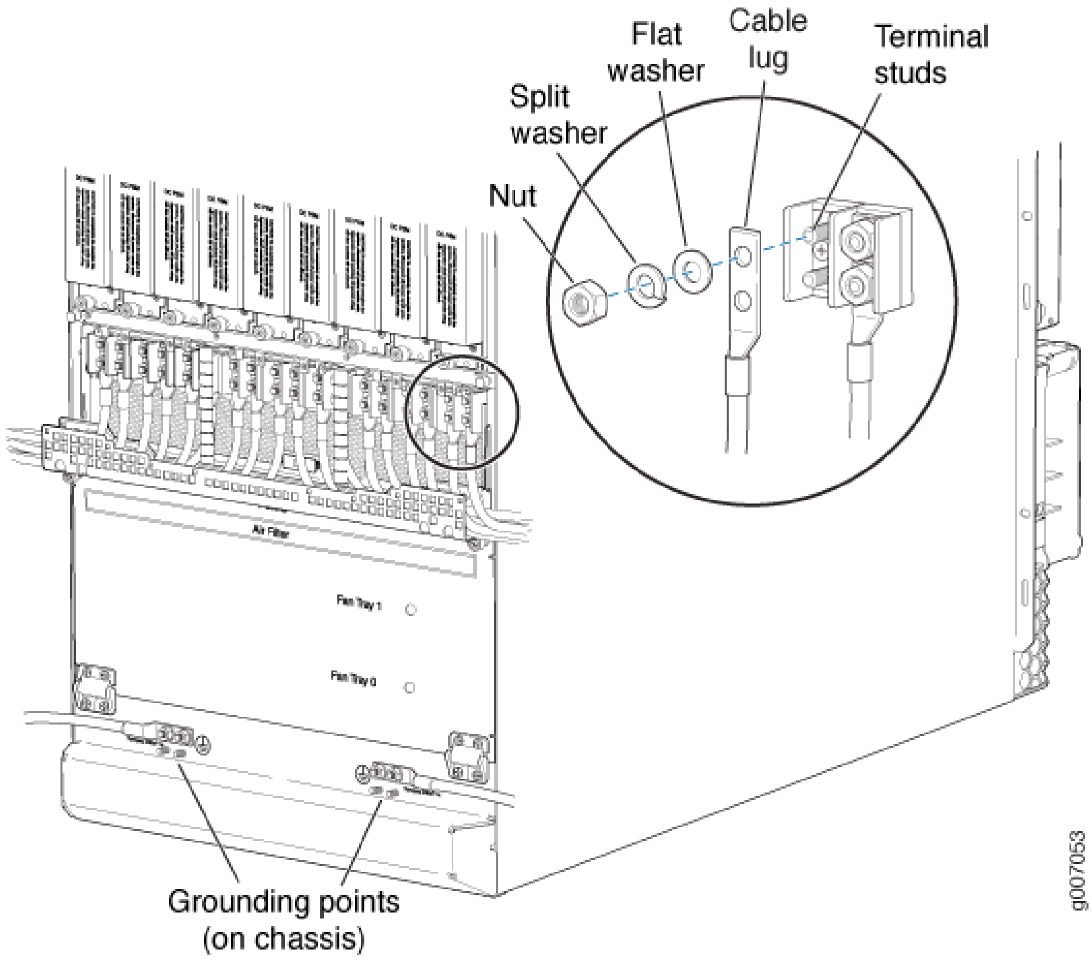
1. Locate a replacement power cable that meets the specifications defined in *MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications*.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the **–48V** LED is off.
4. Secure the power cable lug to the terminal studs, first with the flat washer, then the split washer, and finally with the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut (see Figure 149 on page 386). Do not overtighten the nut. (Use a 7/16-in. [11 mm)] torque-controlled driver or socket wrench.)

   NOTE: The input positions for the **RTN** (return) DC terminal studs and the **-48V** (input) DC terminal studs correspond to the DC Power Supply Module (PSM) directly above and below. The DC PSM slot positions are labeled, but the DC PDM cable positions that correlate to the PSM positions are not labeled.

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

   b. Attach the negative (–) DC source power cable lug to the **–48V** (input) terminal.

Figure 149: Connecting Power Cables to the DC Power Distribution Module (-48 V)



CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when the nut is improperly threaded may result in damage to the terminal stud.

CAUTION: The maximum torque rating of the terminal studs on the DC PDM is 25 lb-in. (33.89 Nm). The terminal studs may be damaged if excessive torque is applied.

Use only a torque-controlled driver or socket wrench to tighten nuts on the DC PDM terminal studs.

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

NOTE: The DC PDMs in slots **PDM0/Input0**, **PDM2/Input0**, (and **PDM1/Input1**, and **PDM3/Input1** on MX2020 Routers) can be powered by dedicated power feeds derived from feed **A**, or feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system to balance the power draw. For information about connecting to DC power sources, see *MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications*.

NOTE: Make sure the amperage switch is set to 60 A or 80 A to match the DC circuit input feed.

5. Route the positive and negative DC power cables through the plastic cable restraint cover. Make sure that the cable does not touch or obstruct any router components.
6. Verify that the power cabling is correct, that the cables are not touching, and that they do not block access to router components or drape where people could trip on them.
7. Attach the power cable to the DC power source.
8. Switch on the dedicated customer site circuit breaker.
9. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

NOTE: The circuit breaker may bounce back to the off position if you move the breaker too quickly.

10. Verify that the **–48V** LED on the PDM is lit steadily.
11. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

NOTE: The circuit breaker may bounce back to the **OFF** position if you move the breaker too quickly.

12. Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the **–48V** LEDs light green steadily.

Connecting an MX2000 DC Router Power Distribution Module (240 V China) Cable

WARNING: Before performing DC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

To connect the DC (240 V China) source power cables (CBL-PWR-240V-CH) to the router:

1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

   NOTE: If the DC PSMs (240 V China) are installed in the router, make sure the power switches on all PSMs are turned to the off (**O**) position.

3. Plug the power cord into the power sockets on the DC PDM (240 V China). Refer to Figure 1. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green.

Figure 150: Connecting Power

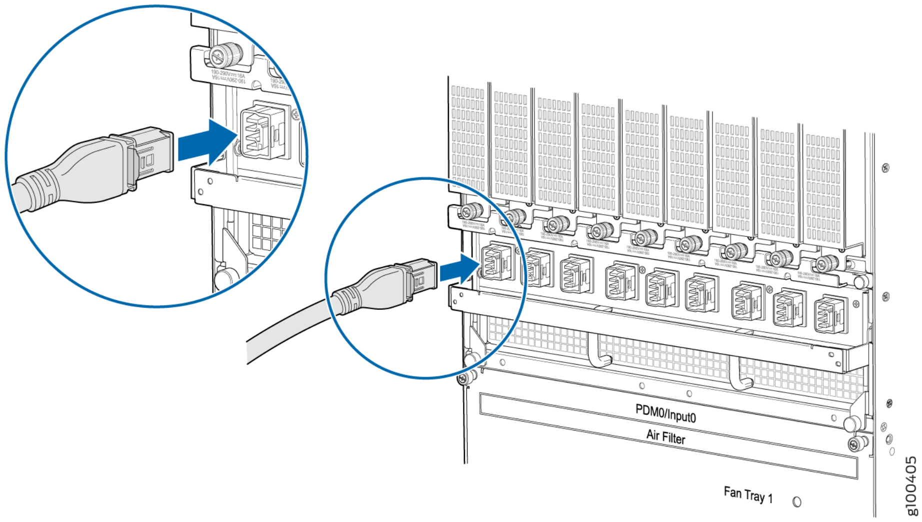
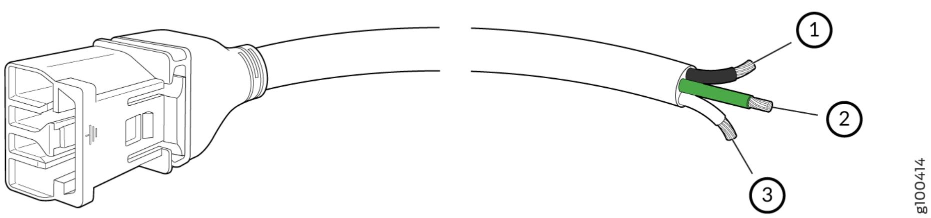


Figure 151: Unplugging the 240 V China Power Cord an MX2000 Router

4. Connect the power cords for the remaining PDMs.
5. Connect the power cable (CBL-PWR-240V-CH) to the DC power source. See Figure 152 on page 389.

Figure 152: 240 V China Power Cable



1– Negative	3– Positive
2– Ground	

6. Switch on the dedicated customer site circuit breaker.
7. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

NOTE: The circuit breaker may bounce back to the off position if you move the breaker too quickly.

8. Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the LEDs light green steadily.
9. On each of the DC PSMs, move the switch to the on (|) position.

Powering On the DC-Powered MX2010 Router

To power on a DC-powered MX2010 router:

1. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board and Routing Engine (CB-RE) (**AUX**, **CONSOLE**, or **MGMT**).
2. Turn on power to the external management device.
3. Verify that the PDMs are fully inserted in the chassis.
4. Verify that the source power cables are connected to the appropriate terminal on the PDMs: the positive (+) source cable to the return terminal labeled (**RTN**) and the negative (–) source cable to the input terminal labeled (**–48V**).
5. Switch on the dedicated customer-site circuit breakers to provide power to the DC power cables. Follow your site's procedures.
6. Check that the input labeled (**–48V**) LEDs are lit green steadily, indicating that the PDMs are installed and functioning normally.

   NOTE: Nine input LEDs indicate proper voltage level and polarity of input feeds.

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.
8. For each of the DC PDMs installed, move the DC circuit breaker at the power source to the (**ON**) position.
9. On each of the DC PSMs, move the switch to the on (|) position.
10. Verify that the **PWR OK** LED is lit green steadily, indicating that the PSM is correctly installed and functioning normally.

NOTE: After a PSM is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the PSM and the `show chassis` command display—to indicate that the PSM is functioning normally. Ignore error indicators that appear during the first 60 seconds.

If any of the status LEDs indicates that the PSM is not functioning normally, repeat the installation and cabling procedures.

11. Verify that the **INP0** or **INP1** LEDs on the PSM are lit green steadily if using two feeds.

    NOTE: The DIP switches **0** and **1** must be set to the ON position for a two-feed installation.

12. On the external management device connected to the CB-RE, monitor the startup process to verify that the system has booted properly.

    NOTE: If the system is completely powered off when you power on the PSM, the Routing Engine boots as the PSM completes its startup sequence. Normally, the router boots from the Junos OS on the CompactFlash card.

    To power off the system after the Routing Engine finishes booting, see "Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router" on page 813.

13. Verify the MX2010 router power up, system initialization, and status (see "Initially Configuring the MX2010 Router" on page 413).

RELATED DOCUMENTATION

Connecting the MX2010 Router to Management and Alarm Devices | 397
Preventing Electrostatic Discharge Damage to an MX Series Router
Replacing an MX2010 DC Power Supply Module (-48 V) | 555
Replacing an MX2000 DC Power Distribution Module (-48 V) | 571

Powering On the DC-Powered (240 V China) MX2000 Router

To power on a DC-powered router:

1. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board and Routing Engine (CB-RE) (**AUX**, **CONSOLE**, or **MGMT**).

2. Turn on the power to the external management device.
3. Verify that the PDMs are fully inserted in the chassis.
4. Verify that the source power cables are connected to the PDM power cable.
5. Switch on the dedicated customer site circuit breakers to provide power to the DC power cables. Follow your site's procedures.
6. Check that the input labeled LEDs are lit green steadily, indicating the PDMs are installed and functioning normally.

   > **NOTE**: Nine input LEDs indicate proper voltage level and polarity of input feeds.

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.
8. For each of the DC PDMs installed, switch the DC circuit breaker at the power source, moving it to the (**ON**) position.
9. On each of the DC PSMs, move the switch to the on (|) position.
10. Verify that the **PWR OK** LED is lit green steadily, indicating the PSM is correctly installed and functioning normally.

    > **NOTE**: After a PSM is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the PSM and the `show chassis` command display—to indicate that the PSM is functioning normally. Ignore error indicators that appear during the first 60 seconds.

    If any of the status LEDs indicates that the PSM is not functioning normally, repeat the installation and cabling procedures.
11. Verify that the **INP0** or **INP1** LEDs on the PSM are lit green steadily if using two feeds.

    > **NOTE**: The DIP switches **0** and **1** must be set to the **ON** position for a two feed installation.

12. On the external management device connected to the Control Board and Routing Engine (CB-RE), monitor the startup process to verify that the system has booted properly.

    > **NOTE**: If the system is completely powered off when you power on the PSM, the Routing Engine boots as the PSM completes its startup sequence. Normally, the router boots from the Junos OS on the CompactFlash card.
    >
    > To power off the system after the Routing Engine finishes booting, see "Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router" on page 813.

13. Verify the MX2010 router power up, system initialization, and status, see "Initially Configuring the MX2010 Router" on page 413.

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Replacing an MX2000 DC Power Supply Module (240 V China) | 559

Replacing an MX2000 DC Power Distribution Module (240 V China) | 578

Powering On the High-Voltage Powered Universal (HVAC/HVDC) MX2000 Router

To power on a high-voltage second-generation universal (HVAC/HVDC) powered router:

1. Verify that an external management device is connected to one of the Routing Engine ports on the Control Board and Routing Engine (CB-RE) (**AUX**, **CONSOLE**, or **MGMT**).
2. Turn on the power to the external management device.
3. Verify that the PDMs are fully inserted in the chassis.
4. Verify that the source power cables are connected to the PDM power cable.
5. Switch on the dedicated customer site circuit breakers to provide power to the AC or DC power cables. Follow your site's procedures.
6. Check that the input labeled LEDs are lit green steadily, indicating the PDMs are installed and functioning normally.

   NOTE: Nine input LEDs indicate proper voltage level and polarity of input feeds.

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.
8. For each of the universal (HVAC/HVDC) PDMs installed, switch the AC or DC circuit breaker at the power source, moving it to the (**ON**) position.
9. On each of the universal (HVAC/HVDC) PSMs, move the switch to the on (|) position.
10. Verify that the **PWR OK** LED is lit green steadily, indicating the PSM is correctly installed and functioning normally.

NOTE: After a PSM is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the PSM and the `show chassis` command display—to indicate that the PSM is functioning normally. Ignore error indicators that appear during the first 60 seconds.

If any of the status LEDs indicates that the PSM is not functioning normally, repeat the installation and cabling procedures.

11. Verify that the **INP0** or **INP1** LEDs on the PSM are lit green steadily if using two feeds.

NOTE: The DIP switches **0** and **1** must be set to the **ON** position for a two feed installation.

12. On the external management device connected to the Control Board and Routing Engine (CB-RE), monitor the startup process to verify that the system has booted properly.

NOTE: If the system is completely powered off when you power on the PSM, the Routing Engine boots as the PSM completes its startup sequence. Normally, the router boots from the Junos OS on the CompactFlash card.

To power off the system after the Routing Engine finishes booting, see "Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router" on page 812.

13. Verify the MX2000 router power up, system initialization, and status, see *Initially Configuring the MX2020 Router*, "Initially Configuring the MX2010 Router" on page 413, or *Initially Configuring the MX2008 Router*.

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Replacing an MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module

Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module

Powering On a Three-Phase AC-Powered MX2000 Router

You can use this procedure for a router with either a three-phase delta AC power distribution module (PDM) or a three-phase wye AC PDM.

1. Verify that the power supply modules (PSMs) are fully inserted in the chassis and that the captive screws on their faceplates are tightened.
2. Verify that the PDMs are fully inserted in the chassis and that the captive screws on their faceplates are tightened.
3. Verify that each AC power cable is properly connected.
4. Verify that an external management device is connected to one of the Routing Engine ports on the CB-RE (**AUX**, **CONSOLE**, or **MGMT**).

   NOTE: The management Ethernet port is not functional until you have completed the initial configuration.

5. Turn on power to the external management device.
6. Switch on the dedicated customer-site circuit breakers to provide power to the AC power cables. Follow your site's procedures.
7. Verify that the LEDs on both PDM and PSM light green steadily.

   If any of the status LEDs indicates that the PDM is not functioning normally, repeat the installation and cabling procedures.
8. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
9. Move the power switch on one of the PSMs to the on (|) position. The **OK** LED blinks momentarily, then lights steadily.

   NOTE: After a PSM and a PDM are powered on, it can take up to 60 seconds for status indicators—such as the output status LEDs on the PSM, and the command output on the craft interface—to indicate that the PSM and PDM are functioning normally. Ignore error indicators that appear during the first 60 seconds.

10. Verify that the **PWR OK** LED on the AC PSM faceplate is lit steadily, indicating that PDM is correctly installed, functioning properly, and providing power to the AC outputs.
11. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
12. Verify that the router powers up and goes through the system initialization process.

RELATED DOCUMENTATION

Initially Configuring the MX2010 Router | 413

Maintaining and Verifying the Status of the MX2010 Router Components | 715

Initially Configuring the MX2020 Router

Maintaining and Verifying the Status of the MX2020 Router Components

MX2000 Three-Phase Delta AC Power Distribution Module Description | **129**

MX2000 Three-Phase Wye AC Power Distribution Module Description | **131**

Connecting an MX2000 Router to a Console or Auxiliary Device | **403**

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | **364**

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers | **229**

Preventing Electrostatic Discharge Damage to an MX2010 Router

Preventing Electrostatic Discharge Damage to an MX2020 Router

CHAPTER 20

Connecting the Router to the Network

IN THIS CHAPTER

- Connecting the MX2010 Router to Management and Alarm Devices | **397**
- Connecting the MX2010 Router to a Network for Out-of-Band Management | **402**
- Connecting an MX2000 Router to a Console or Auxiliary Device | **403**
- Connecting an MX2010 Router to an External Alarm-Reporting Device | **406**
- Connecting the Alarm Relay Wires to the MX2010 Craft Interface | **407**
- Disconnecting the Alarm Relay Wires from the MX2010 Craft Interface | **408**
- Connecting MPC or MIC Cables to the MX2010 Router | **409**

Connecting the MX2010 Router to Management and Alarm Devices

IN THIS SECTION

- Connecting the MX2010 Router to a Network for Out-of-Band Management | **397**
- Connecting an MX2000 Router to a Console or Auxiliary Device | **398**
- Connecting an MX2010 Router to an External Alarm-Reporting Device | **401**

Connecting the MX2010 Router to a Network for Out-of-Band Management

To connect the CB-RE to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the **MGMT** port on the CB-RE interface. To connect to the **MGMT** port on the CB-RE interface:

1. Turn off power to the management device.

2. Plug one end of the Ethernet cable (Figure 154 on page 398 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 153 on page 398 shows the port. Table 99 on page 398 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 153: Out-of-Band Management Port

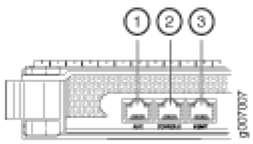


Figure 154: Out-of-Band Management Cable Connector

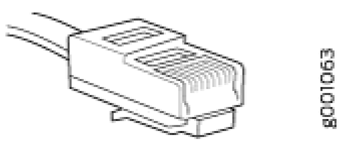


Table 99: Out-of-Band Management Port on the MX2010 CB-RE

Function No.	Label	Description
3	MGMT	Dedicated management channel for device maintenance. It is also used by system administrators to monitor and manage the MX2010 remotely.

SEE ALSO

Connecting the MX2010 Router to Management and Alarm Devices | 397

Connecting an MX2000 Router to a Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the RCB interface. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the RCB interface. Both ports accept a cable with an RJ-45 connector. To connect a device to the **CONSOLE** port and another device to the **AUX** port, you must supply two additional cables.

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

WARNING: The MX2000 router must be adequately grounded before powering on the console or auxiliary devices (see "MX2000 Router Grounding Specifications" on page 183).

To connect a management console or auxiliary device:

1. Turn off power to the console or auxiliary device.
2. Plug the RJ-45 end of the serial cable (see Figure 156 on page 400) into the **AUX** port or **CONSOLE** port on the RCB interface. Figure 155 on page 400 shows the ports. Table 100 on page 400 describes the auxiliary and console ports.
3. Plug the socket DB-9 end into the device's serial port.

   NOTE: For console devices, configure the serial port to the following values:

   - Baud rate—9600
   - Parity—N
   - Data bits—8
   - Stop bits—1
   - Flow control—none

Figure 155: Console and Auxiliary Ports

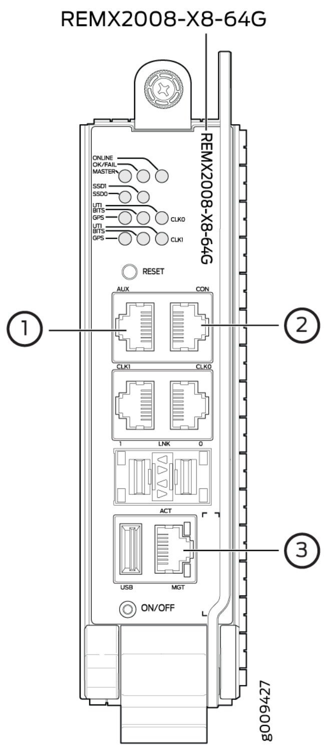


Figure 156: Console and Auxiliary Cable Connector

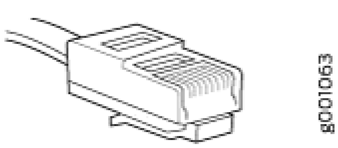


Table 100: Console and Auxiliary Ports on the MX2000 RCB

Function No.	Label	Description
1	**AUX**	Connect a laptop, modem, or other auxiliary unit.
2	**CONSOLE**	Connect a laptop or console terminal to configure the MX2000 router.

Connecting an MX2010 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED** and **YELLOW** relay contacts on the craft interface (see Figure 157 on page 401). A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router (see Table 101 on page 402). They accept wire of any gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2); the wire is not provided. Use the gauge of wire appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact (see Figure 157 on page 401):

1. Prepare the required length of wire with gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2).
2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws. With the small screws facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.
3. 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.
4. Attach the other end of the wires to the external device.

To attach a reporting device for the other kind of alarm, repeat the procedure.

Figure 157: Alarm Relay Contacts

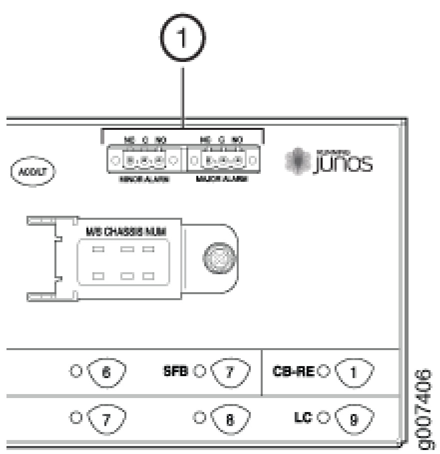


Table 101: Alarm Relay Contacts

Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with normal closed (NC), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

SEE ALSO

Tools and Parts Required for MX2010 Router Connections | 281

Connecting MPC or MIC Cables to the MX2010 Router | 409

Connecting an MX2000 Router to a Console or Auxiliary Device | 403

Connecting the MX2010 Router to a Network for Out-of-Band Management | 402

CB-RE and RCB Interface Cable and Wire Specifications for MX Series Routers | 197

Connecting the MX2010 Router to a Network for Out-of-Band Management

To connect the CB-RE to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the **MGMT** port on the CB-RE interface. To connect to the **MGMT** port on the CB-RE interface:

1. Turn off power to the management device.
2. Plug one end of the Ethernet cable (Figure 159 on page 403 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 158 on page 403 shows the port. Table 102 on page 403 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 158: Out-of-Band Management Port

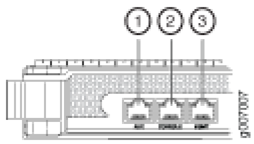


Figure 159: Out-of-Band Management Cable Connector

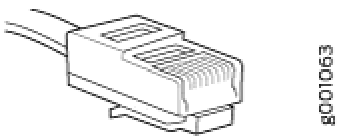


Table 102: Out-of-Band Management Port on the MX2010 CB-RE

Function No.	Label	Description
3	MGMT	Dedicated management channel for device maintenance. It is also used by system administrators to monitor and manage the MX2010 remotely.

RELATED DOCUMENTATION

Connecting the MX2010 Router to Management and Alarm Devices | 397

Connecting an MX2000 Router to a Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the RCB interface. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the RCB interface. Both ports accept a cable with an RJ-45 connector. To connect a device to the **CONSOLE** port and another device to the **AUX** port, you must supply two additional cables.

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

WARNING: The MX2000 router must be adequately grounded before powering on the console or auxiliary devices (see "MX2000 Router Grounding Specifications" on page 183).

To connect a management console or auxiliary device:

1. Turn off power to the console or auxiliary device.
2. Plug the RJ-45 end of the serial cable (see Figure 161 on page 405) into the **AUX** port or **CONSOLE** port on the RCB interface. Figure 160 on page 405 shows the ports. Table 103 on page 405 describes the auxiliary and console ports.
3. Plug the socket DB-9 end into the device's serial port.

NOTE: For console devices, configure the serial port to the following values:

- Baud rate—9600
- Parity—N
- Data bits—8
- Stop bits—1
- Flow control—none

Figure 160: Console and Auxiliary Ports

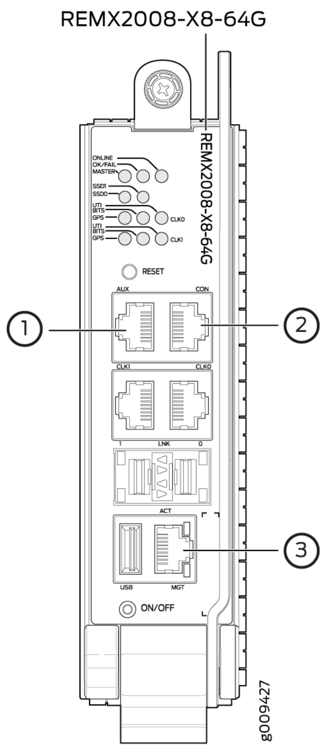


Figure 161: Console and Auxiliary Cable Connector

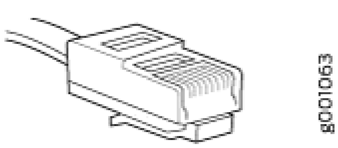


Table 103: Console and Auxiliary Ports on the MX2000 RCB

Function No.	Label	Description
1	**AUX**	Connect a laptop, modem, or other auxiliary unit.
2	**CONSOLE**	Connect a laptop or console terminal to configure the MX2000 router.

Connecting an MX2010 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED** and **YELLOW** relay contacts on the craft interface (see Figure 162 on page 406). A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router (see Table 104 on page 407). They accept wire of any gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2); the wire is not provided. Use the gauge of wire appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact (see Figure 162 on page 406):

1. Prepare the required length of wire with gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2).
2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws. With the small screws facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.
3. 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.
4. Attach the other end of the wires to the external device.

To attach a reporting device for the other kind of alarm, repeat the procedure.

Figure 162: Alarm Relay Contacts

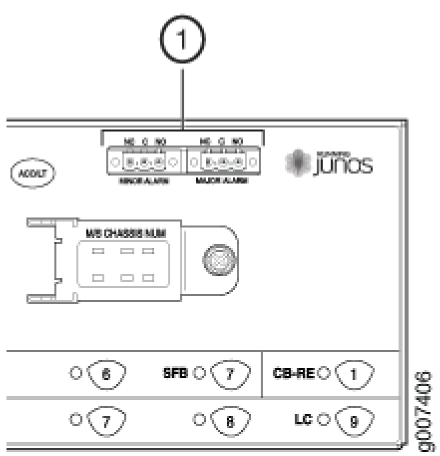


Table 104: Alarm Relay Contacts

Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with normal closed (NC), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

RELATED DOCUMENTATION

Tools and Parts Required for MX2010 Router Connections | 281

Connecting MPC or MIC Cables to the MX2010 Router | 409

Connecting an MX2000 Router to a Console or Auxiliary Device | 403

Connecting the MX2010 Router to a Network for Out-of-Band Management | 402

CB-RE and RCB Interface Cable and Wire Specifications for MX Series Routers | 197

Connecting the Alarm Relay Wires to the MX2010 Craft Interface

Here's how to connect the alarm relay wires between a router and an alarm-reporting device (see Figure 163 on page 408):

1. Prepare the required length of replacement wire with gauge between 28 AWG (0.08 mm^2) and 14 AWG (2.08 mm^2).
2. Insert the replacement wires into the slots in the front of the block (see Table 105 on page 408). Use a 2.5-mm flat-blade screwdriver to tighten the screws and secure the wire.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. 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.

Figure 163: Alarm Relay Contacts

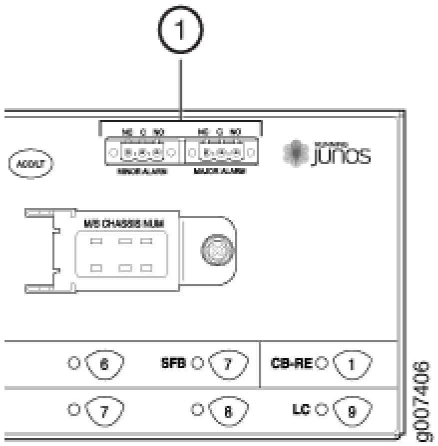


Table 105: Connecting Alarm Relay Contacts

Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with a normal closed (NC), a common (C), and a normal open (NO) relay that signal a minor or major alarm when broken.

Disconnecting the Alarm Relay Wires from the MX2010 Craft Interface

Here's how to disconnect the alarm relay wires from the MX2010 and an alarm-reporting device (see Figure 164 on page 409):

1. Disconnect the existing wire at the external device.
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. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block (see Table 106 on page 409).

Figure 164: Alarm Relay Contacts

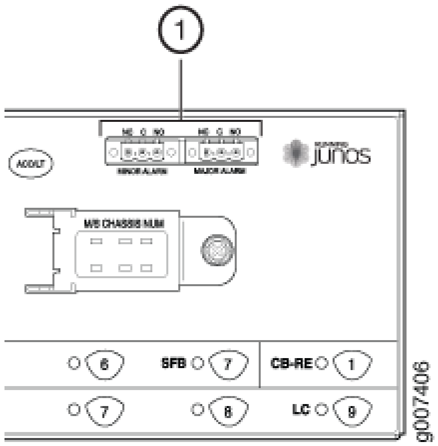


Table 106: Alarm Relay Contacts on the Craft Interface

Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with a normal closed (NC), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

Connecting MPC or MIC Cables to the MX2010 Router

To connect the MPCs or MICs to the network (see Figure 165 on page 411 and Figure 166 on page 412):

1. Have ready a length of the type of cable used by the component. For cable specifications, see the *MX Series Interface Module Reference*.
2. Remove the rubber safety plug from the 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 faceplate.
4. Arrange the cable in the cable manager to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

CAUTION: 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 165: Attaching a Cable to an MPC

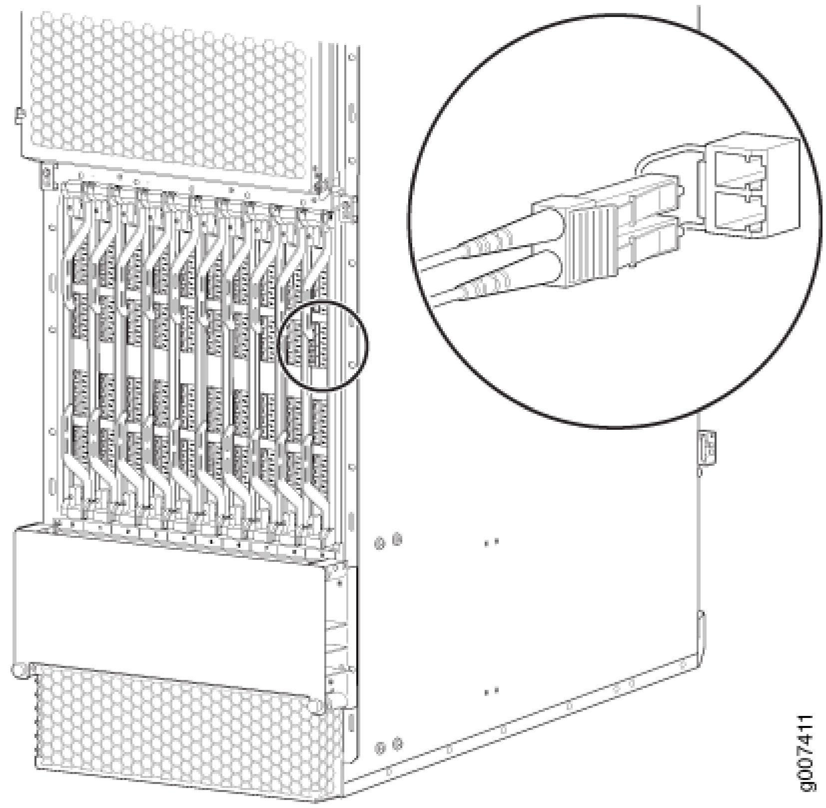
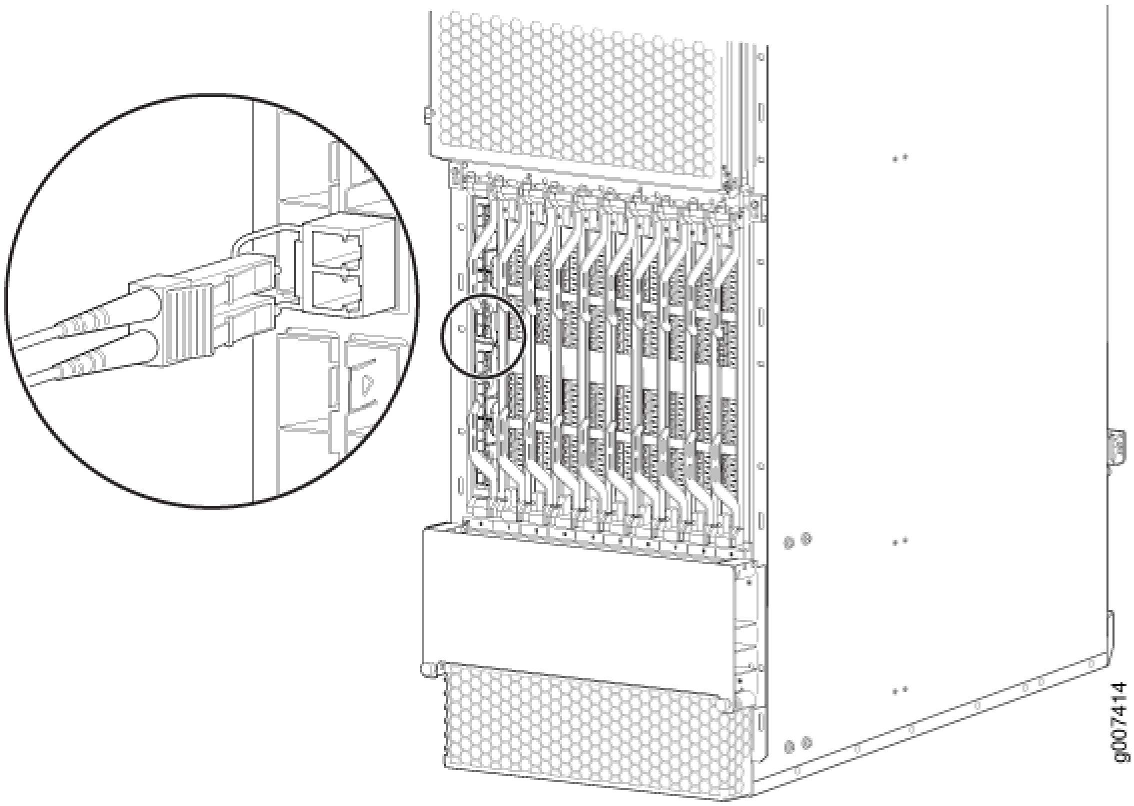


Figure 166: Attaching a Cable to a MIC



RELATED DOCUMENTATION

Connecting the MX2010 Router to Management and Alarm Devices | 397

Tools and Parts Required for MX2010 Router Connections | 281

Grounding an MX2000 Router | 362

CHAPTER 21

Initially Configuring the Router

IN THIS CHAPTER

- Initially Configuring the MX2010 Router | **413**

Initially Configuring the MX2010 Router

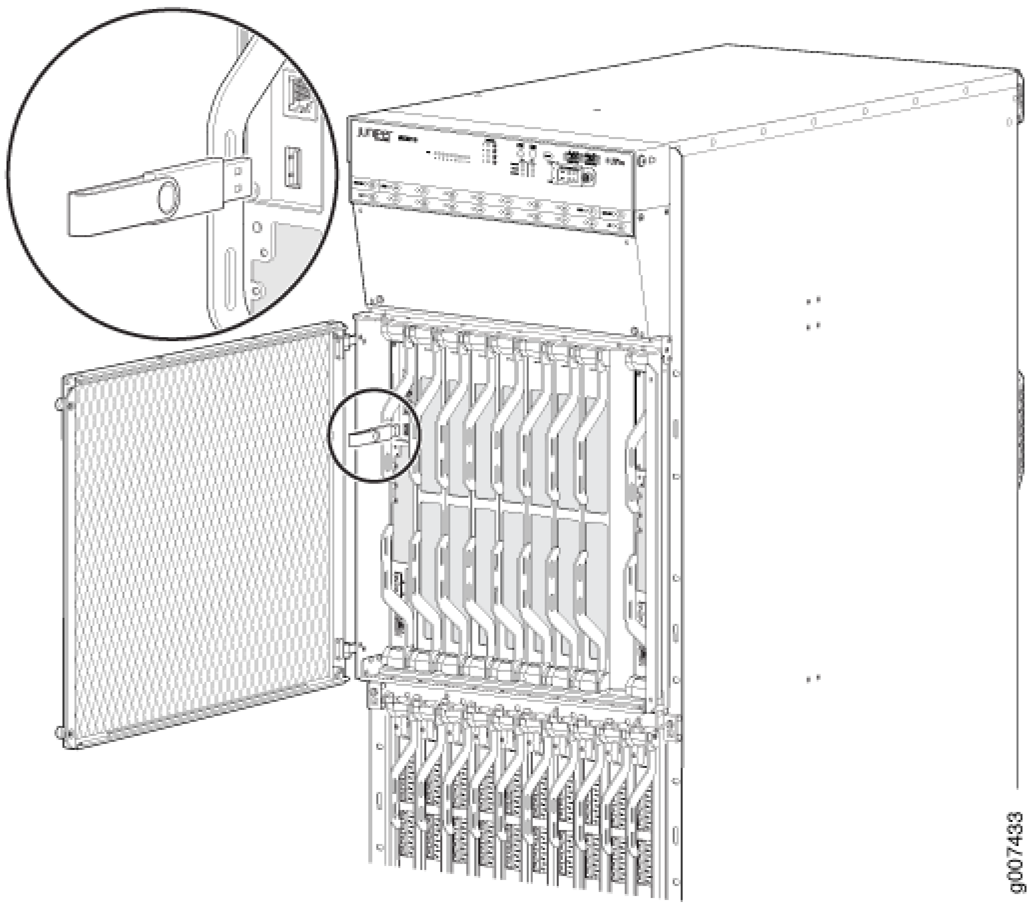
The MX2010 router is shipped with Junos OS preinstalled and ready to be configured when the MX2010 router is powered on. There are three copies of the software: one on a CompactFlash card in the CB-RE, one on the solid-state drive (SSD) in the CB-RE, and one on a USB flash drive that can be inserted into the slot in the CB-RE faceplate (see Figure 167 on page 414).

> **NOTE**: The SSD is internal in the CB-RE and cannot be removed.

When the router boots, it first attempts to start the image on the USB flash drive. If a USB flash drive is not inserted into the CB-RE or the attempt otherwise fails, the router next tries the CompactFlash card, and then the SSD.

You configure the router by issuing Junos OS CLI commands, either on a console device attached to the **CONSOLE** port on the Routing Engine or over a Telnet connection to a network connected to the **MGMT** port on the Routing Engine.

Figure 167: USB Flash Drive Port on CB-RE



Gather the following information before configuring the router:

- Name the router will use on the network
- Domain name the router 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

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

To configure the software:

1. Verify that the router is powered on.
2. Log in as the root user. There is no password.
3. Start the CLI.

```
root# cli
root@>
```

4. Enter configuration mode.

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

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

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

6. Create a management console user account.

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

7. Set the user account class to super-user.

```
[edit]
root@# set system login user user-name class super-user
```

8. Configure the router’s domain name.

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

9. Configure the IP address and prefix length for the router’s Ethernet interface.

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

10. Configure the IP address of a backup router, which is used only while the routing protocol is not running.

```
[edit]
root@# set system backup-router address
```

11. Configure the IP address of a DNS server.

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

12. Set the root authentication password by entering a plain-text password, an encrypted password, or an SSH public key string (DSA or RSA).

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

or

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

or

```
[edit]
root@# set system root-authentication ssh-dsa public-key
```

or

```
[edit]
root@# set system root-authentication ssh-rsa public-key
```

13. (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 need to add a static route to that subnet within the routing table. For more information about static routes, see the *Junos OS System Basics Configuration Guide*.

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

14. Configure the Telnet service at the `[edit system services]` hierarchy level.

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

15. (Optional) 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 {
    fxp0 {
        unit 0 {
            family inet {
                address address/prefix-length;
            }
        }
    }
}
```

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

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

17. (Optional) Configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the router.

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

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

```
[edit]
root@host# exit
root@host>
```

NOTE: To reinstall Junos OS, you boot the router from the removable media. Do not insert the removable media during normal operations. The router does not operate normally when it is booted from the removable media.

When the router boots from the storage media (removable media, or CompactFlash card), it expands its search in the **/config** directory of the ruoter for the following files in the following order: **juniper.conf** (the main configuration file), **rescue.conf** (the rescue configuration file), and **juniper.conf.1** (the first rollback configuration file). When the search finds the first configuration file that can be loaded properly, the file loads and the search ends. If none of the files can be loaded properly, the router does not function properly. If the router boots from an alternate boot device, Junos OS displays a message indicating this when you log in to the router.

RELATED DOCUMENTATION

Powering On a Three-Phase AC-Powered MX2000 Router

Powering On the DC-Powered MX2010 Router | 390

Grounding an MX2000 Router | 362

Routine Maintenance Procedures for the MX2010 Router | 806

4

PART

Installing and Replacing Components

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Replacing Components | 500

CHAPTER 22

Installing Components

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- Installing the MX2010 Air Filter | **422**
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- Installing an MX2000 Router DC Power Distribution Module (240 V China) | **434**
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- Installing an SFP or XFP into an MX2000 MPC or MIC | 499

Installing an MX2010 Adapter Card

An adapter card weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To install an adapter card (see Figure 168 on page 422):

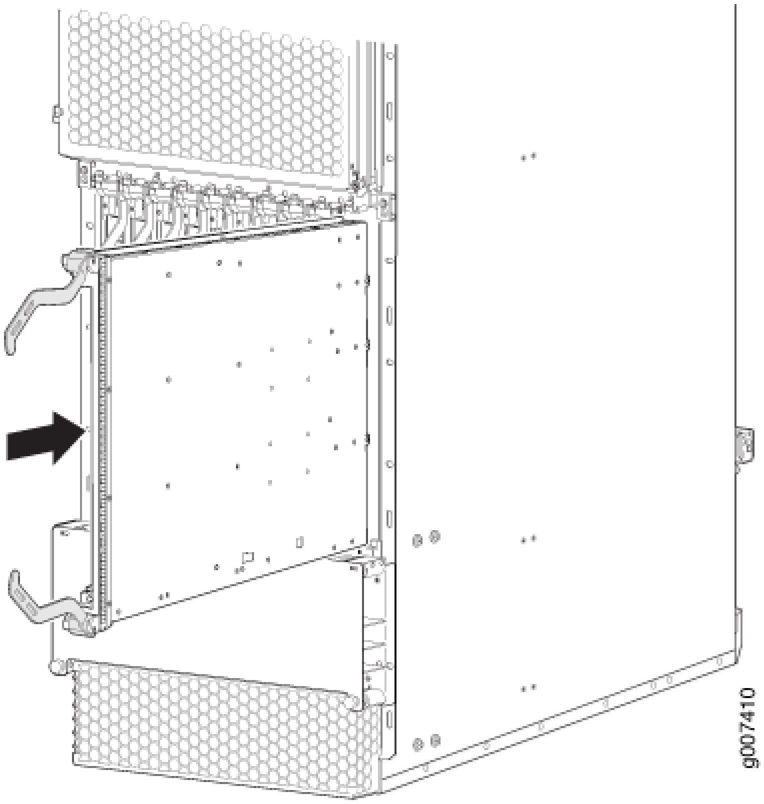
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the adapter card from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Orient the adapter card so that the faceplate faces you vertically.
5. Lift the adapter card into place, and carefully align the sides of the adapter card with the guides inside the card cage.
6. Slide the adapter card all the way into the card cage until you feel resistance.
7. Grasp both ejector handles, and gently close them inward simultaneously until the adapter card is fully seated.
8. Issue the following CLI command to bring the adapter card online:

```
user@host>request chassis adc slot slot-number online
```

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

   NOTE: When you issue the `request chassis adc slot slot-number online` command, the FRU gains power, and the system's total power decreases.

Figure 168: Installing an Adapter Card



RELATED DOCUMENTATION

MX2000 Adapter Card (ADC) Description | 90

Maintaining the MX2010 Adapter Cards | 712

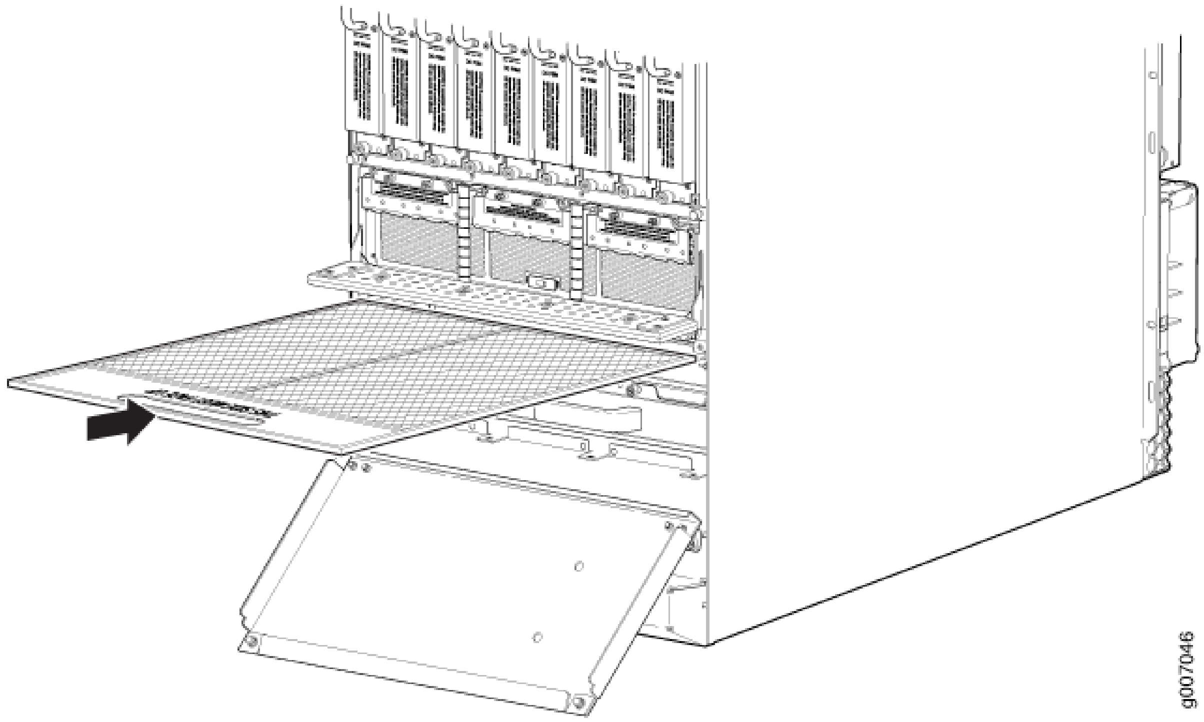
Installing the MX2010 Air Filter

To install the lower air filter—MX2010-FLTR-KIT-S:

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 air filter is right side up.
3. Open the fan tray and air filter access door, located at the bottom of the chassis.
4. Grasp the handle on the air filter and insert into the chassis until it stops (see Figure 169 on page 423).

5. Close the access door and tighten the two captive screws to secure.
6. Lower the cable manager back into position, and rearrange the cables in the cable manager.

Figure 169: Installing the Air Filter



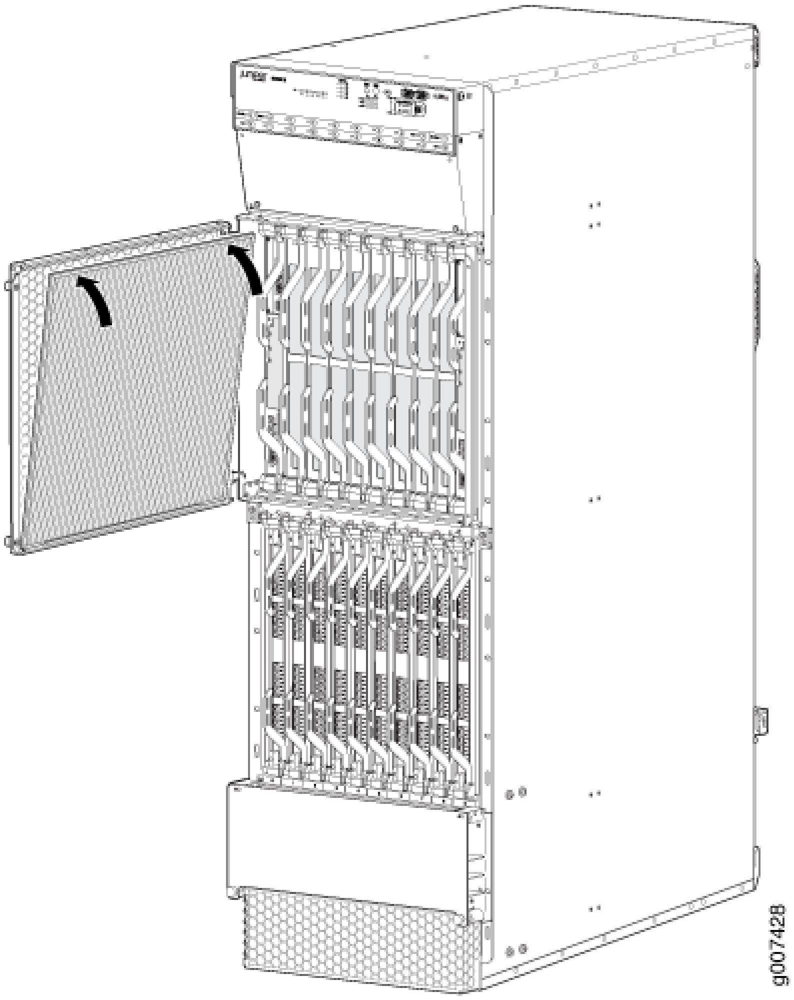
To install the card-cage cable manager air filter—MX2010-MID-FLTR-PNL-S:

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. Move the cables from the card-cage cable manager, if necessary.
3. Loosen the two captive screws located on the front of the card-cage cable manager door, and open.

> **CAUTION**: Do not run the router for more than 2 minutes without the air filter in place.

4. Grasp the air filter, and slide the bottom of the air filter into the channel of the access door, (see Figure 170 on page 424).

Figure 170: Installing the Card-Cage Cable Manager Air Filter



5. Push the air filter in place, close the door, and tighten the two captive screws.

6. Replace the cables in the card-cage cable manager, if necessary.

To install the PSM air filter—MX2000-FLTR-PWR:

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.

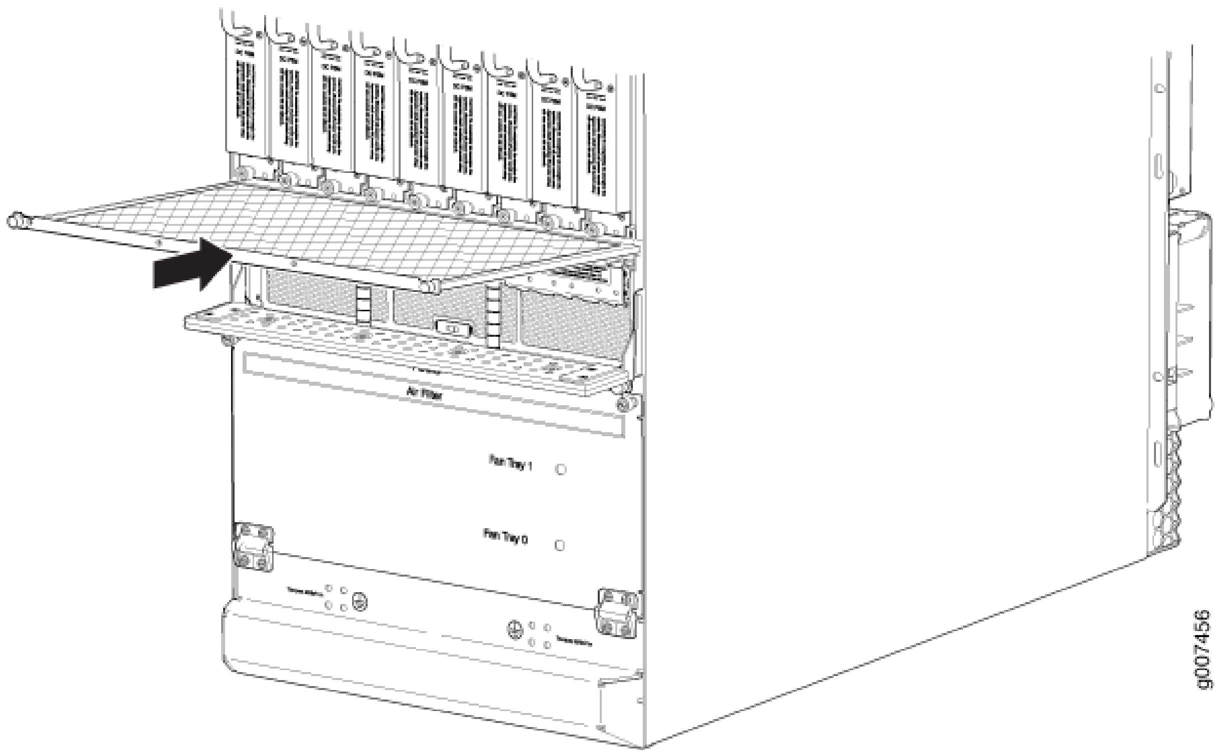
2. Ensure that the air filter is right side up.

3. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 171 on page 425).

4. Tighten the two captive screws to secure.

NOTE: The AC–powered MX2010 router has the same air filter.

Figure 171: Installing the PSM Air Filter



To install the PSM air filter—MX2000-FLTR-PWR for chassis with 240 V China power supplies and universal (HVAC/HVDC) power supplies:

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. Unscrew the mechanical interlock bracket from the PDM (see Figure 172 on page 426 and Figure 173 on page 426).

Figure 172: Removing the Bracket from the 240 V China PDM

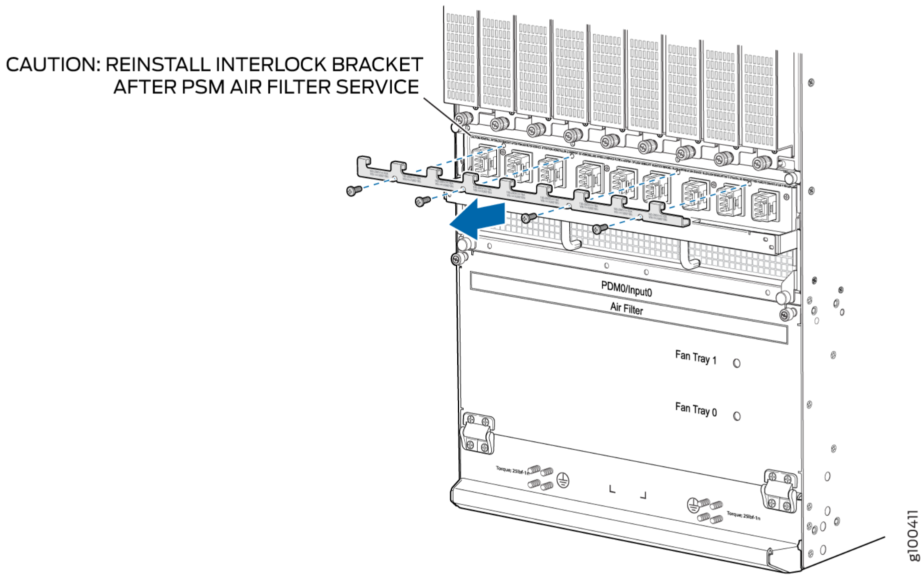
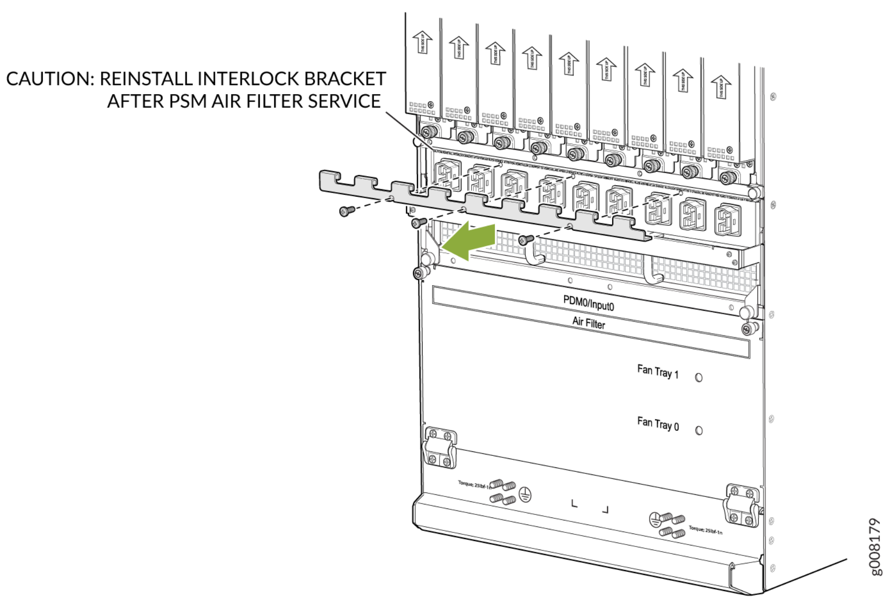


Figure 173: Removing the Bracket from the Universal (HVAC/HVDC) PDM

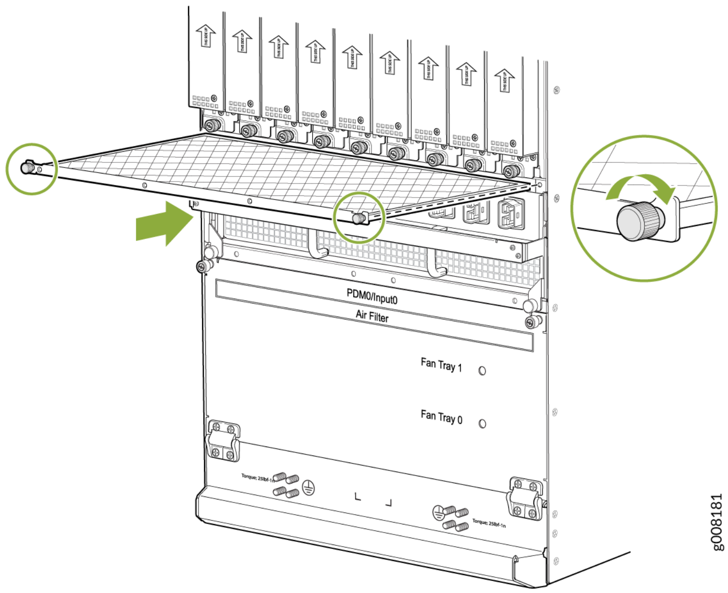


3. Ensure that the air filter is right side up.

4. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 174 on page 427).

5. Tighten the two captive screws to secure.

Figure 174: Installing the PSM Filter



6. Install the mechanical interlock bracket and tighten the screws. See Figure 175 on page 427 and Figure 176 on page 428.

Figure 175: Installing the Bracket (with 240 V China PSM Installed)

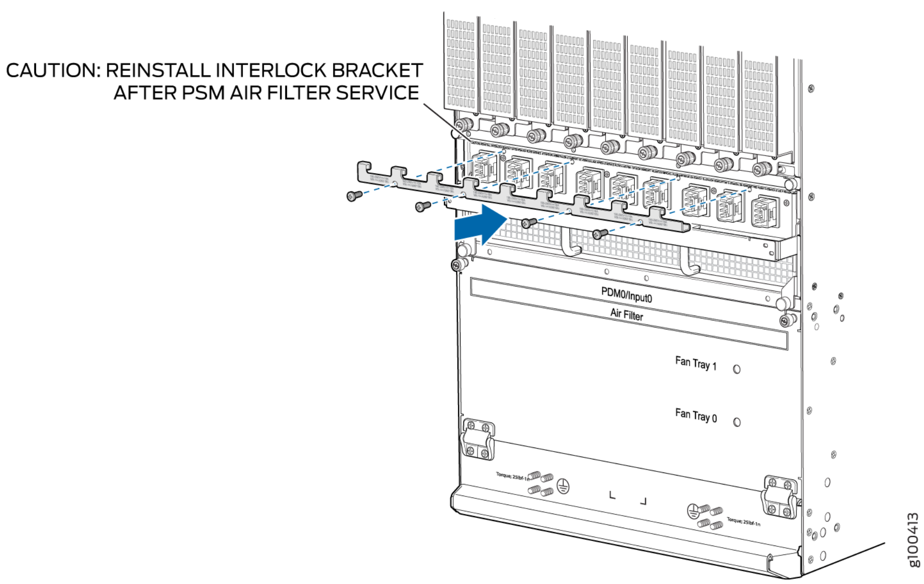
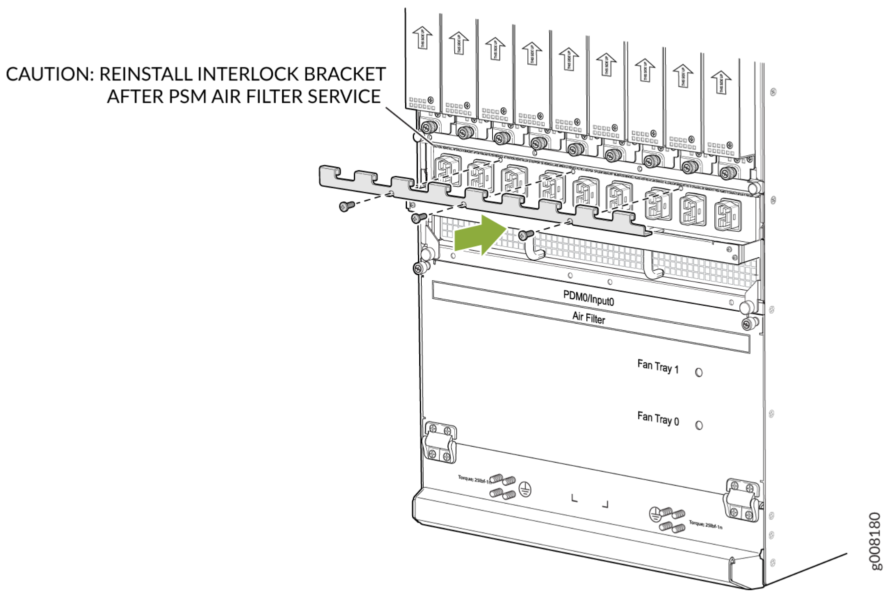


Figure 176: Installing the Mechanical Interlock Bracket (with Universal HVAC/HVDC PSM Installed)



RELATED DOCUMENTATION

Maintaining the MX2010 Air Filters | **716**

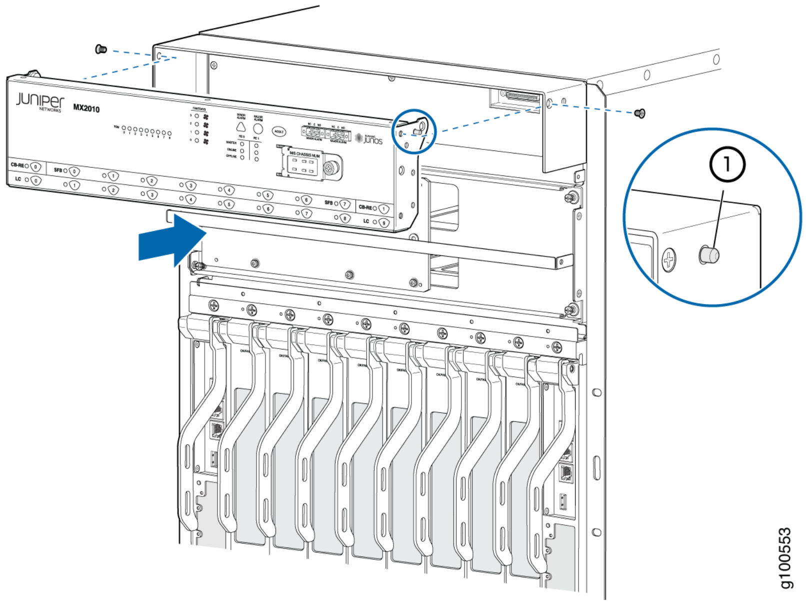
Removing the MX2010 Air Filter | **522**

Installing the MX2010 Craft Interface

Here's how to install the MX2010 craft interface:

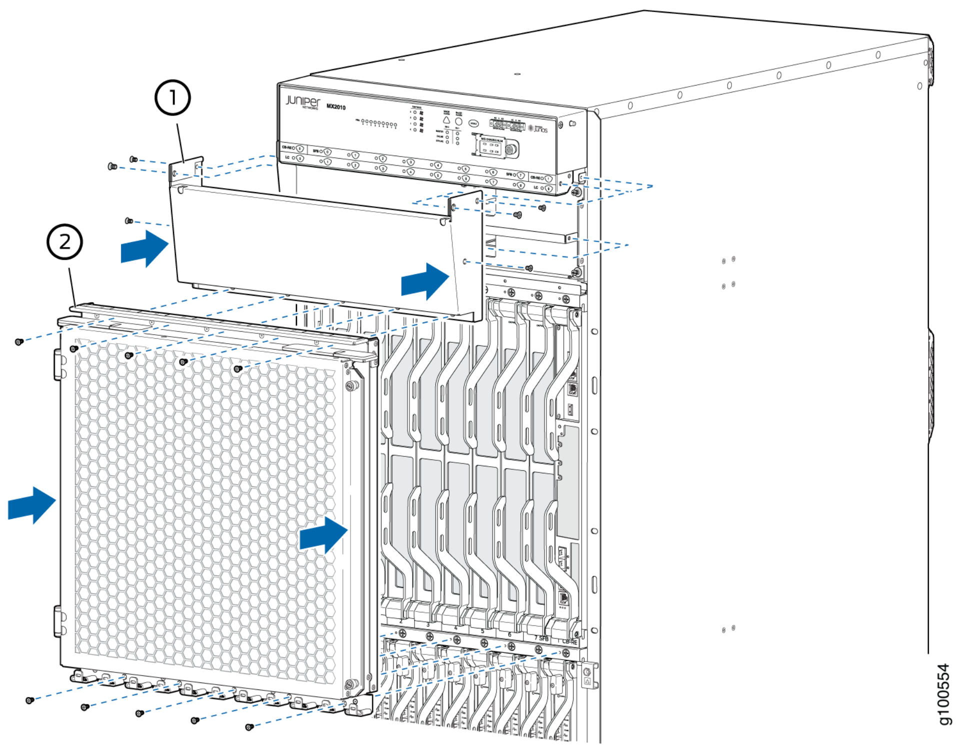
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the craft interface with one hand, and hold the bottom edge of the craft interface with the other hand to support its weight.
3. Orient the ribbon cable so that it plugs into the connector socket. The connector is keyed and can be inserted only one way. The pin on the right side of the craft interface indicates the positioning.
4. Align the pin on the right side of the craft interface with the dedicated hole in the housing and gently slide the craft interface into the housing. See Figure 177 on page 429.

Figure 177: Installing the Craft Interface into the Housing



5. Reattach the craft interface faceplate by positioning it in place and then tightening the two screws on the left and right sides using the Torx (T10) screwdriver.
6. Reattach the sheet metal cover and EMI door by positioning them in place and then tightening the screws using a Torx (T10) screwdriver. See Figure 178 on page 430.

Figure 178: Reattaching the Sheet Metal Cover and EMI Door



7. Reattach any external devices connected to the craft interface.

RELATED DOCUMENTATION

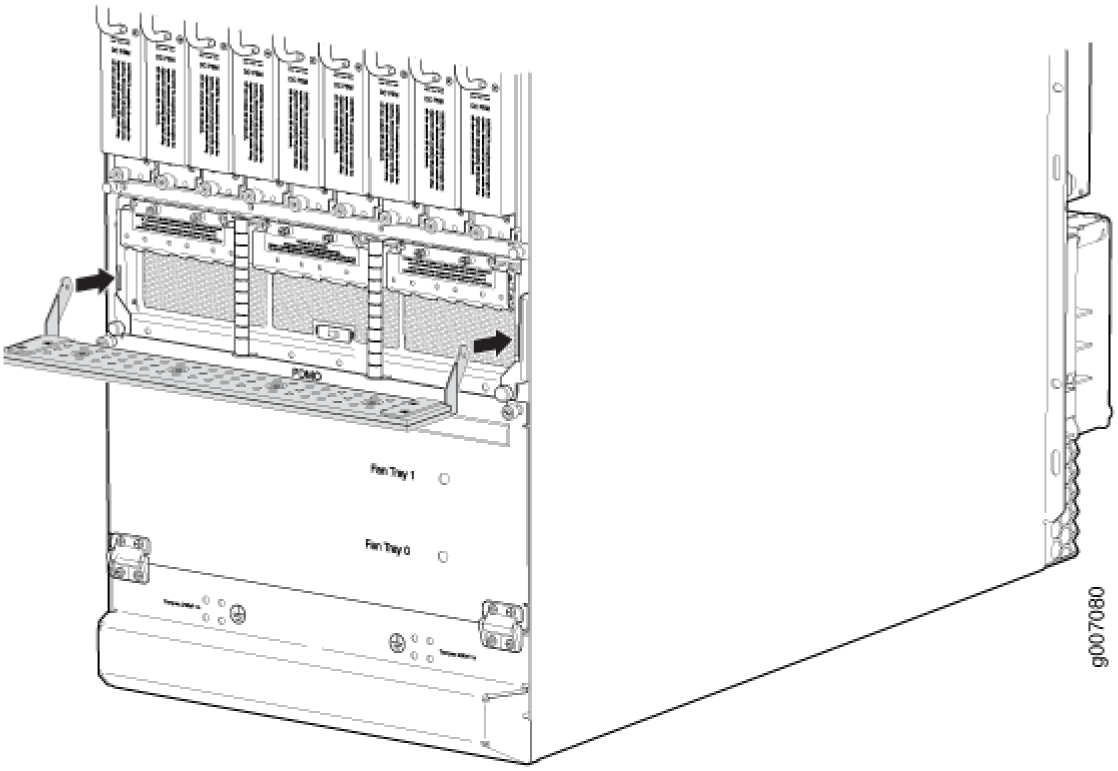
MX2010 Craft Interface Description | 34
Maintaining and Verifying the Status of the MX2010 Craft Interface | 798

Installing the MX2010 Standard DC Cable Manager

To install the standard DC cable manager (see Figure 179 on page 431):

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. Position the DC cable manager over the two slots located on both sides of the DC PDM.
3. Lift the DC cable manager slightly up while inserting the two flanges into the slots on both sides of the DC PDM.
4. Push down to secure the DC cable manager in place.

Figure 179: Installing the Standard DC Cable Manager



RELATED DOCUMENTATION

Removing the MX2010 Standard DC Cable Manager | 538

Installing an MX2000 Router DC Power Distribution Module (-48 V)

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

To install a DC power distribution module (PDM) in an MX2000 Router:

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 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 DC circuit breaker on the power input source to the off position.
4. [Optional]—If you are switching from an AC PDM to DC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to DC.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 180 on page 432(MX2020), Figure 181 on page 433(MX2010), or Figure 182 on page 434 (MX2008).

Figure 180: Installing an MX2020 Router DC Power Distribution Module

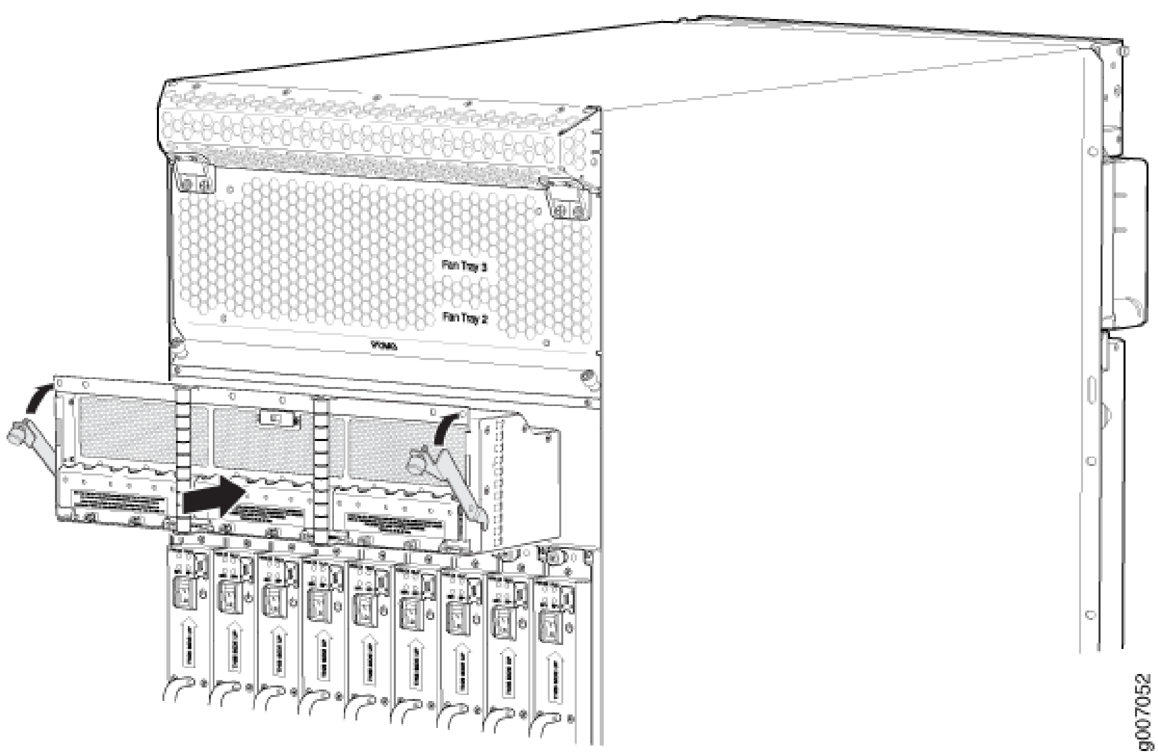


Figure 181: Installing an MX2010 Router DC Power Distribution Module

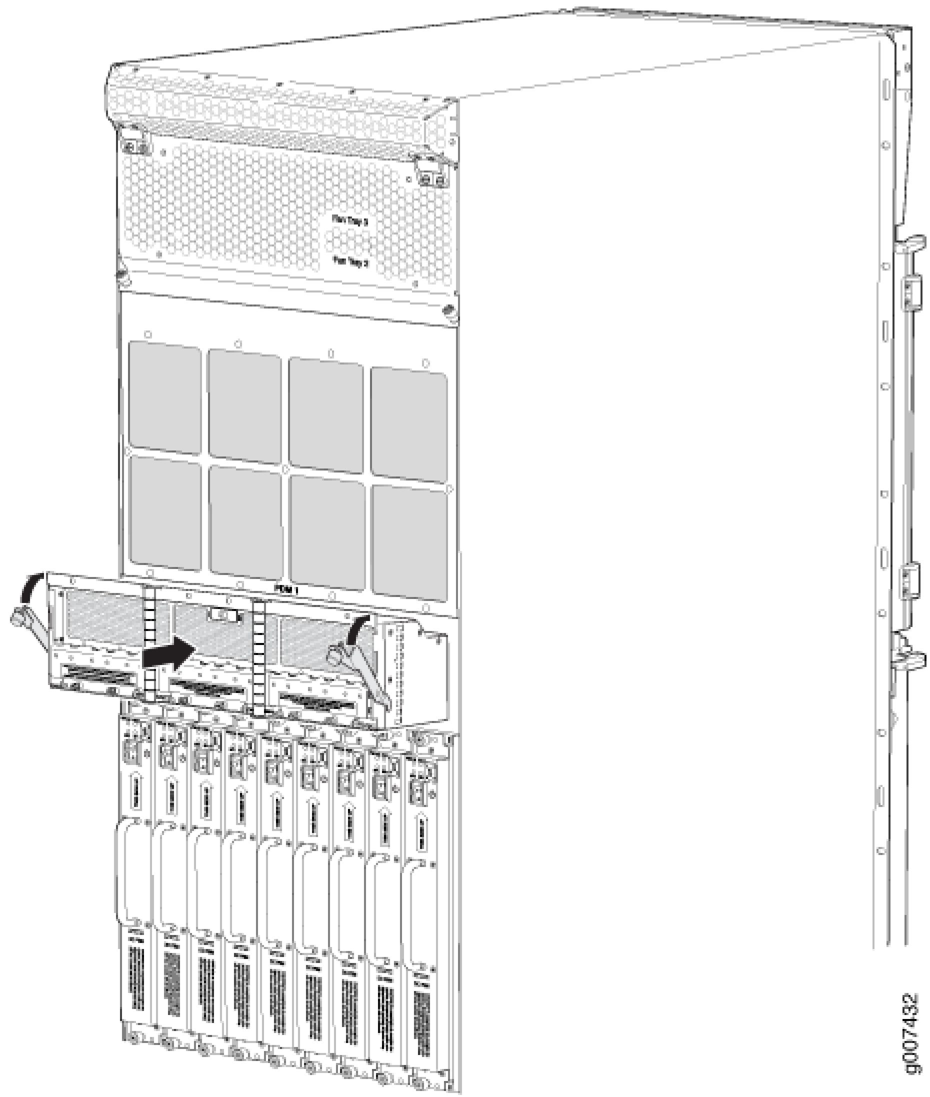
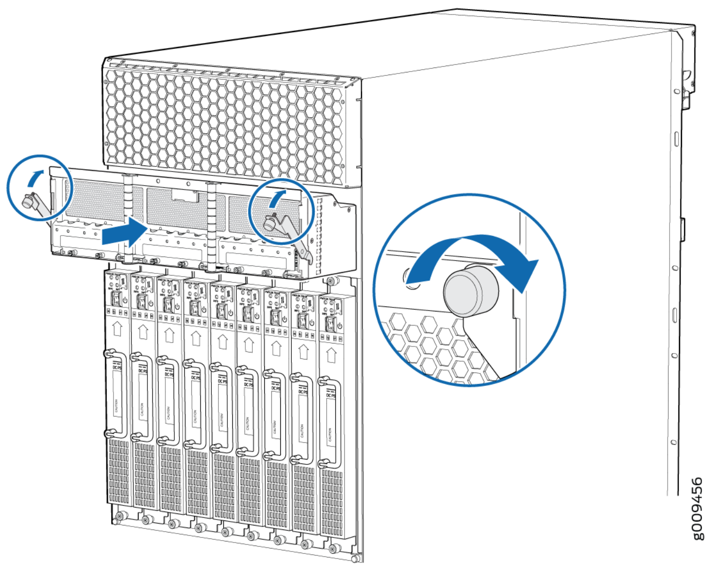


Figure 182: Installing an MX2008 Router Power Distribution Module



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
9. Remove the clear plastic cover protecting the terminal studs on the PDM faceplate.
10. Remove the nut and washers from each of the terminal studs.

Installing an MX2000 Router DC Power Distribution Module (240 V China)

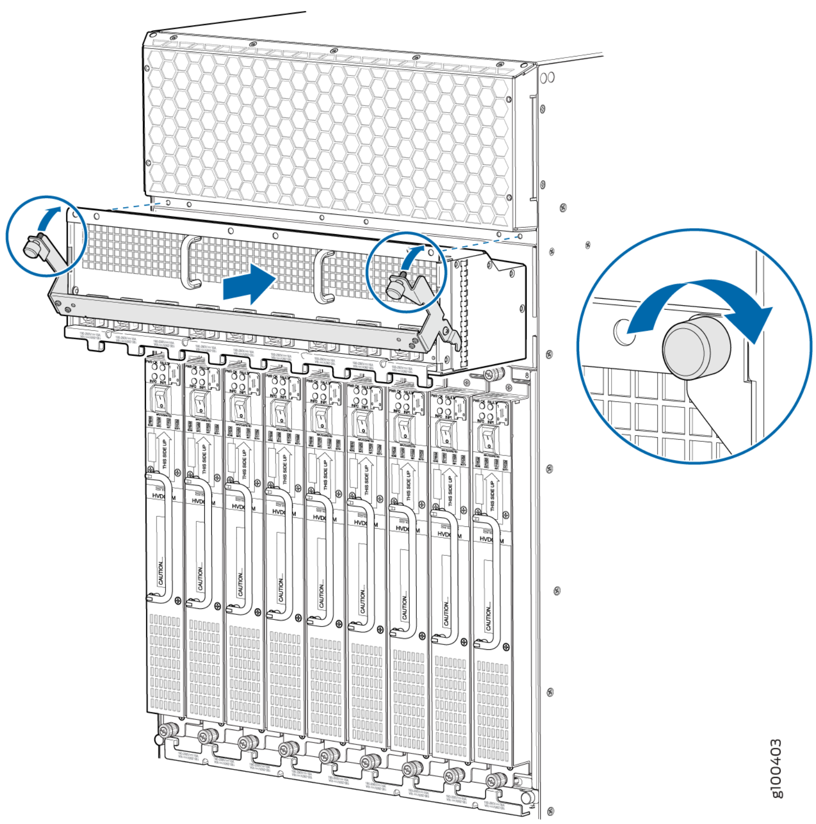
WARNING: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To install a DC power distribution module (PDM) in an MX2000 Router:

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 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 DC circuit breaker on the power input source to the off position.

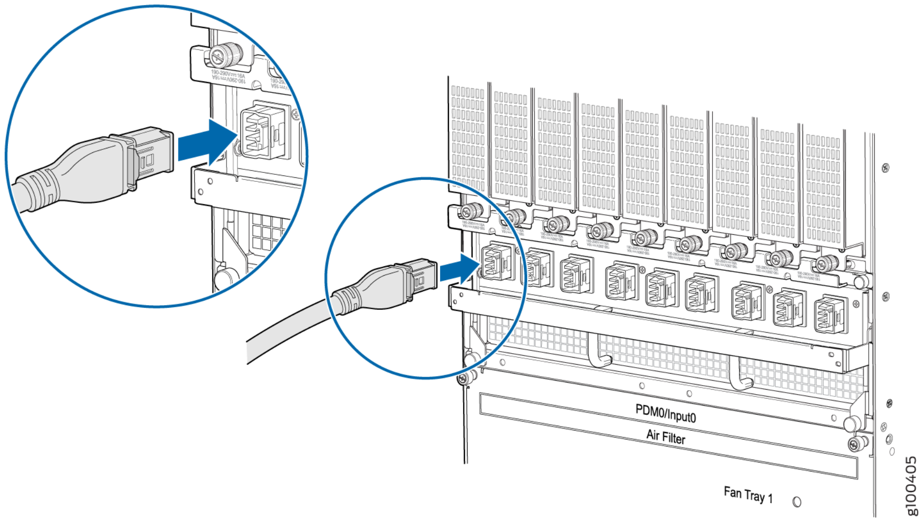
4. [Optional]—If you are switching from an AC PDM to DC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to DC.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 183 on page 435).

Figure 183: Installing an MX2020 Router DC Power Distribution Module (240 V China)



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
9. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green. See Figure 184 on page 436.

Figure 184: Plugging the 240 V China Power Cord an MX2000 Router



Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Distribution Module

Depending on whether you are connecting to AC or DC power, these warnings apply to the universal HVAC/HVDC power distribution module (PDM):

> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

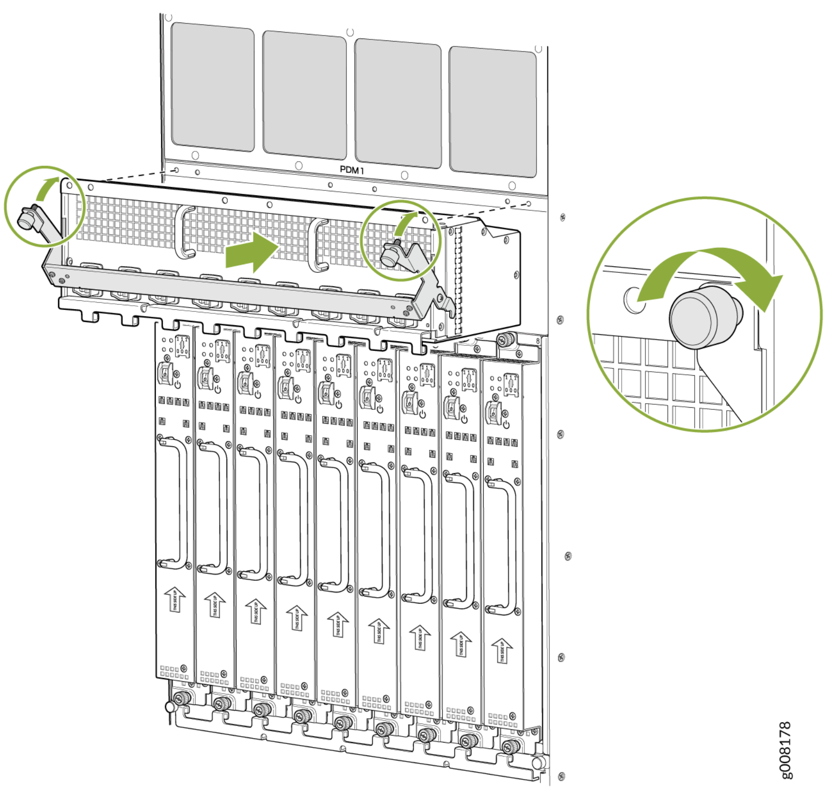
> **WARNING**: Before performing AC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

> **WARNING**: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

To install a universal HVAC/HVDC power distribution module (PDM) in an MX2000 Router:

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 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 DC circuit breaker on the power input source to the off position.
4. [Optional]—If you are switching from an AC PDM or 48V DC PDM to a universal PDM, the universal HVAC/HVDC PSMs and PDMs work with either AC or DC bar setting, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for details.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 185 on page 437).

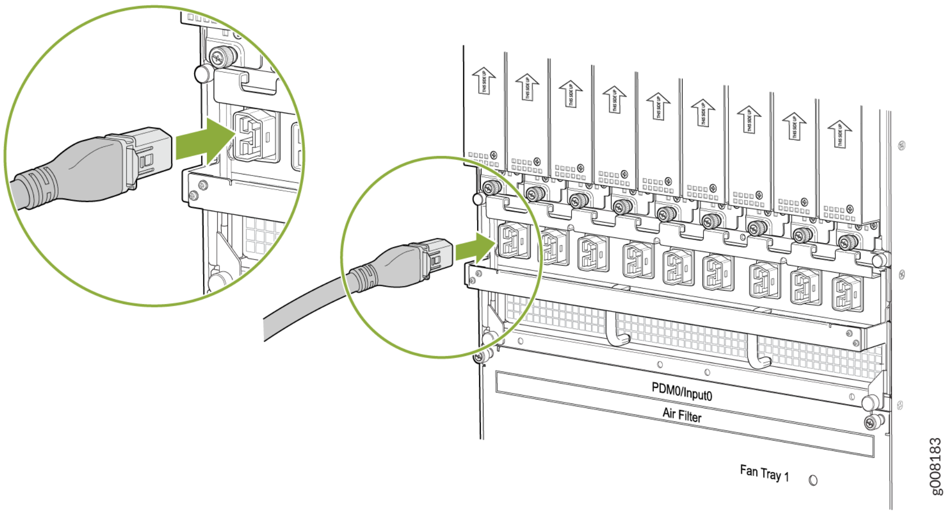
Figure 185: Installing an MX2000 Router Universal (HVAC/HVDC) Power Distribution Module



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.

9. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green. See Figure 186 on page 438.

Figure 186: Plugging the Universal (HVAC/HVDC) Power Cord an MX2000 Router



Installing an MX2010 DC Power Supply Module (-48 V)

Before you install a PSM, be aware of the following:

NOTE: The DC PSM is hot-swappable when a minimum number of PSMs installed and operational.

WARNING: The DC PSMs have no circuit breakers that can physically disconnect DC line from the router. After DC feeds have been connected to the PDM, the DC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

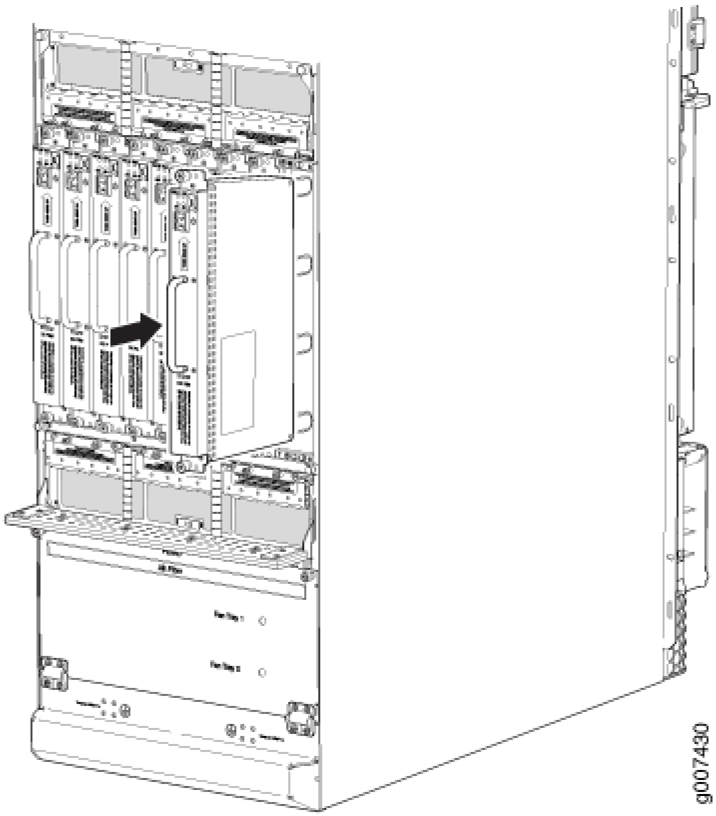
To install a DC PSM (see Figure 187 on page 440):

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**) or in the on (|) position.

   CAUTION: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate.
5. Turn on the power switch to the on (|) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 187: Installing a DC Power Supply Module



RELATED DOCUMENTATION

MX2010 DC Power Supply Module (-48 V) Description | 147
Removing an MX2010 DC Power Supply Module (-48 V) | 555

Installing MX2000 Router DC Power Supply Modules (240 V China)

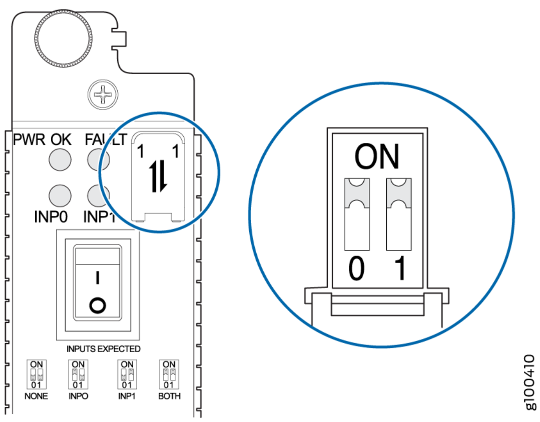
To install an MX2000 DC PSM (240 V China:

1. Verify that the power switches on all PSMs are in the off (**O**) position.
2. On the PSM, slide the plastic cover away from the input mode switch to expose the dual DIP switches. Move the input mode DIP switch **0** (left switch) to the **ON** position for the bottom feed **INP0** (expected to be connected), and DIP switch **1** (right switch) to the **ON** position for the top feed **INP1** (expected to be connected). If both DIP switches **0** and **1** are turned to the **ON** position, then both top and bottom feeds are expected to be connected, (see Figure 188 on page 441).

In addition, a PSM failure triggers the alarm LED on the craft interface.

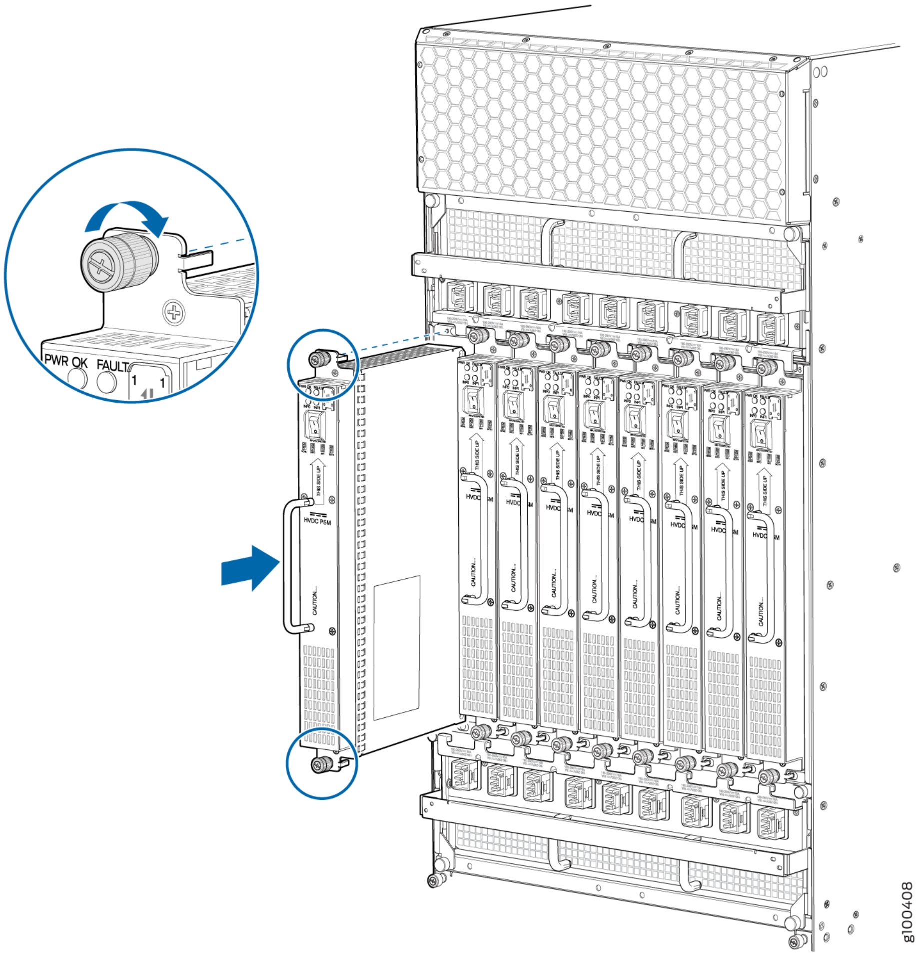
> **NOTE**: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed **0**. Power will be drawn from feed **1** only if feed **0** fails.

Figure 188: Selecting DC Power (240 V China) Subsystem Feed Redundancy



3. Using both hands, grasp the handle and slide the PSM straight into the chassis until the PSM is fully seated in the chassis slot. Tighten the two captive screws (see Figure 189 on page 442). Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.

Figure 189: Installing an MX2020, MX2010, MX2008 Router DC Power Supply Module (240 V China)



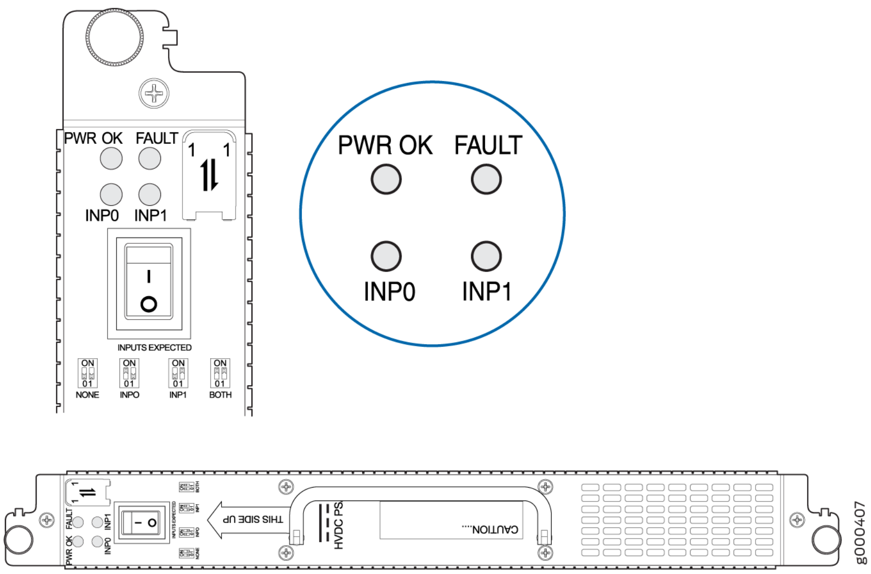
4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 190 on page 443).

> **NOTE**: If you are connecting two feeds, **INP0** and **INP1**, both LEDs on the PSM will be lit green steadily.

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. Move the switch to the on (|) position.
7. Verify that the **PWR OK** LED is lit green steadily. See *MX2020 DC Power Supply Module LEDs*, "MX2010 DC Power Supply Module LEDs" on page 152, or *MX2008 DC Power Supply Module LEDs* for information on PSM LED behavior.

8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 190: MX2000 DC Power Supply Module Front View (240 V China)



> **NOTE**: Each PSM slot not occupied by a (240 V China) DC PSM must be covered by a PSM blank panel.

RELATED DOCUMENTATION

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | **813**

Replacing an MX2000 DC Power Supply Module (240 V China) | **559**

Installing MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Supply Modules

To install an MX2000 high-voltage second-generation universal (HVAC/HVDC) PSM:

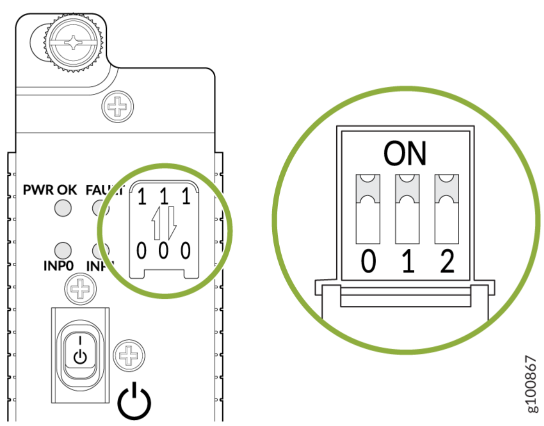
1. Verify that the power switches on all PSMs are in the off (**O**) position.
2. On the PSM, slide the plastic cover away from the input mode switch to expose the dual DIP switches. Move the input mode DIP switch **0** (left switch) to the **ON** position for the bottom feed

INP0 (expected to be connected), and DIP switch **1** (middle switch) to the **ON** position for the top feed **INP1** (expected to be connected). If both DIP switches **0** and **1** are turned to the **ON** position, then both top and bottom feeds are expected to be connected, (see Figure 191 on page 444).

In addition, a PSM failure triggers the alarm LED on the craft interface.

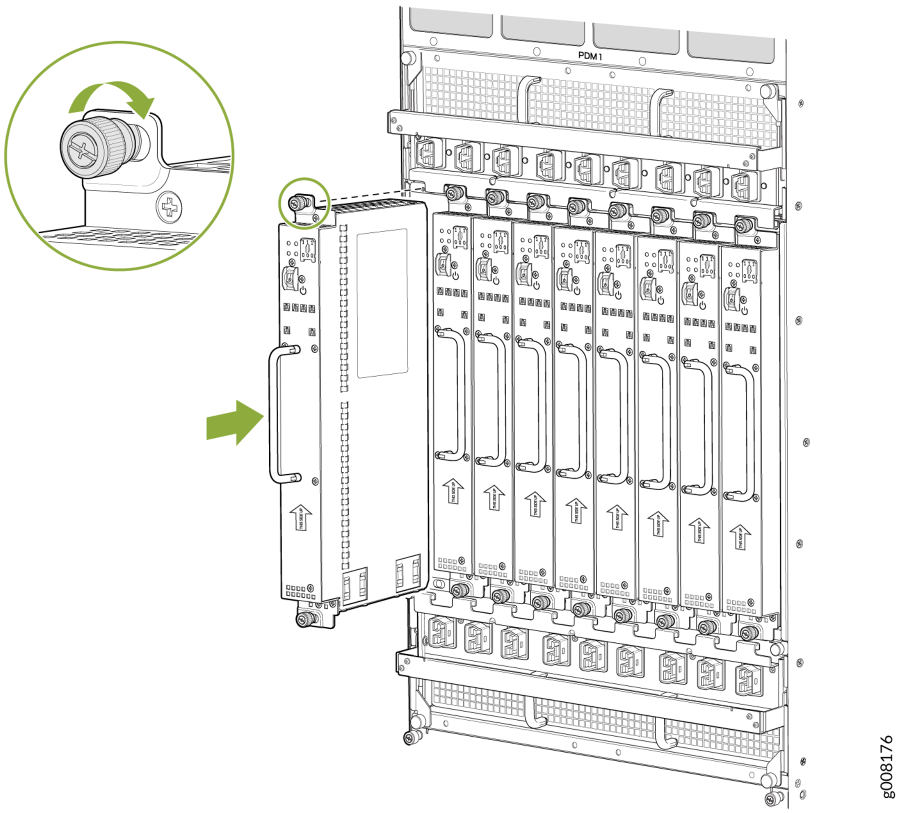
> **NOTE**: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed **0**. Power will be drawn from feed **1** only if feed **0** fails.

Figure 191: Selecting Input Feed on the Universal (HVAC/HVDC) Power Supply Module



3. Using both hands, grasp the handle and slide the PSM straight into the chassis until the PSM is fully seated in the chassis slot. Tighten the two captive screws (see Figure 192 on page 445). Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.

Figure 192: Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) PSM

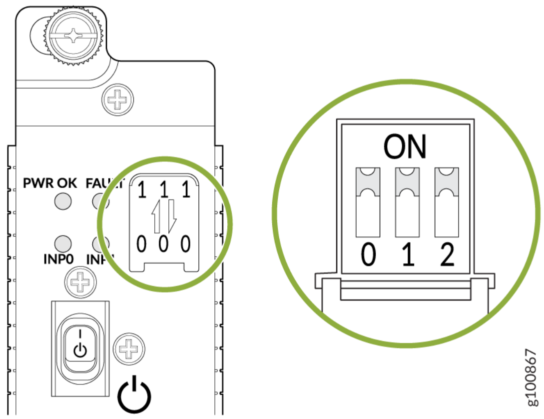


4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 193 on page 446).

> **NOTE**: If you are connecting two feeds, **INP0** and **INP1**, both LEDs on the PSM will be lit green steadily.

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. Move the switch to the on (|) position.
7. Verify that the **PWR OK** LED is lit green steadily. See *MX2020 High-Voltage Universal Power Supply Module LEDs*, "MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs" on page 159, or *MX2008 High-Voltage Universal Power Supply Module LEDs*.
8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 193: Selecting Input Feed on the Universal (HVAC/HVDC) Power Supply Module



> **NOTE**: Each PSM slot not occupied by a universal (HVAC/HVDC) PSM must be covered by a PSM blank panel.

RELATED DOCUMENTATION

Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router | **812**

Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module

Installing an MX2010 Dual-Wide MIC

To install a dual-wide MIC:

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 septum, if necessary (see Figure 194 on page 447):
   a. Place the MPC on a flat surface. If necessary, remove the MPC from the adapter card as described in "Removing an MX2010 MPC from the Adapter Card " on page 628.

   b. Remove the four screws labeled **S** on the bottom of the MPC.

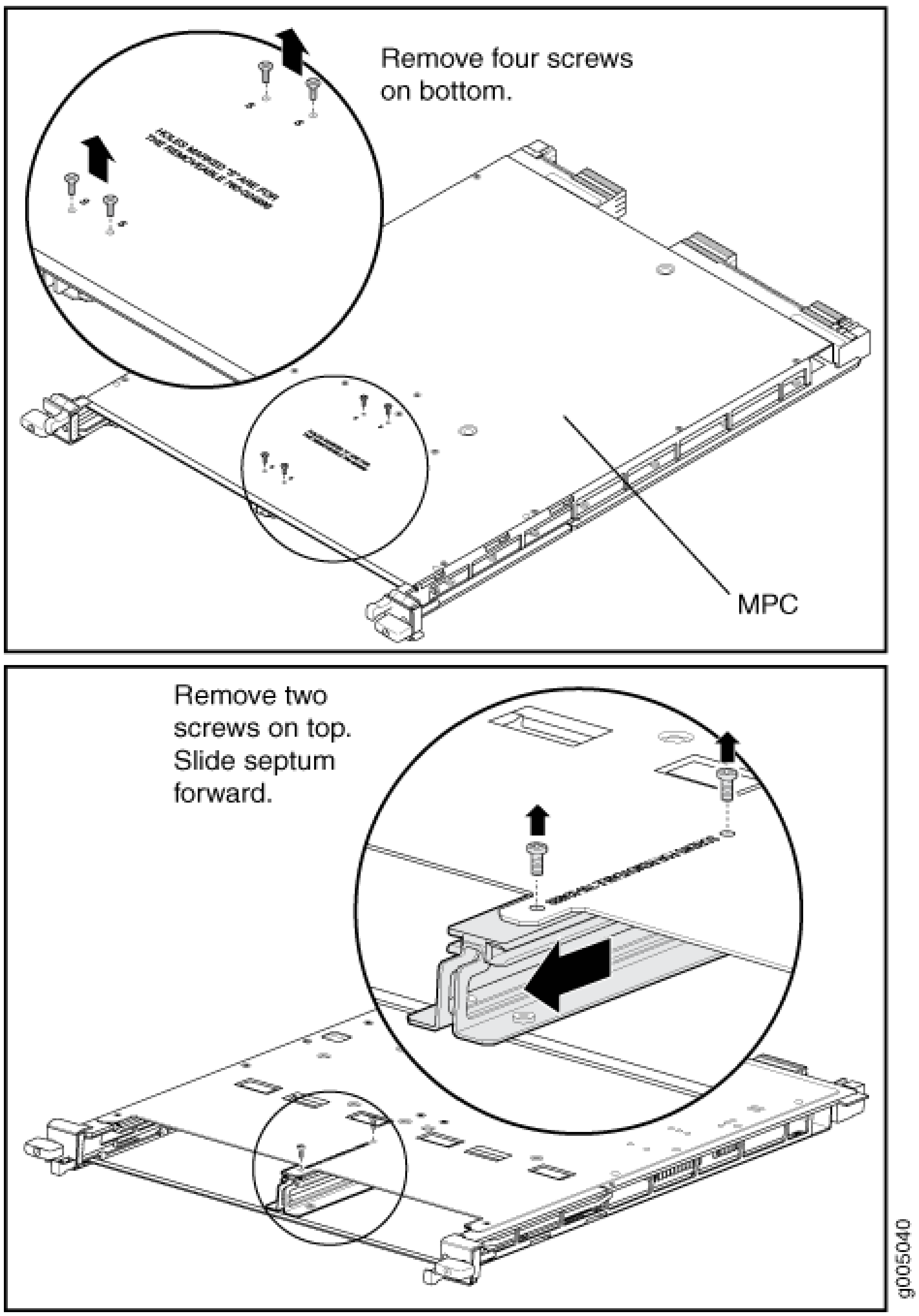
   c. Remove the two screws labeled **S** on the top of the MPC.

d. Slide the septum toward you and out of the MPC.

e. Store the septum and screws for later use.

f. Install the MPC as described in "Installing an MX2010 MPC into an Adapter Card" on page 633.

Figure 194: Removing the Septum



3. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
4. Pull the ejector lever above both MIC slots outward away from the router.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MIC slot until it is firmly seated in the chassis.

> **CAUTION**: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector levers are engaged by pushing them inward toward the router.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

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

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

9. Insert the appropriate cables into the cable connectors on the MIC.
10. Arrange each cable 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.

> **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.

11. Use one of the following methods to bring the MIC online:

- Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
- Issue the following CLI command:

```
user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot online
```

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the `show chassis fpc pic-status` command described in "Maintaining MX2010 MICs" on page 760.

RELATED DOCUMENTATION

Maintaining MX2010 MICs | 760
Replacing an MX2010 MIC | 613

Installing the MX2010 Standard EMI Cover

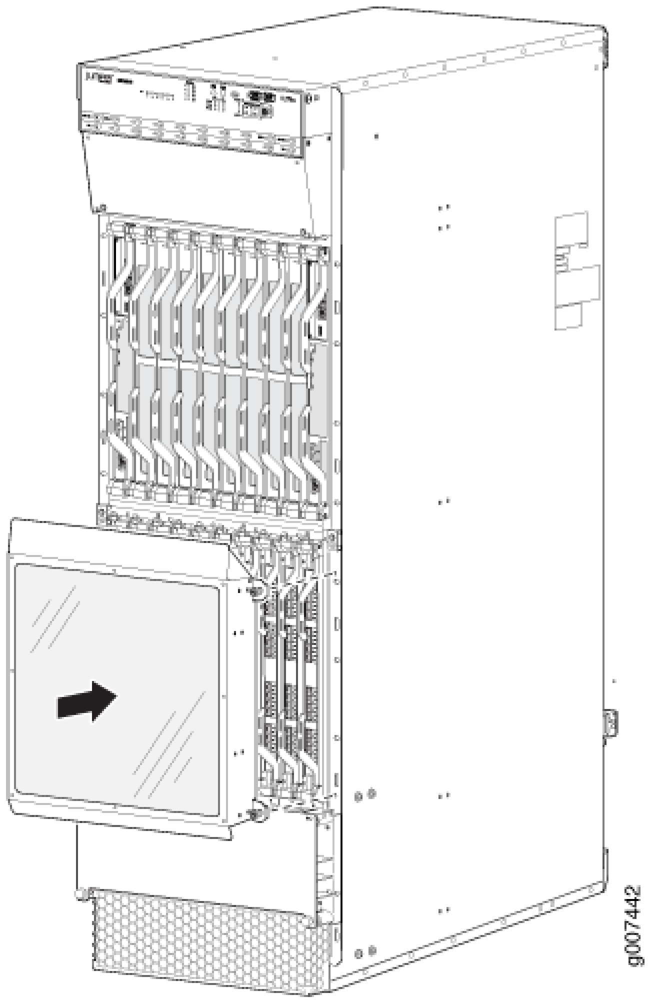
The MPCs require an EMI cover to reduce the risk of radio frequency interference disturbance that affects an electrical circuit because of electromagnetic interference emitted from an external source. The EMI cover is designed to reduce the electromagnetic interference (EMI) to comply with the Federal Communications Commission (FCC) requirements.

To install the EMI card-cage cover (see Figure 195 on page 450):

1. Align the four brackets on either side of the EMI cover with the chassis front-mounting flanges on the outside of the card cage.

   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. Adjust the EMI cover until the four captive screws align with the holes in the front-mounting flanges.
3. Tighten the four captive screws to secure the EMI cover in place.

Figure 195: Installing the EMI Card-Cage Cover



RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

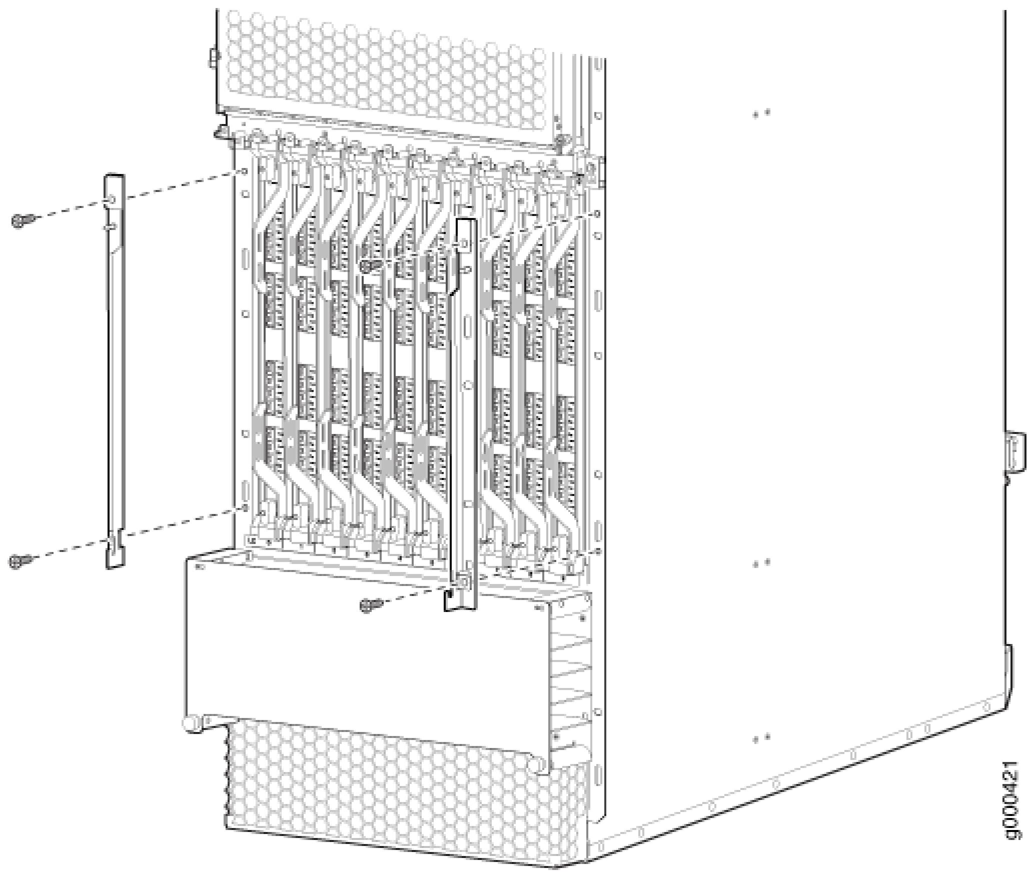
Installing the MX2010 Extended EMI Cover

The extended electromagnetic interference (EMI) covers attaches to the router over the card cage.

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

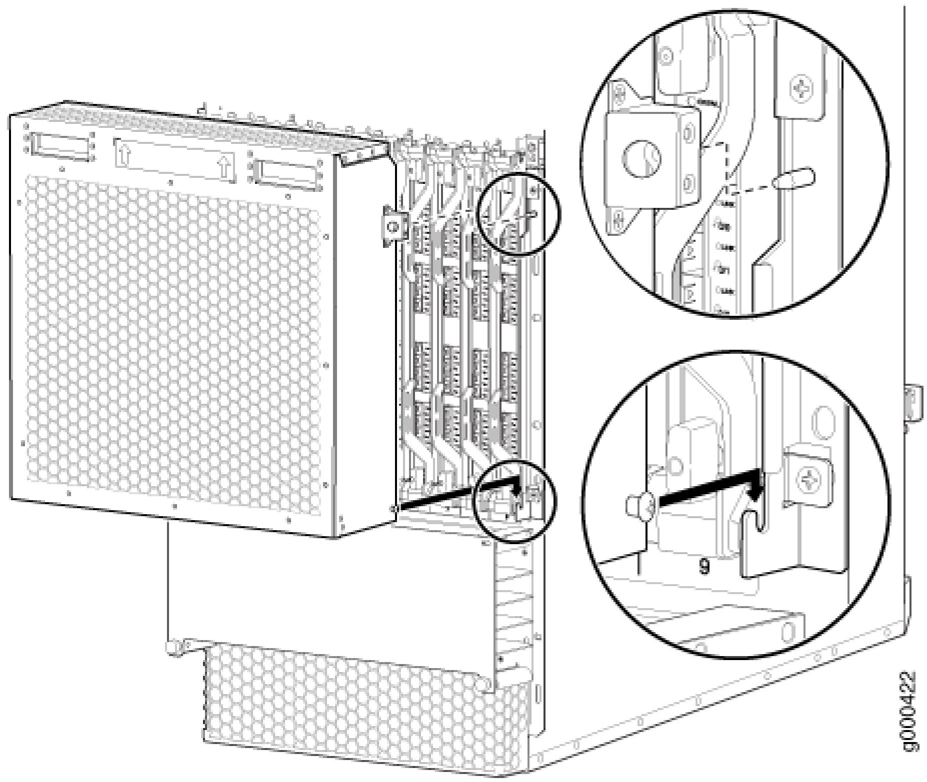
2. On each side of the card cage, orient the extended EMI cover's mounting brackets so that they line up with the mounting holes. The groove that holds the points on the cover should be at the top.
3. Using a number 2 Phillips (+) screwdriver, secure the extended EMI cover mounting brackets to the sides of the card cage by using the four screws provided (two on each side) (see Figure 196 on page 451).

Figure 196: Installing the Extended EMI Cover Mounting Brackets



4. Orient the cover so that the arrows point up in front of the card cage.
5. Angle the extended EMI cover so that the points at each side fit into the grooves on the EMI cover's mounting brackets.
6. Tilt the extended EMI cover into place and press firmly until the sides contact the mounting brackets of the EMI cover.

Figure 197: Installing the Extended EMI Card-Cage Cover



RELATED DOCUMENTATION

Replacing the MX2010 Extended Cable Manager | **541**

Replacing the MX2010 Standard EMI Cover | **598**

Preventing Electrostatic Discharge Damage to an MX Series Router

Installing an MX2010 Fan Tray

This topic describes how to install the upper or lower fan trays in a MX2010. This procedure applies to both the standard fan tray and the optimized power fan tray. To install the upper or lower fan tray (see Figure 198 on page 453 and Figure 199 on page 454):

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. Reposition the DC cable manager, if necessary, before installing the upper or lower fan tray:
   - Unwrap any cables on the DC cable manager and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable manager, and tray and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
3. Loosen the two captive screws on the access panel and open.
4. Remove the fan tray from the antistatic mat or ESD bag.
5. Grasp the fan tray by the handle, and place one hand under the fan tray for support. Insert the fan tray partially into the chassis while pressing the latch.

> **NOTE**: When inserting the fan tray, observe the correct orientation by the "this side up" label on the fan tray.

6. Press and hold the latch again while carefully pushing the fan tray into the chassis.

> **NOTE**: The fan tray has a double-locking safety mechanism that allows you to safely install the fan tray in a two-stage process.

7. Tighten the two captive screws on the fan tray faceplate.
8. Close the access panel and secure the two captive screws on either side of the access panel.
9. Reinstall the DC cable manager back into position, if necessary.

Figure 198: Installing Upper Fan Trays

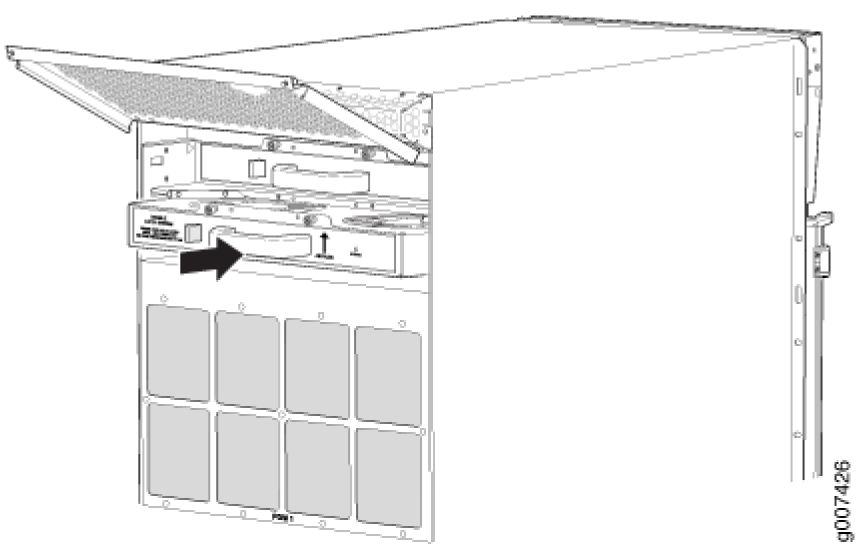
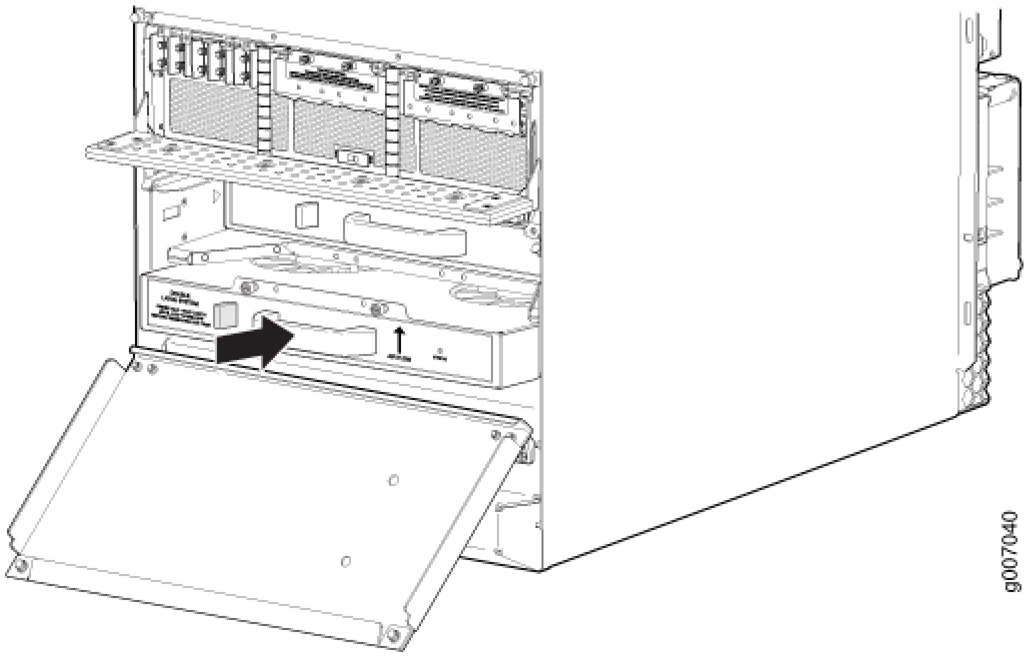


Figure 199: Installing Lower Fan Trays



RELATED DOCUMENTATION

Maintaining the MX2010 Fan Trays | 743

Installing the MX2010 Air Baffle

To install the upper air baffle—MX2000-UPR-BAFFLE-A:

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. Close the upper fan tray access door.
3. Align the holes on the air baffle with the holes located on either side of the upper fan tray access door, (see Figure 200 on page 455).
4. Tighten the four captive screws to secure the air baffle to the upper fan tray access door. Use #2 Phillips screwdriver. Do not overtighten. Do not apply more than 8.0 lb-in (0.90 Nm) of torque to the captive screws.

5. An air baffle can have fixed or adjustable louvers. Fixed louvers are set at an angle of 10-degrees. You must set adjustable louvers at a 10-degree upward tilt/angle to direct the exhaust air away from the router, (see Figure 201 on page 455).

Figure 200: Installing the Air Baffle

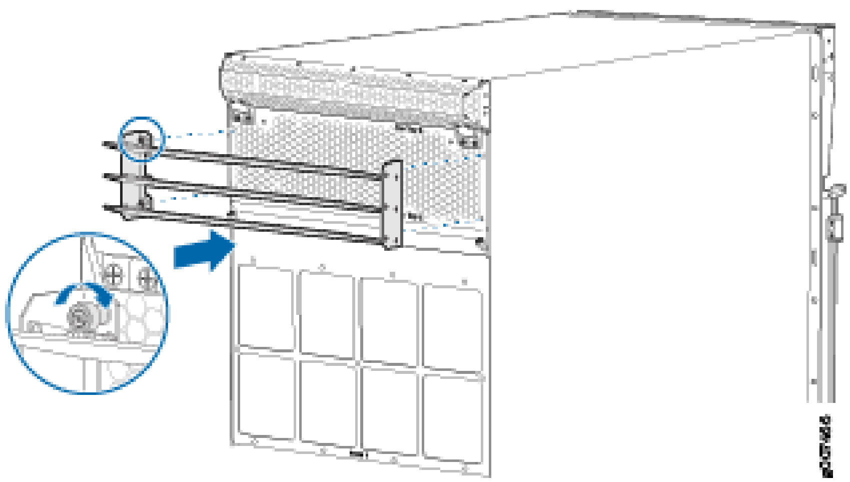
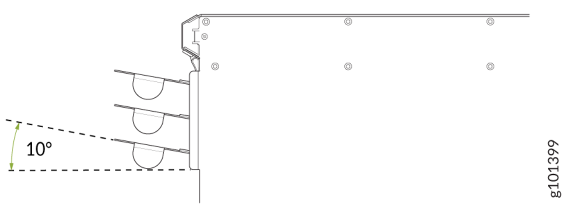


Figure 201: Air Baffle Louvers Adjusted at 10 Degrees Angle



RELATED DOCUMENTATION

Maintaining the MX2010 Air Baffle | 754

Replacing the MX2010 Air Baffle | 610

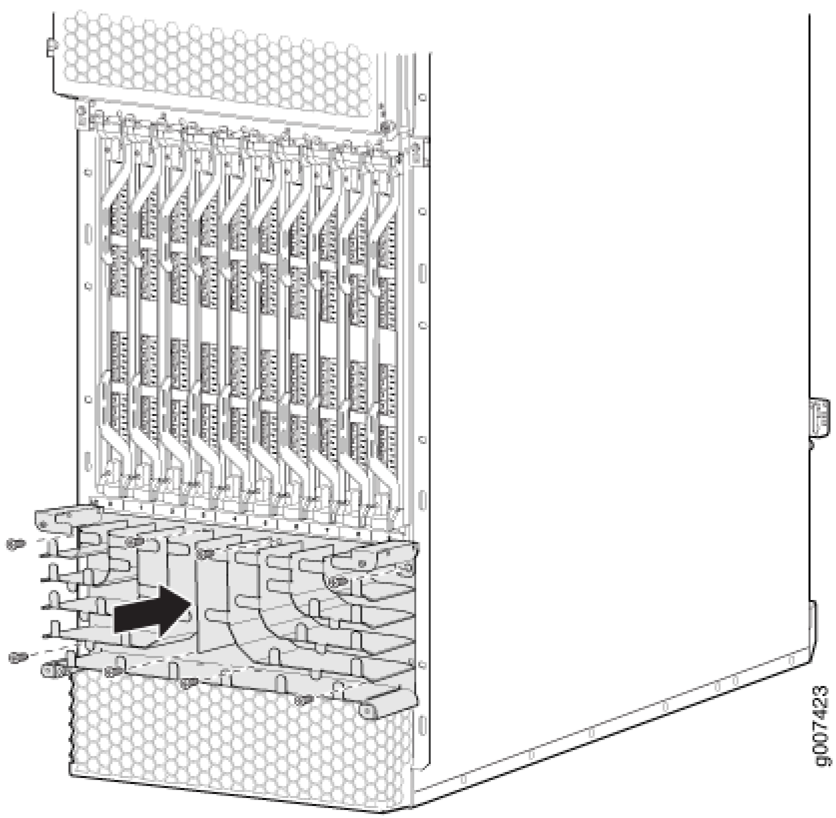
Installing the MX2010 Standard Cable Manager

To install the standard cable manager (see Figure 202 on page 456):

NOTE: The MX2010 comes equipped with a standard lower cable manager. The extended lower cable manager can be ordered from Juniper Networks.

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. Position the lower cable manager on the studs on the lower front of the chassis, just below the MPCs.
3. Insert the screws into the corners in the lower cable manager onto the studs on the chassis.
4. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.
5. Replace the cable manager cover, and secure it with the two captive screws.

Figure 202: Installing the Standard Cable Manager



RELATED DOCUMENTATION

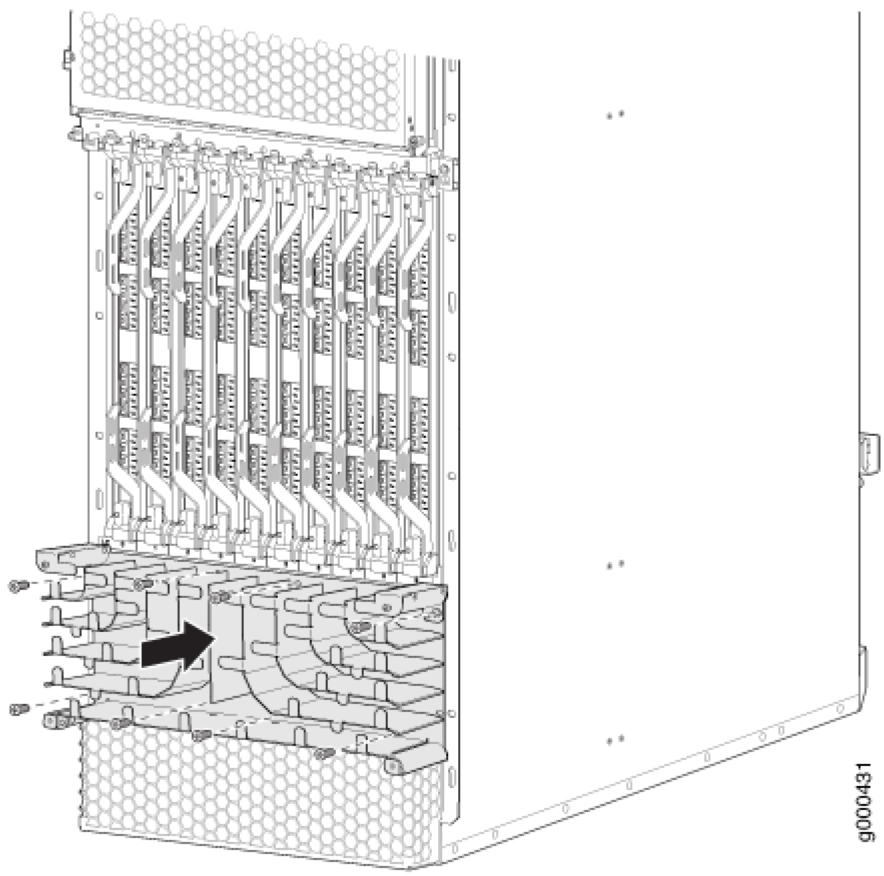
Replacing the MX2010 Standard Cable Managers | 535

Installing the MX2010 Extended Cable Manager

To install the extended cable manager (see Figure 203 on page 457):

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. Position the extended cable manager on the studs below the lower card cage.
3. Attach the extended cable manager using eight screws as shown in Figure 203 on page 457.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 203: Installing the Extended Lower Cable Manager

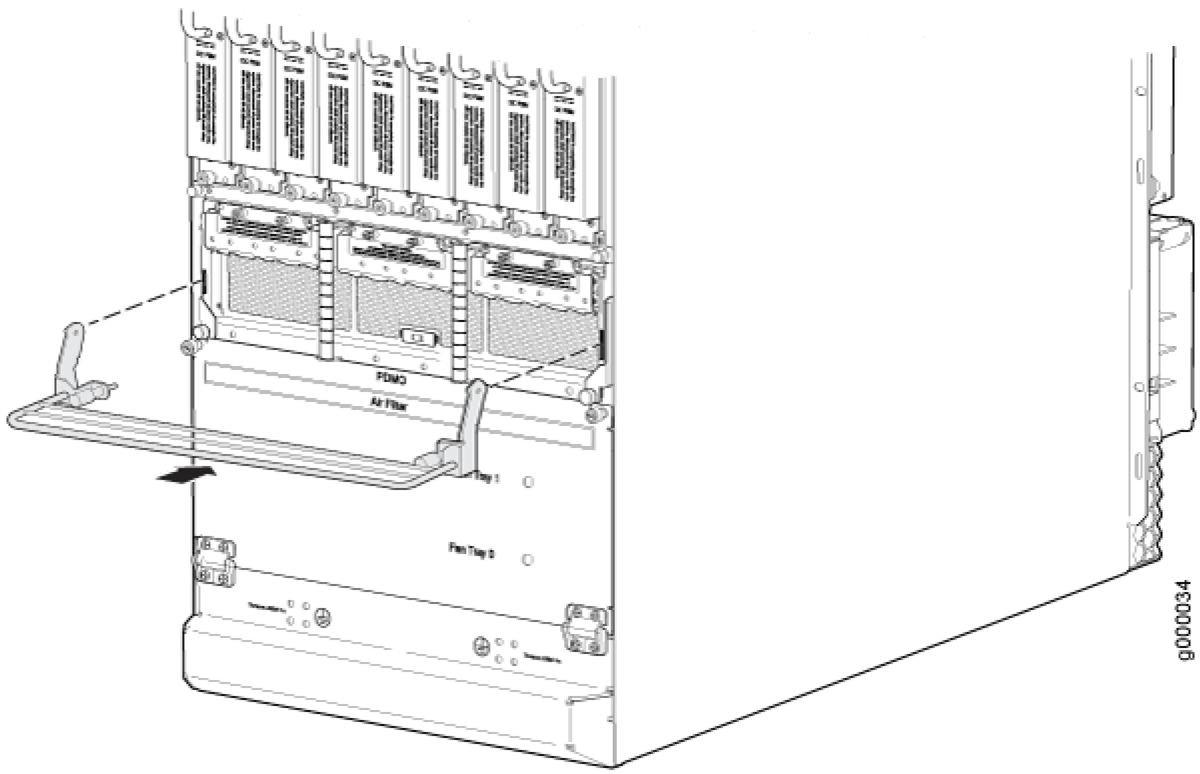


Installing the MX2010 Extended DC Cable Manager

To install the extended DC cable manager (see Figure 204 on page 458):

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. Position the extended DC cable manager over the two slots located on both sides of the DC PDM.
3. Lift the extended DC cable manager slightly up while inserting the two flanges into the slots on both sides of the DC PDM.
4. Push the extended DC cable manager into place.
5. Tighten the two captive screws to secure the extended DC cable manager.

Figure 204: Installing the Extended DC Cable Manager



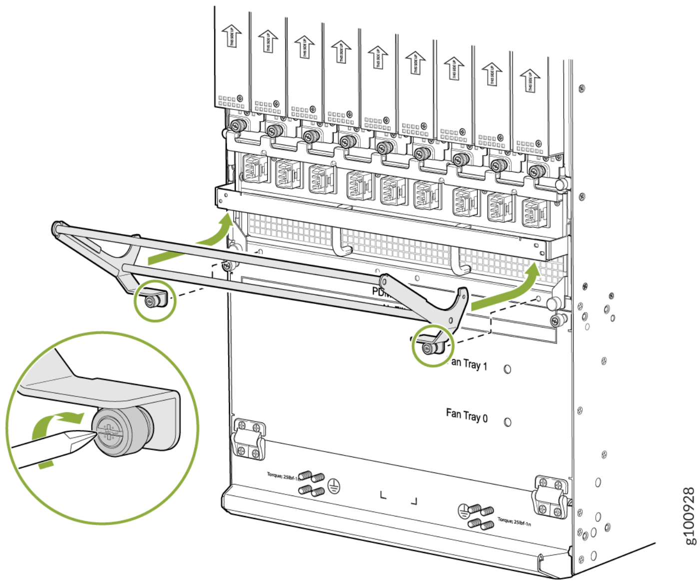
To install the extended cable manager for the DC PDM (240 V China) or the universal (HVAC/HVDC) PDM (see Figure 205 on page 459):

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. Position the cable manager over the two slots located on both sides of the PDM.

3. Lift the cable manager slightly up while inserting the two flanges into the slots on both sides of the PDM.

Figure 205: Installing the Extended Rear Cable Manager on the DC PDM (240 V China) and Universal (HVAC/HVDC) PDM



4. Push down to secure the extended cable manager in place. Tighten the screws using a screwdriver. See Figure 205 on page 459.

Installing an MX2010 MIC

To install a MIC (see Figure 207 on page 462):

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 you have used a dual-wide MIC and are now replacing it with two single-wide MICs, install the septum (see Figure 206 on page 460):

    a. Place the MPC on a flat surface (if necessary, remove the MPC from the adapter card as described in "Removing an MX2010 MPC from the Adapter Card" on page 628.

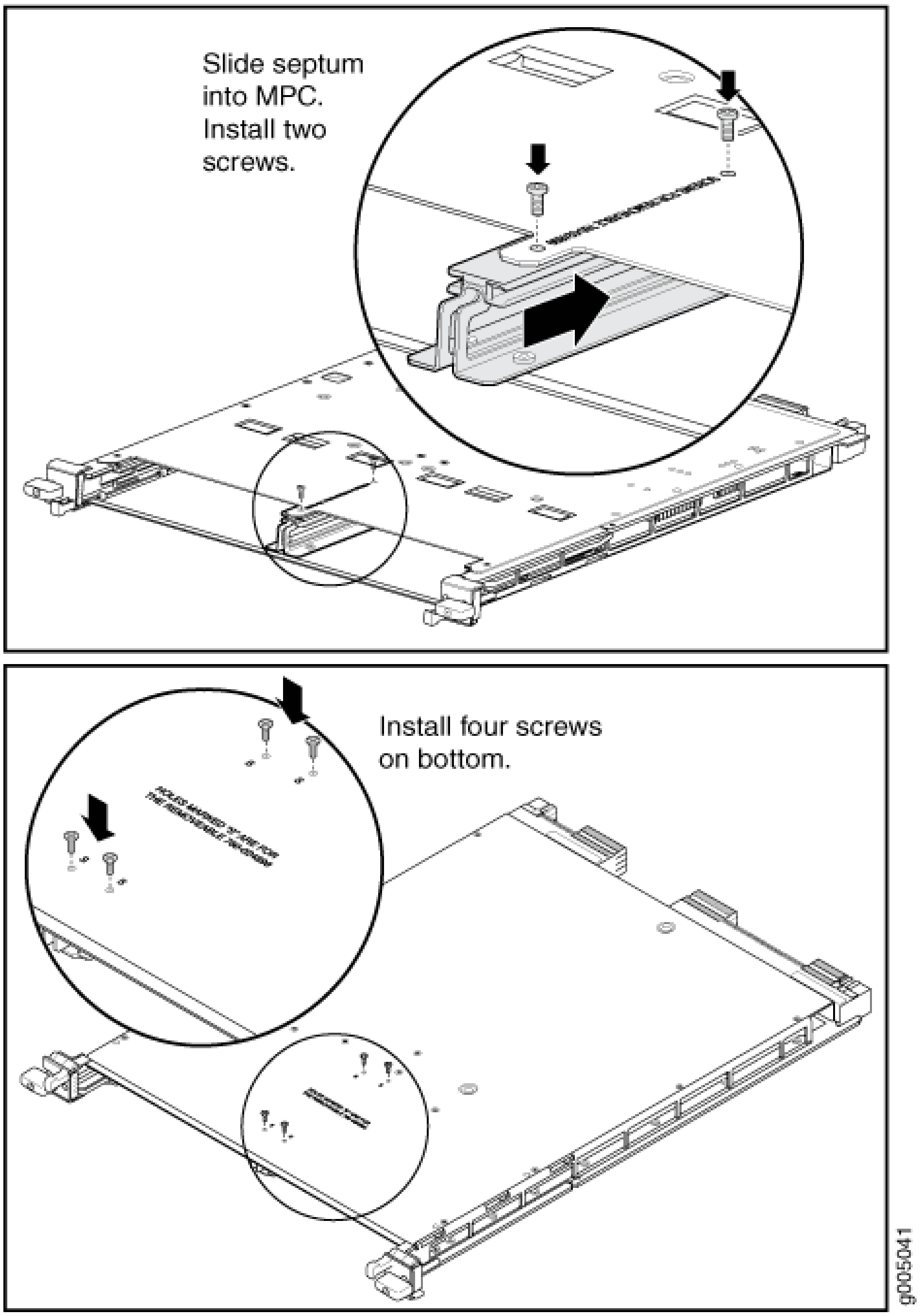
    b. Position the septum in the center of the MPC so that it lines up with holes labeled **S** on the top of the MPC.

    c. Insert a screw into each of the two holes labeled **S**, and then tighten them completely.

    d. On the bottom of the MPC, insert a screw into each of the four holes labeled **S**, and then tighten them completely.

e. Install the MPC as described in "Installing an MX2010 MPC into an Adapter Card" on page 633.

Figure 206: Installing the Septum



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

4. On the MPC, pull the ejector lever that is adjacent to the MIC you are installing away from the MPC faceplate.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MPC until it is firmly seated in the MPC.

> **CAUTION**: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector lever is engaged by pushing it toward the MPC faceplate.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

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

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

9. Insert the appropriate cables into the cable connectors on the MIC.
10. Arrange each cable 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.

> **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.

11. Use one of the following methods to bring the MIC online:

    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.

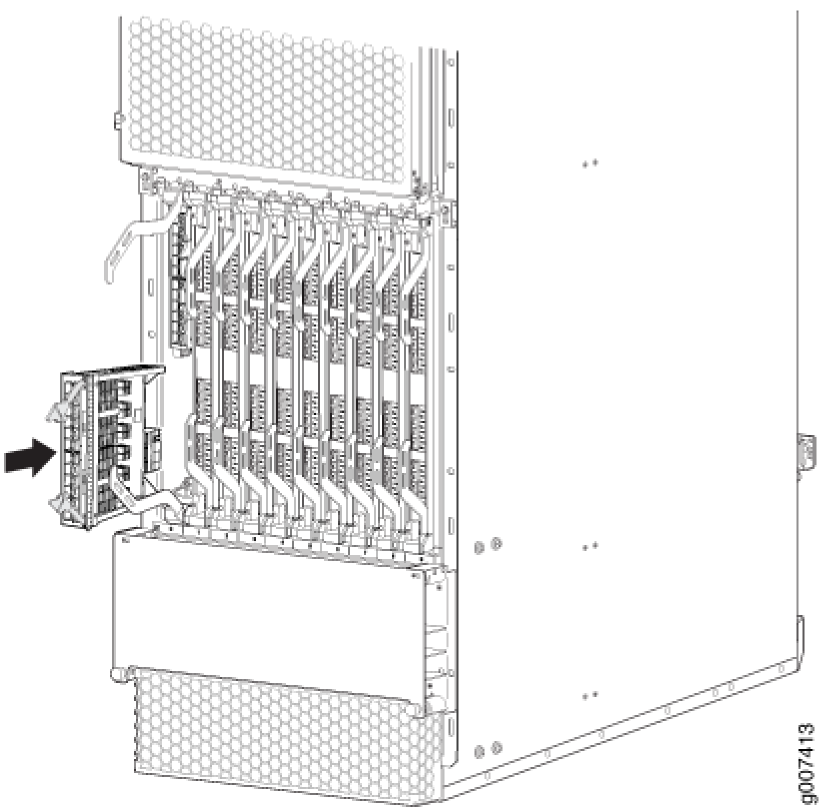
- Issue the following CLI command:

```
user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot online
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the `show chassis fpc pic-status` command described in "Maintaining MX2010 MICs" on page 760.

Figure 207: Installing a MIC



RELATED DOCUMENTATION

Maintaining MX2010 MICs | 760
Replacing an MX2010 MIC | 613
Installing an MX2010 Dual-Wide MIC | 446

Installing an MX2000 SFB

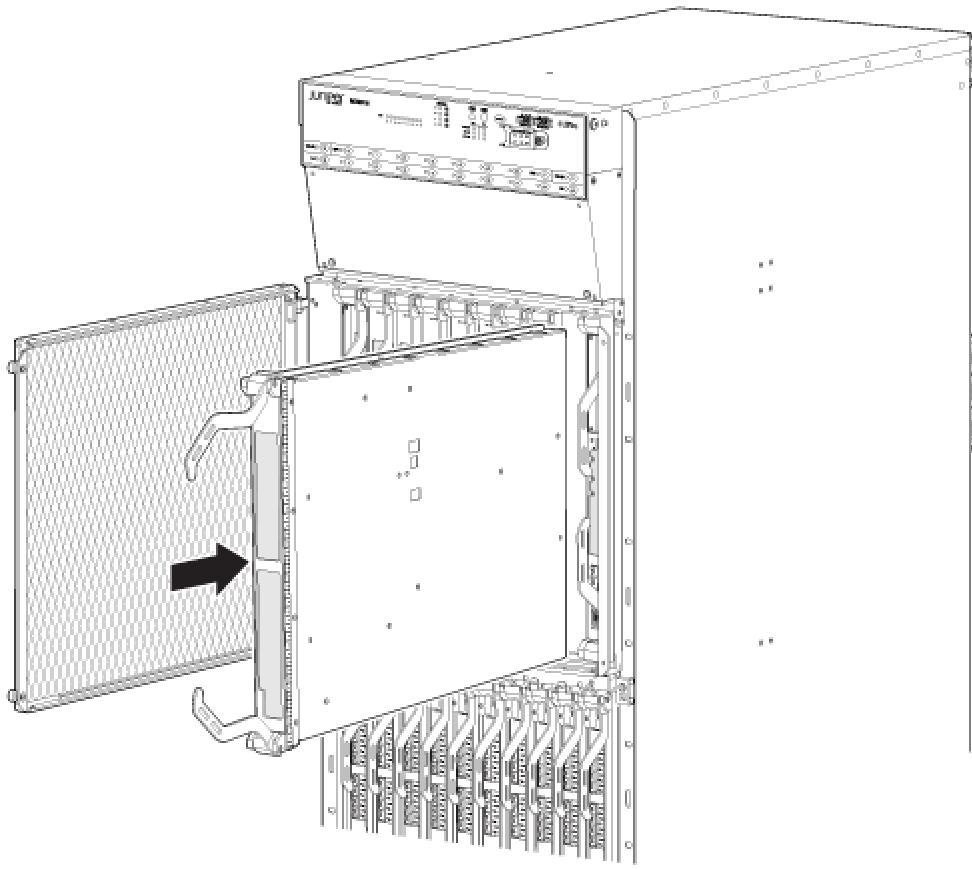
To install an SFB (see Figure 208 on page 464):

CAUTION: Before removing or replacing an SFB, ensure that the ejector handles are stored horizontally and pressed toward the center of the SFB.

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

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. Take each SFB to be installed out of its electrostatic bag, and identify the slot on the SFB where it will be connected.
3. Carefully align the sides of the SFB with the guides inside the chassis.
4. Slide the SFB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Place the ejector handles in their proper position, vertically and toward the center of the board.

Figure 208: Installing an SFB



6. Check the LEDs on the SFB faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the SFB is installed.
   - If the **OK/FAIL** LED is red, remove and install the SFB again. If the **OK/FAIL** LED still lights steadily, the SFB is not functioning properly. Contact your customer support representative. See "Contact Customer Support" on page 838.
7. Check the status of the SFB by using the `show chassis environment sfb` command:

```
user@host> show chassis environment sfb
SFB 0 status:
  State                         Online
  Intake-Zone0 Temperature      32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature     38 degrees C / 100 degrees F
  IntakeA-Zone0 Temperature     28 degrees C / 82 degrees F
  IntakeB-Zone1 Temperature     29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature     31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature     55 degrees C / 131 degrees F
```

```
  SFB-XF1-Zone0 Temperature  48 degrees C / 118 degrees F
  SFB-XF0-Zone0 Temperature  47 degrees C / 116 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3299 mV
    LTC3880-3.3v-CH0          3299 mV
    LTC3880-3.3v-CH1          3299 mV
SFB 1 status:
  State                      Online
  Intake-Zone0 Temperature   32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  27 degrees C / 80 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature  56 degrees C / 132 degrees F
  SFB-XF1-Zone0 Temperature  47 degrees C / 116 degrees F
  SFB-XF0-Zone0 Temperature  47 degrees C / 116 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1499 mV
    LTC3880-XF2-1.5v-CH0      1499 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
```

```
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1030 mV
    LTC3880-XF1-1.0v-CH0      1030 mV
    LTC3880-XF1-1.0v-CH1      1033 mV
    LTC3880-XF0-1.5v-RAIL     1500 mV
    LTC3880-XF0-1.5v-CH0      1500 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 2 status:
  State                      Online
  Intake-Zone0 Temperature   33 degrees C / 91 degrees F
  Exhaust-Zone1 Temperature  38 degrees C / 100 degrees F
  IntakeA-Zone0 Temperature  29 degrees C / 84 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  33 degrees C / 91 degrees F
  SFB-XF2-Zone1 Temperature  58 degrees C / 136 degrees F
  SFB-XF1-Zone0 Temperature  49 degrees C / 120 degrees F
  SFB-XF0-Zone0 Temperature  49 degrees C / 120 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1500 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3299 mV
```

```
    LTC3880-3.3v-CH0          3299 mV
    LTC3880-3.3v-CH1          3299 mV
SFB 3 status:
  State                       Online
  Intake-Zone0 Temperature    44 degrees C / 111 degrees F
  Exhaust-Zone1 Temperature   40 degrees C / 104 degrees F
  IntakeA-Zone0 Temperature   36 degrees C / 96 degrees F
  IntakeB-Zone1 Temperature   31 degrees C / 87 degrees F
  Exhaust-Zone0 Temperature   38 degrees C / 100 degrees F
  SFB-XF2-Zone1 Temperature   59 degrees C / 138 degrees F
  SFB-XF1-Zone0 Temperature   52 degrees C / 125 degrees F
  SFB-XF0-Zone0 Temperature   59 degrees C / 138 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 4 status:
  State                       Online
  Intake-Zone0 Temperature    32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature   37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature   27 degrees C / 80 degrees F
  IntakeB-Zone1 Temperature   28 degrees C / 82 degrees F
  Exhaust-Zone0 Temperature   31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature   54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature   46 degrees C / 114 degrees F
```

```
  SFB-XF0-Zone0 Temperature  45 degrees C / 113 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1499 mV
    LTC3880-XF2-1.5v-CH0      1499 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1500 mV
    LTC3880-XF1-1.5v-CH0      1500 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1500 mV
    LTC3880-XF0-1.0v-RAIL      949 mV
    LTC3880-XF0-1.0v-CH0       949 mV
    LTC3880-XF0-1.0v-CH1       952 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 5 status:
  State                      Online
  Intake-Zone0 Temperature   33 degrees C / 91 degrees F
  Exhaust-Zone1 Temperature  36 degrees C / 96 degrees F
  IntakeA-Zone0 Temperature  28 degrees C / 82 degrees F
  IntakeB-Zone1 Temperature  28 degrees C / 82 degrees F
  Exhaust-Zone0 Temperature  32 degrees C / 89 degrees F
  SFB-XF2-Zone1 Temperature  54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature  50 degrees C / 122 degrees F
  SFB-XF0-Zone0 Temperature  50 degrees C / 122 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
```

```
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1033 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 6 status:
  State                      Online
  Intake-Zone0 Temperature   41 degrees C / 105 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  32 degrees C / 89 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  37 degrees C / 98 degrees F
  SFB-XF2-Zone1 Temperature  54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature  60 degrees C / 140 degrees F
  SFB-XF0-Zone0 Temperature  60 degrees C / 140 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1033 mV
    LTC3880-XF0-1.5v-RAIL     1500 mV
    LTC3880-XF0-1.5v-CH0      1500 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1033 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
```

```
    LTC3880-3.3v-CH1          3299 mV
SFB 7 status:
  State                      Online
  Intake-Zone0 Temperature   41 degrees C / 105 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  33 degrees C / 91 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  37 degrees C / 98 degrees F
  SFB-XF2-Zone1 Temperature  55 degrees C / 131 degrees F
  SFB-XF1-Zone0 Temperature  50 degrees C / 122 degrees F
  SFB-XF0-Zone0 Temperature  57 degrees C / 134 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1501 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1033 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
```

Installing an MX2010 CB-RE

To install a CB-RE (seeFigure 209 on page 472):

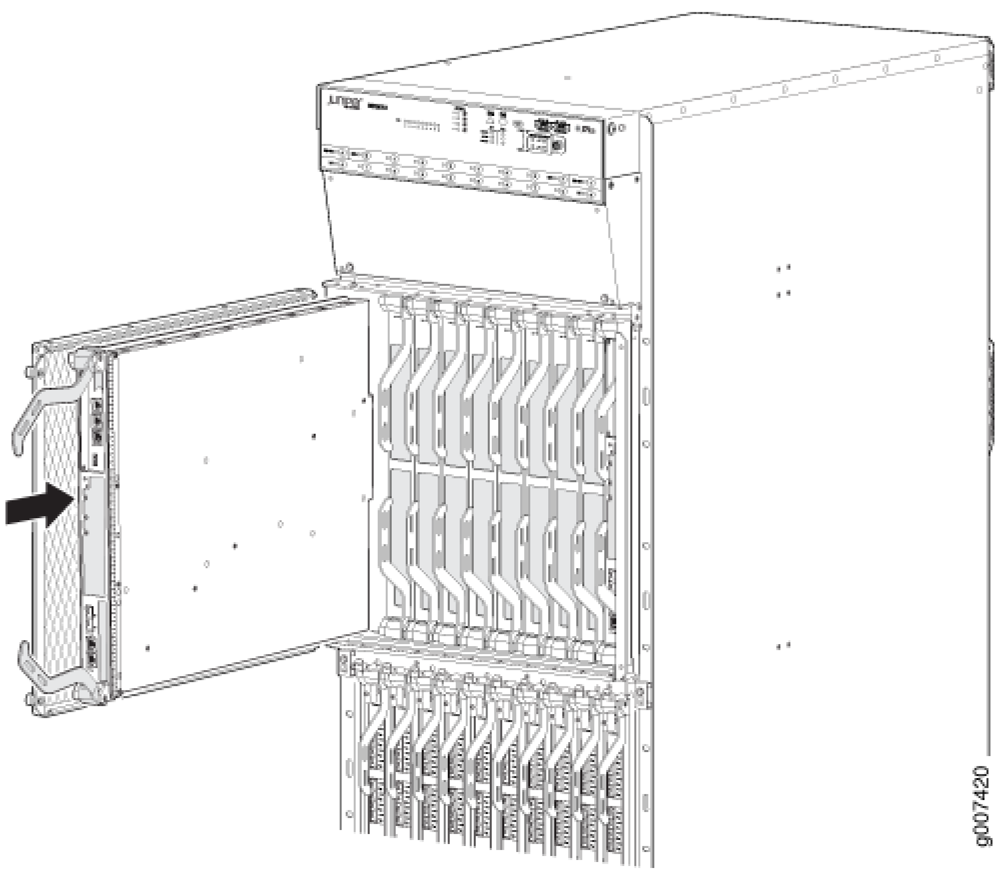
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

2. Remove the CB-RE from the electrostatic bag.
3. Carefully align the sides of the CB-RE with the guides inside the chassis.
4. Slide the CB-RE into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.
6. Check the LEDs on the CB-RE faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the CB-RE is installed.
   - If the **OK/FAIL** LED is red, remove and install the CB-RE again. If the **OK/FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative. See *Contact Customer Support*.
7. Check the status of the CB-RE by using the `show chassis environment cb` command:

```
user@host> show chassis environment cb
CB 0 status:
 State                      Online Master
  IntakeA-Zone0 Temperature  25 degrees C / 77 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  IntakeC-Zone0 Temperature  28 degrees C / 82 degrees F
  ExhaustA-Zone0 Temperature 26 degrees C / 78 degrees F
  ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
  TCBC-Zone0 Temperature     32 degrees C / 89 degrees F
  Power 1
    1.0 V                     1008 mV
    1.2 V                     1208 mV
    1.8 V                     1801 mV
    2.5 V                     2526 mV
    3.3 V                     3312 mV
    5.0 V                     5020 mV
    5.0 V RE                  4995 mV
    12.0 V                   12123 mV
    12.0 V RE                12007 mV
  Bus Revision               100
  FPGA Revision              271
CB 1 status:
  State                      Online Standby
  IntakeA-Zone0 Temperature  30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature  25 degrees C / 77 degrees F
  IntakeC-Zone0 Temperature  39 degrees C / 102 degrees F
  ExhaustA-Zone0 Temperature 33 degrees C / 91 degrees F
```

```
ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
TCBC-Zone0 Temperature     31 degrees C / 87 degrees F
Power 1
  1.0 V                     1015 mV
  1.2 V                     1211 mV
  1.8 V                     1814 mV
  2.5 V                     2545 mV
  3.3 V                     3345 mV
  5.0 V                     5066 mV
  5.0 V RE                  5020 mV
  12.0 V                   12104 mV
  12.0 V RE                12046 mV
Bus Revision               100
FPGA Revision              0
```

Figure 209: Installing an MX2010 CB-RE



Installing MX2000 Router AC Power Supply Modules

Before you install a PSM, be aware of the following:

NOTE: The AC PSM is hot-swappable when a minimum number of PSMs installed and operational.

WARNING: The AC PSMs have no circuit breakers that can physically disconnect AC current from the router. After AC feeds have been connected to the PDM, the AC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To install an AC PSM (see Figure 210 on page 474,Figure 211 on page 475, or Figure 212 on page 476:

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**), or in the on (**|**) position.

   WARNING: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate.
5. Turn on the power switch to the on (**|**) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 210: Installing an MX2020 Router AC Power Supply Module

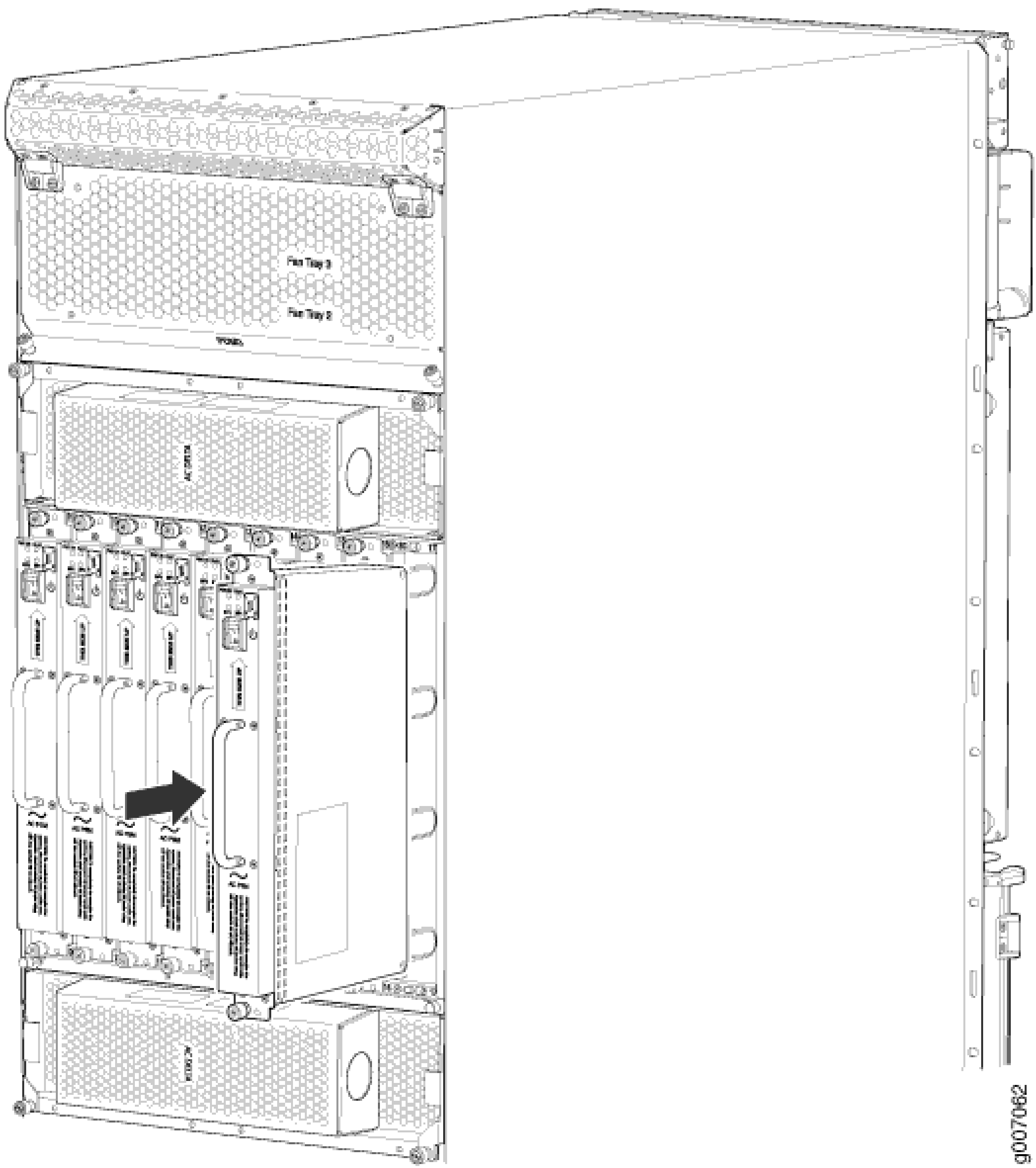


Figure 211: Installing an MX2010 Router AC Power Supply Module

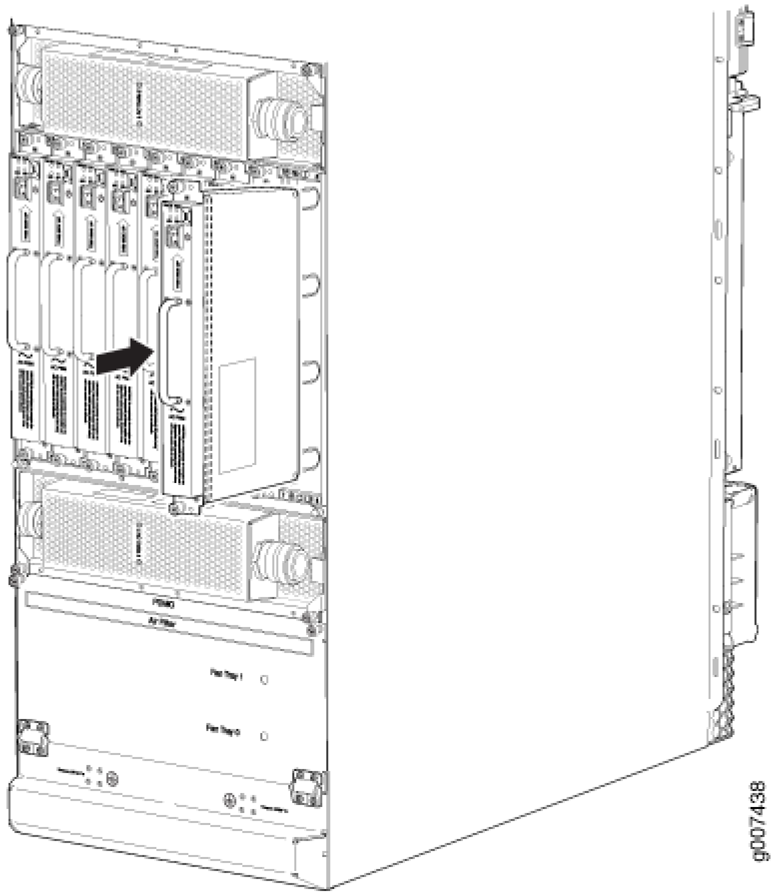
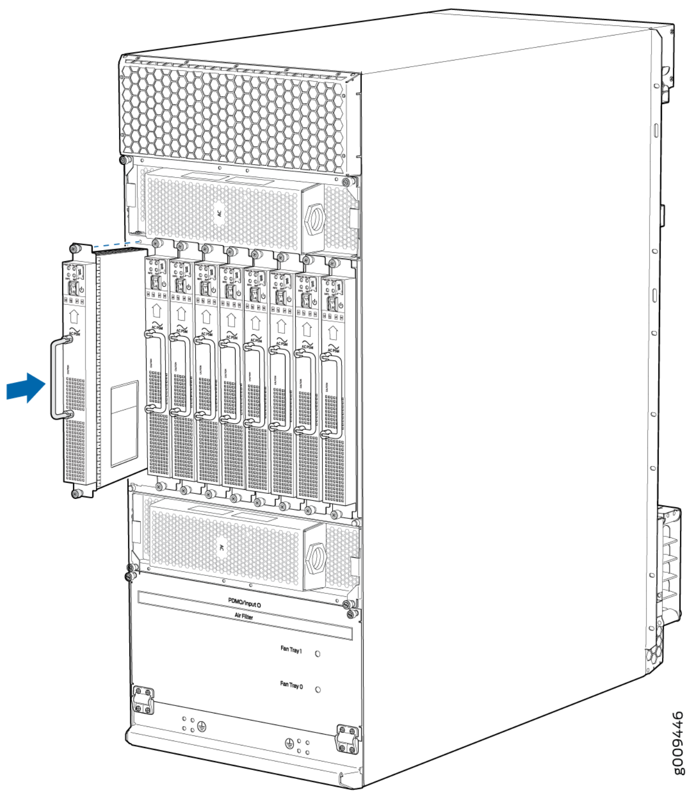


Figure 212: Installing an MX2008 Router AC Power Supply Module



Installing MX2000 Router DC Power Supply Modules (-48 V)

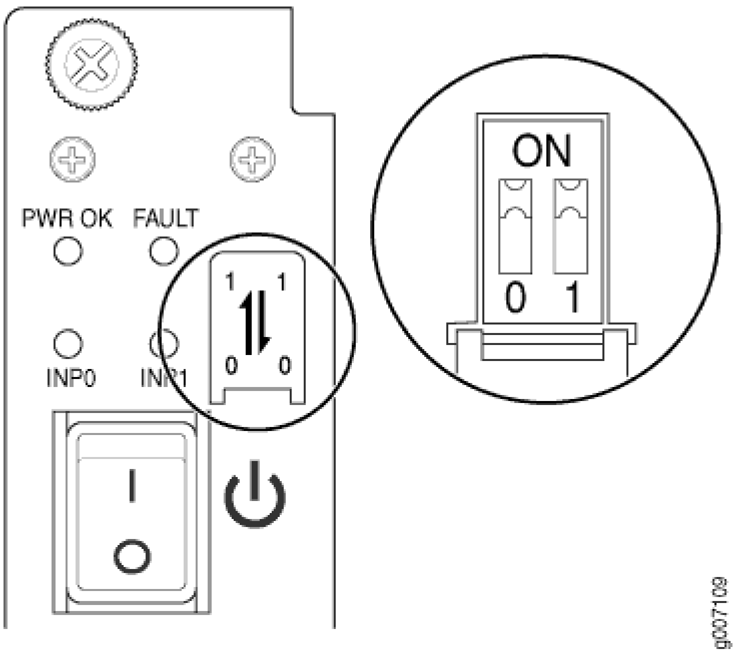
To install an MX2000 DC PSM (-48 V):

1. Verify that the power switches on all PSMs are in the off (**O**) position.
2. On the PSM, slide the plastic cover away from the input mode switch to expose the dual DIP switches. Move the input mode DIP switch **0** (left switch) to the **ON** position for the bottom feed **INP0** (expected to be connected), and DIP switch **1** (right switch) to the **ON** position for the top feed **INP1** (expected to be connected). If both DIP switches **0** and **1** are turned to the **ON** position, then both top and bottom feeds are expected to be connected, (see Figure 213 on page 477).

   In addition, a PSM failure triggers the alarm LED on the craft interface.

NOTE: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed **0**. Power will be drawn from feed **1** only if feed **0** fails.

Figure 213: Selecting DC Power Subsystem Feed Redundancy



3. Using both hands, grasp the handle and slide the PSM straight into the chassis until the PSM is fully seated in the chassis slot. Tighten the two captive screws (see Figure 214 on page 478 (MX2020) and Figure 215 on page 479) (MX2010), or Figure 216 on page 480 (MX2008). Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.

Figure 214: Installing an MX2020 Router DC Power Supply Module Installed

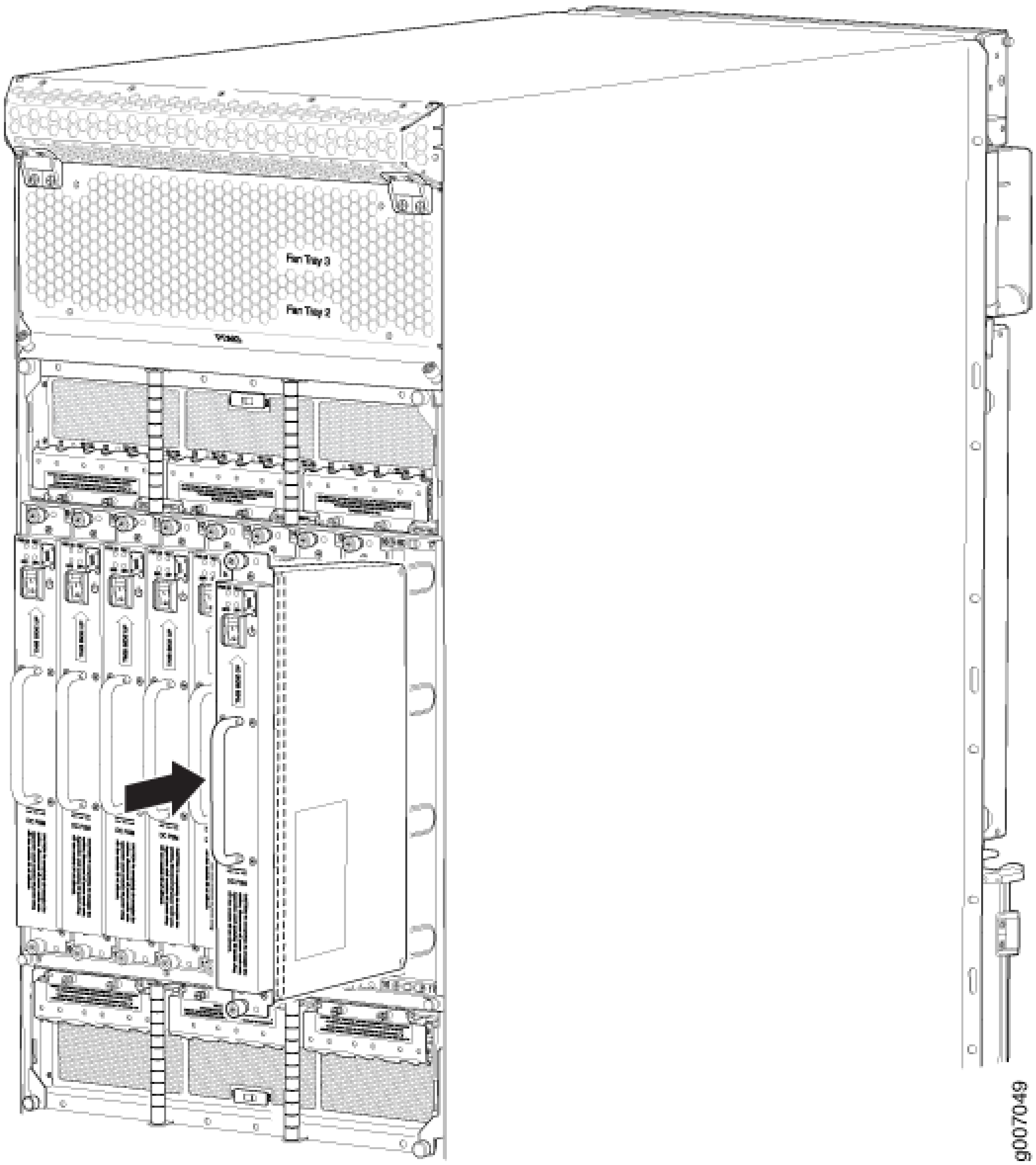


Figure 215: Installing an MX2010 Router DC Power Supply Module

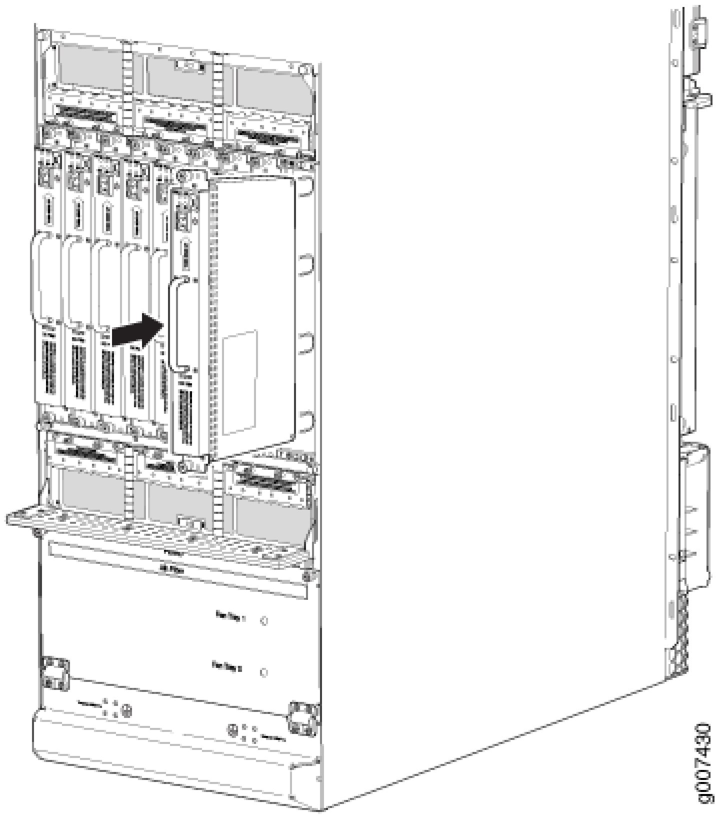
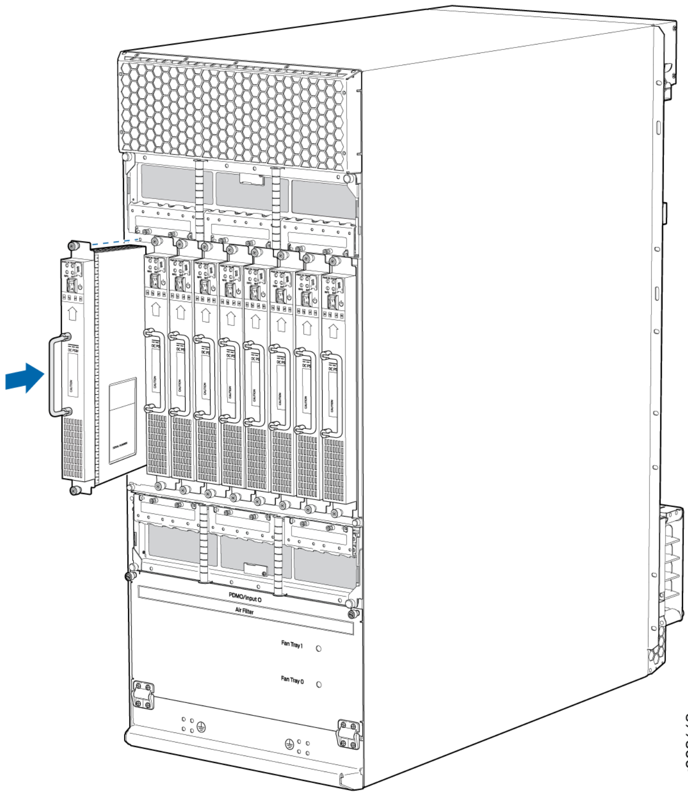


Figure 216: Installing an MX2008 Router DC Power Supply Module

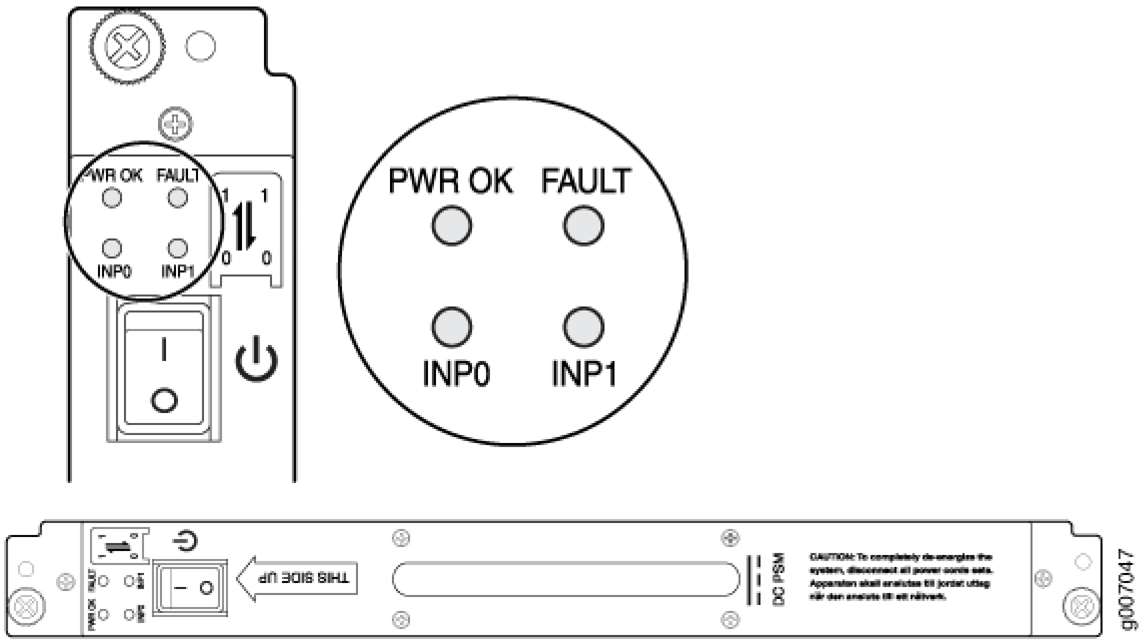


4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 217 on page 481).

> **NOTE**: If you are connecting two feeds, **INP0** and **INP1**, both LEDs on the PSM will be lit green steadily.

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. Move the switch to the on (|) position.
7. Verify that the **PWR OK** LED is lit green steadily. See *MX2020 DC Power Supply Module LEDs*, "MX2010 DC Power Supply Module LEDs" on page 152, or *MX2008 DC Power Supply Module LEDs* for information on PSM LED behavior.
8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 217: MX2000 DC Power Supply Module Front View



NOTE: Each PSM slot not occupied by a DC PSM must be covered by a PSM blank panel.

RELATED DOCUMENTATION

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | 813

Replacing an MX2020 DC Power Supply Module (-48 V)

Replacing an MX2010 DC Power Supply Module (-48 V) | 555

Replacing an MX2008 DC Power Supply Module (-48 V)

Installing an MX2000 Router Three-Phase Delta AC Power Distribution Module

Before you install a three-phase delta AC power distribution module (PDM), be aware of the following:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

NOTE: The PDMs are hot swappable in a redundant configuration. However, you cannot switch from one type of PDM (AC or DC) to another while the system is on.

Each three-phase delta AC PDM weighs approximately 12 lb (5.44 kg). To install a three-phase delta AC PDM:

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. [Optional]—If you are switching from a DC PDM to an AC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to AC.
4. Pull the locking levers on either side of the faceplate away until they stop.
5. Using both hands, slide the PDM into the chassis until you feel resistance (see Figure 218 on page 483Figure 219 on page 484, and Figure 220 on page 485).
6. Push the lock levers until they make contact with the PDM faceplate.
7. Tighten the two captive screws on the locking levers of the PDM faceplate to secure the PDM in the chassis. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
8. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.

Figure 218: Installing a Three-Phase Delta AC Power Distribution Module (MX2020)

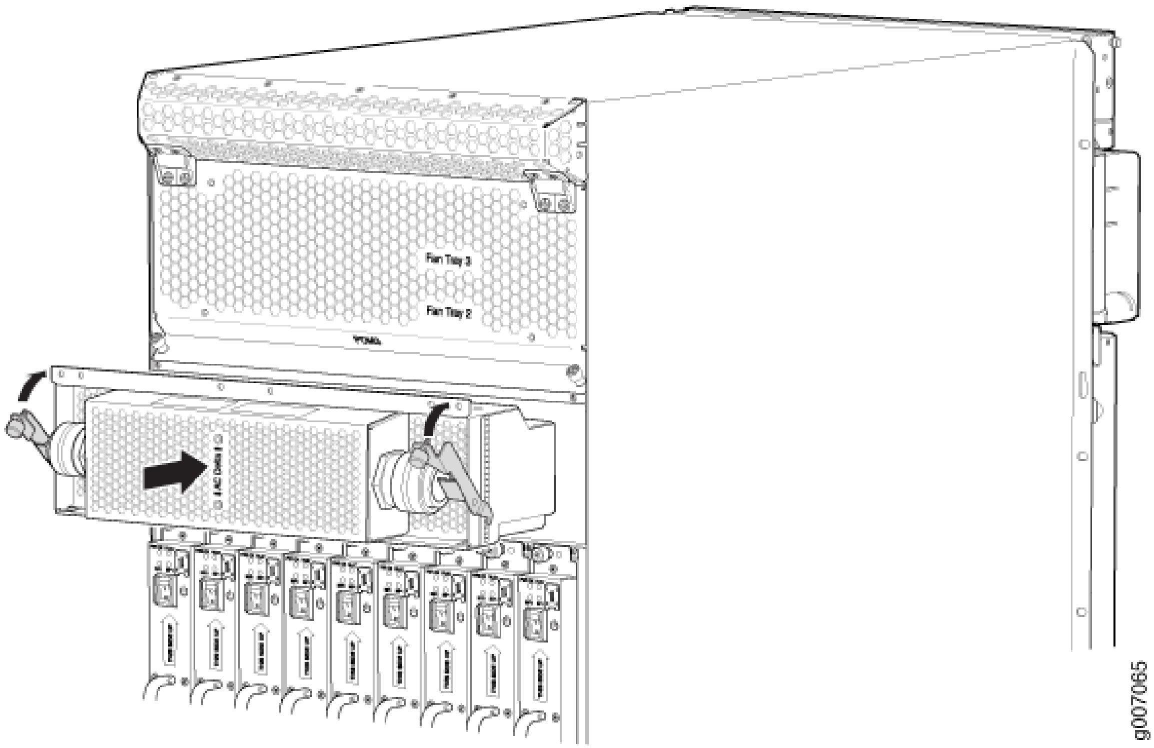


Figure 219: Installing a Three-Phase Delta AC Power Distribution Module (MX2010)

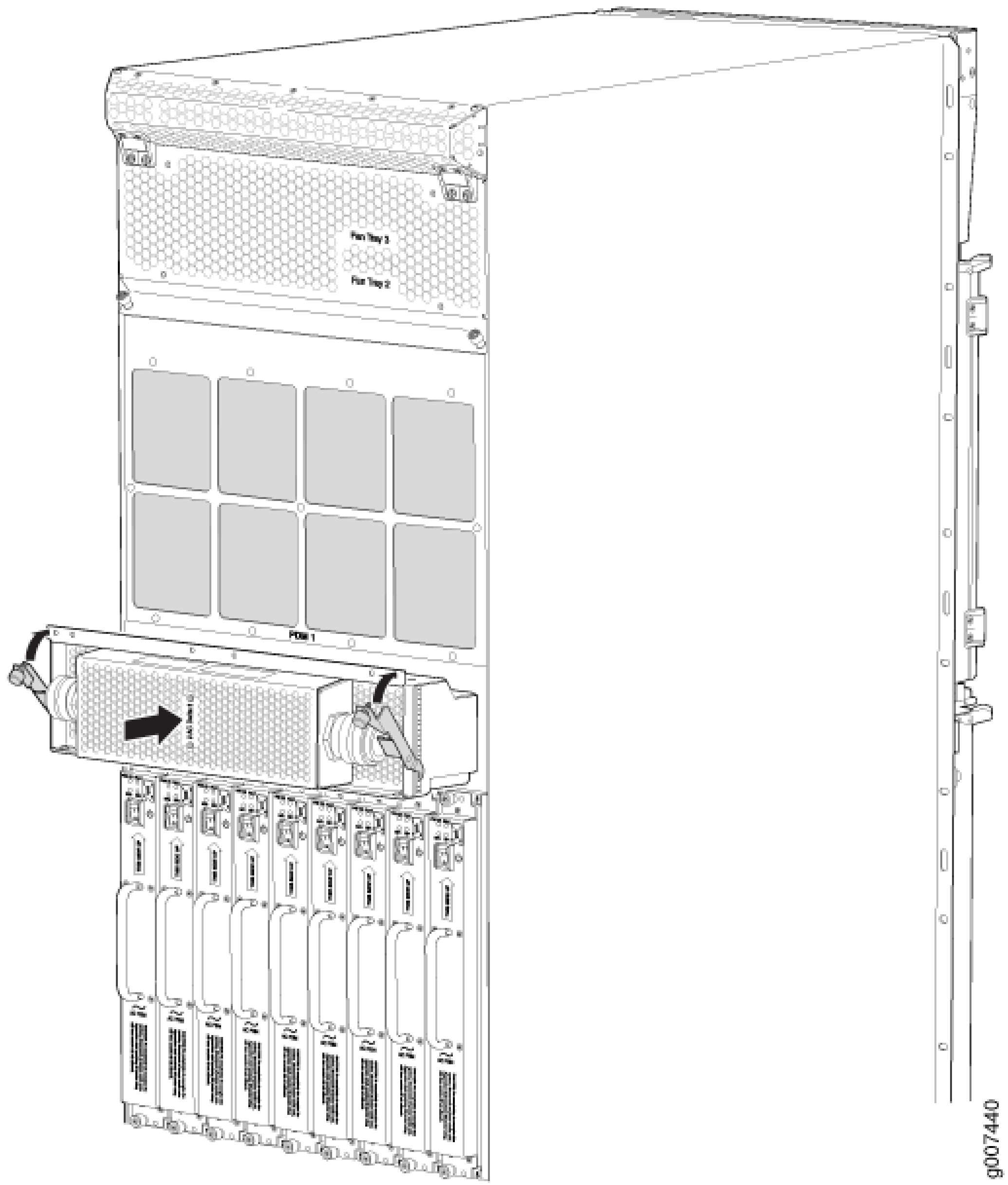
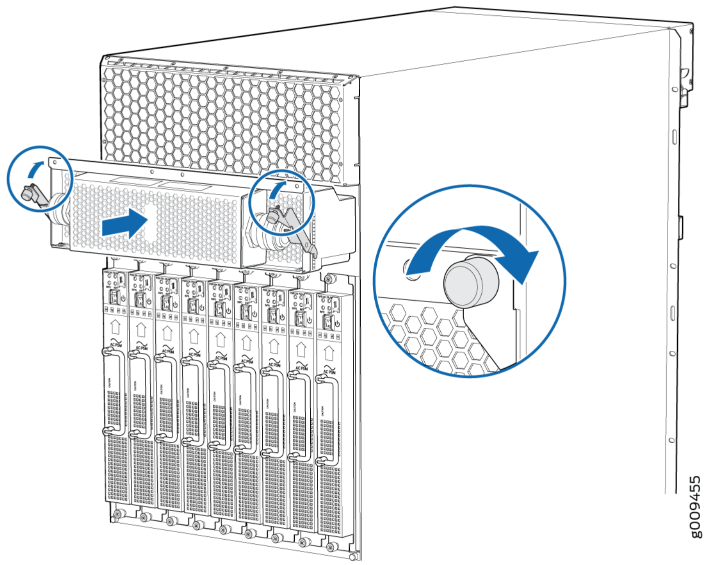


Figure 220: Installing a Three-Phase Delta AC Power Distribution Module (MX2008)



9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
14. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 221 on page 486). Loosen each of the input terminals or grounding point screws, and insert the wire into the grounding point or input terminal, and tighten the screw (see Table 107 on page 487 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

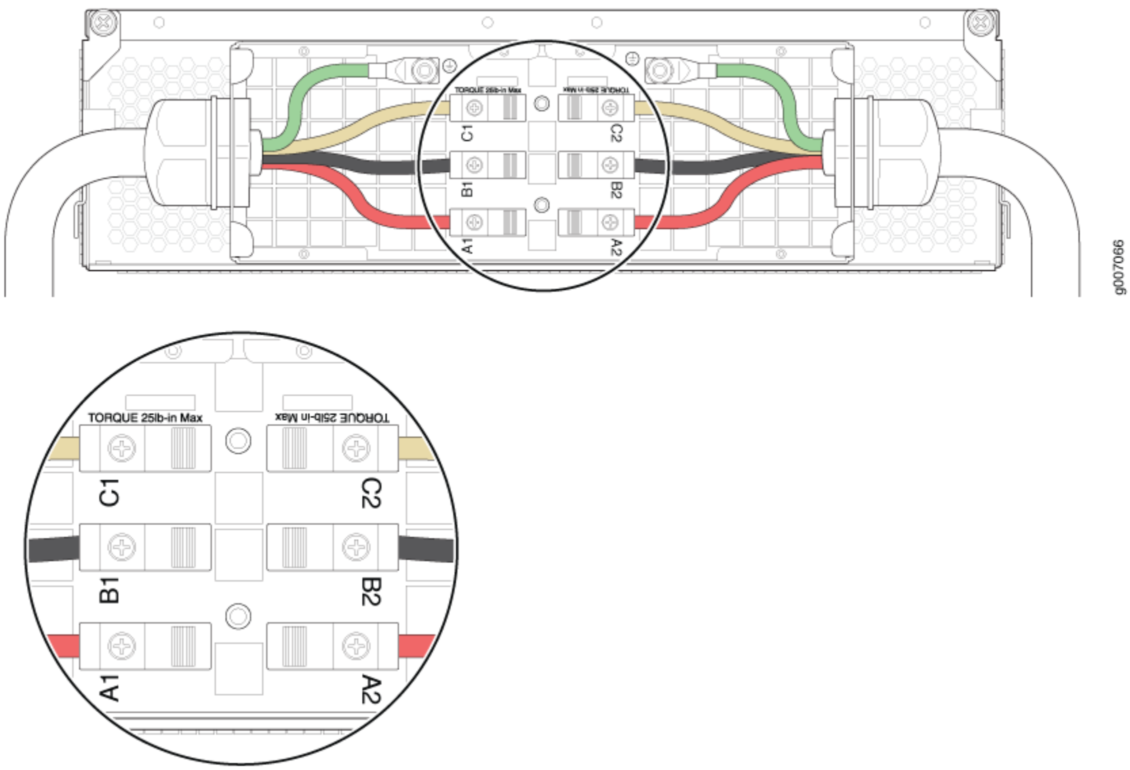
    a. Insert the grounding wire into the grounding point labeled **GND**.

    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

Figure 221: Connecting Power to a Three-Phase Delta AC Power Distribution Module



NOTE: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either clockwise or counterclockwise will operate correctly.

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with the PSM power switch turned off). Verify that the two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-B1, B1-C1, C1-A1, A2-B2, B2-C2, and C2-A2 for three-phase delta PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker to remove power from the PDM and install the metal cover.

NOTE: Three-phase delta AC wire assembly kits can be purchased from Juniper Networks.

Table 107: Supported Three-Phase Delta AC Wire Gauge

Wire Gauge	Description
4 x 6-AWG or equivalent	4 conductor wires, each wire is 6-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

WARNING: Power connections must be performed by a licensed electrician only.

15. Verify that the power cord wire connections are correct.
16. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.

17. Using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
18. 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.
19. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.
20. Connect the AC power cord plug to the power source.
21. Switch on the customer-site circuit breakers to provide voltage on the AC power cord.
22. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
23. Verify that the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.

Installing an MX2000 Router Three-Phase Wye AC Power Distribution Module

Each three-phase wye AC PDM weighs approximately 12 lb (5.44 kg). To install a three-phase wye AC PDM:

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

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

NOTE: The PDMs are hot swappable in a redundant configuration. However, you cannot convert to a DC configuration while the system is on.

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. [Optional]—If you are switching from a DC PDM to an AC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to AC.
4. Pull the locking levers on either side of the faceplate away until they stop.
5. Using both hands, slide the PDM into the chassis until you feel resistance (see Figure 222 on page 489, Figure 223 on page 490, or Figure 224 on page 491.

Figure 222: Installing a Three-Phase Wye AC PDM (MX2020)

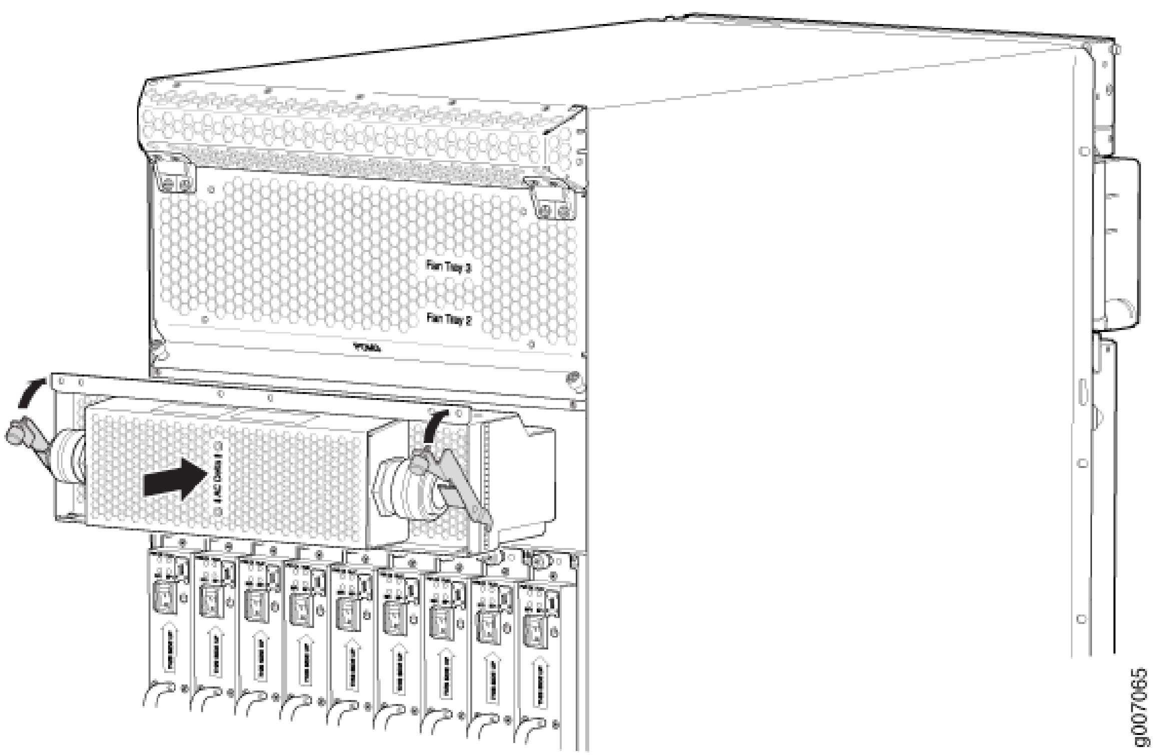


Figure 223: Installing a Three-Phase Wye AC PDM (MX2010)

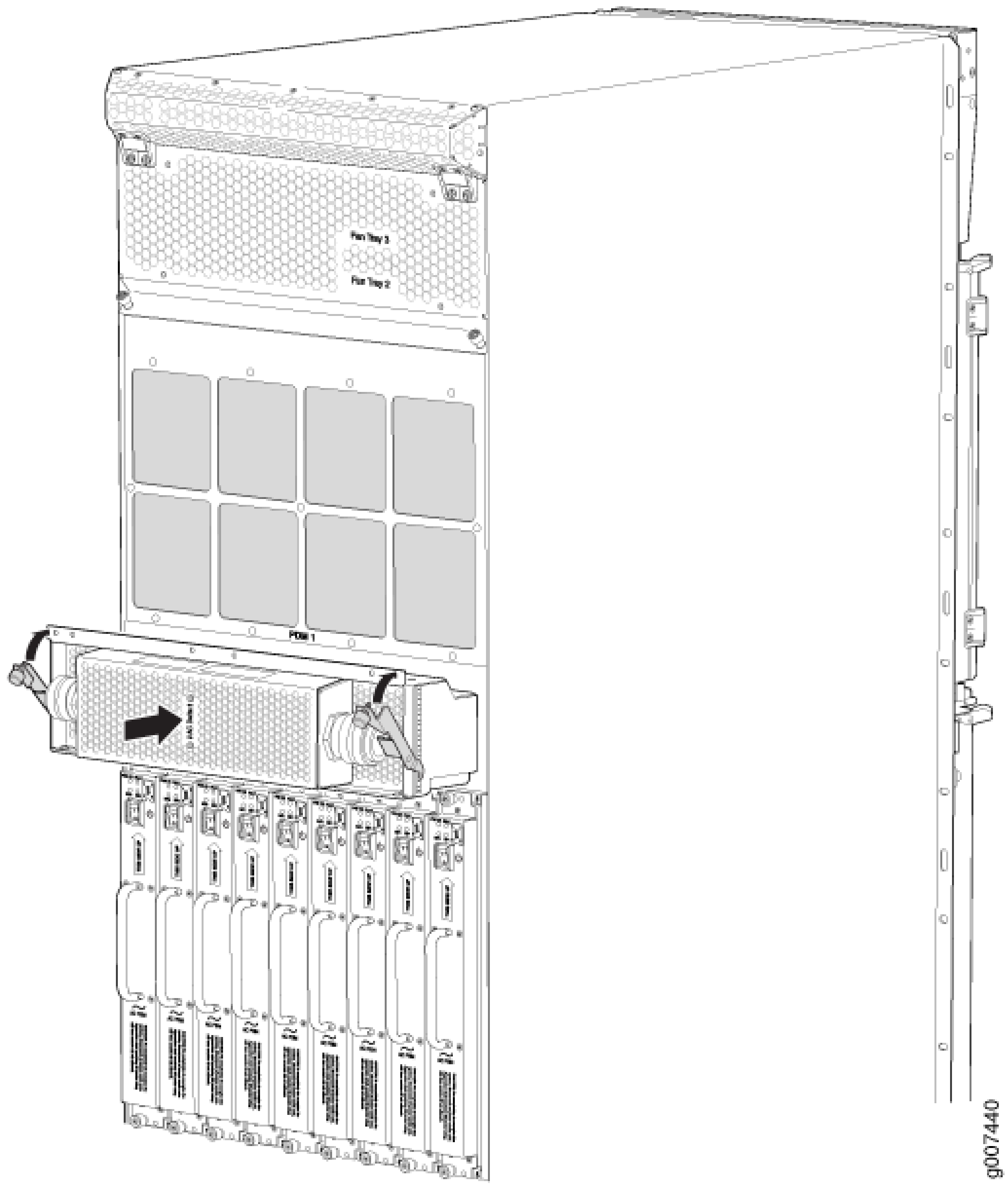
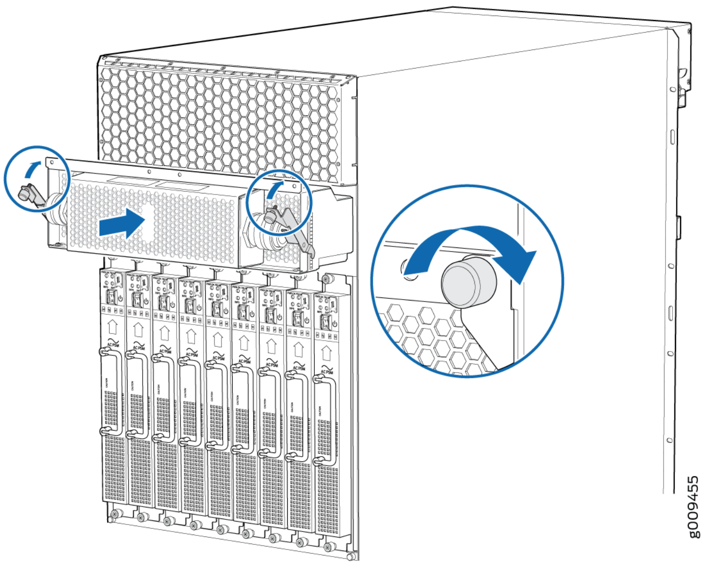


Figure 224: Installing an Three-Phase Wye AC PDM (MX2008)



6. Push the lock levers completely in until they make contact with the PDM faceplate.
7. Tighten the two captive screws on the locking levers of the PDM faceplate to secure the PDM in the chassis.
8. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
14. Connect the wires to the AC terminal block on the three-phase wye AC PDM (see Figure 225 on page 492). Loosen each of the input terminals or grounding point screws, insert the wire into the grounding point or input terminal, and tighten the screw (see Table 108 on page 493 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

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

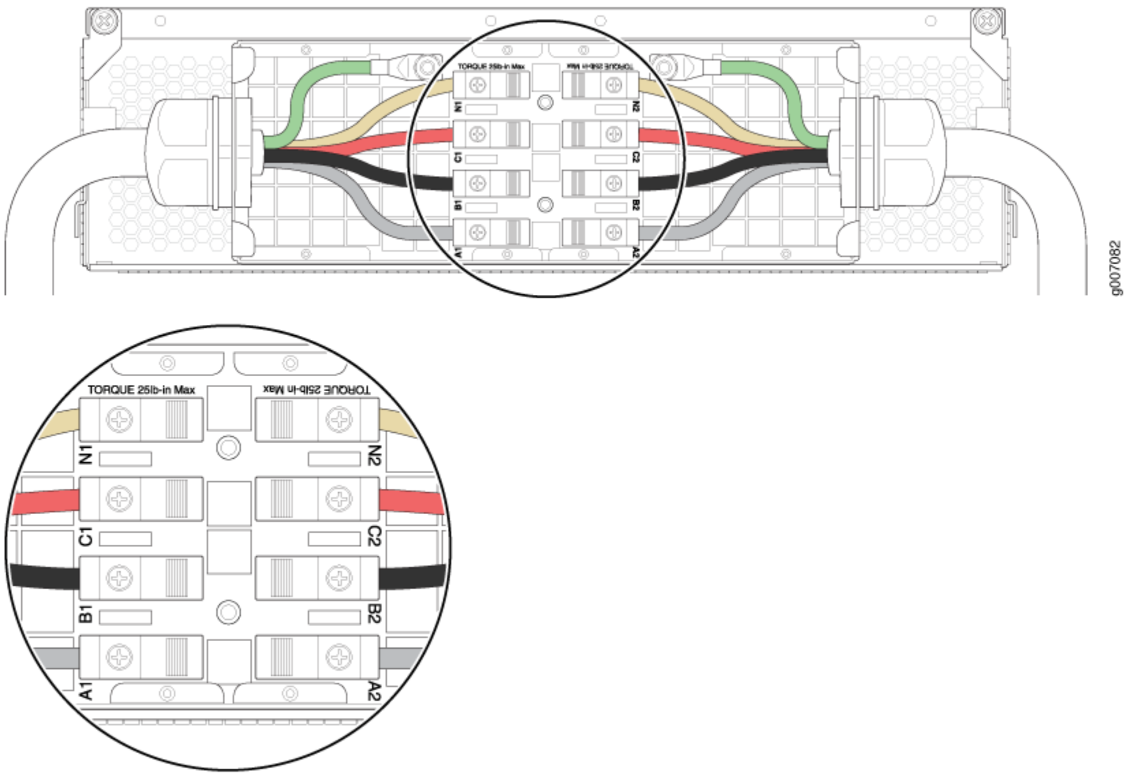
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

    e. Insert the wire labeled **N** into the input terminal labeled **N1**.

Figure 225: Connecting Power to a Three-Phase Wye AC Power Distribution Module



NOTE: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

⚠ **CAUTION**: Wire label configuration is for Juniper Networks supplied cable only. If using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

e. Insert the wire labeled **N** into the input terminal labeled **N2**.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with disengaged PSM) to make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker de-energizing the PDM and install the metal cover and engage all AC PSMs.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

NOTE: Three-phase wye AC wire assembly kits can be purchased from Juniper Networks.

Table 108: Supported Three-Phase Wye AC Wire Gauge

Wire Gauge	Description
5 x 10-AWG or equivalent	5 conductor wires, each wire is 10-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

WARNING: Power connections must be performed by a licensed electrician only.

15. Verify that the power cord wire connections are correct.

16. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.
17. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
18. Verify that the AC power cord is not touching or blocking access to router components, and that it does not drape where people could trip on it.
19. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.
20. Connect the AC power cord plug to the power source.
21. Switch on the customer-site circuit breakers to provide voltage on the AC power cord.
22. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
23. Verify that the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.

Installing an MX2000 Single-Phase AC Power Distribution Module

Before you install a single-phase AC power distribution module (PDM), be aware of the following:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

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

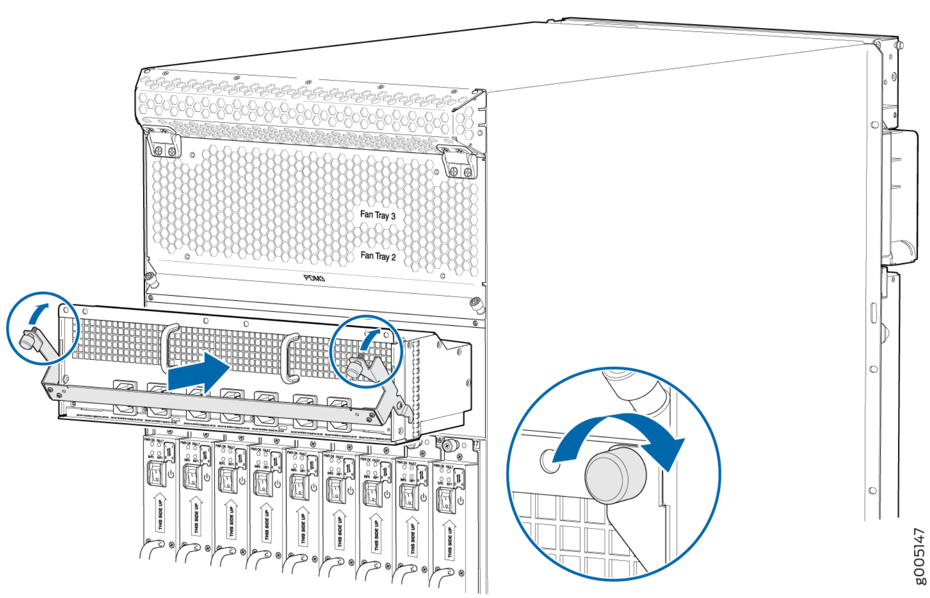
CAUTION: The single-phase AC PDM must be installed and secured in the chassis before connecting the input power cables. If the PDM must be removed, all input power cables must be removed from the PDM before the PDM can be removed from the chassis.

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

The seven-feed single-phase AC PDM weighs approximately 8 lbs (3.6 kg). The nine-feed single-phase AC PDM weighs approximately 9 lbs (4.1 kg). To install a single-phase AC PDM:

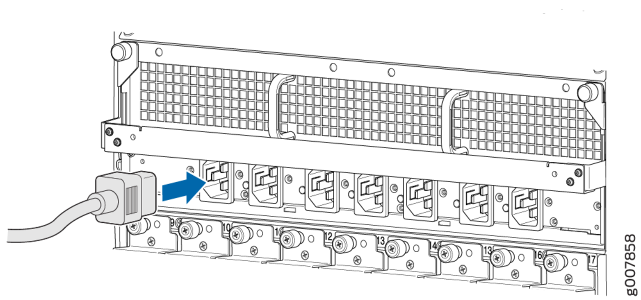
1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. (Optional) If you are switching from a DC PDM to an AC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to AC.
4. Remove the faceplate covering the PDM slot.
5. On the PDM, remove the two thumb screws holding the two ejector levers in the locked position. Put the screws aside for later use.
6. Pull the two ejector levers away from the PDM until they stop.
7. Using both hands, hold the PDM with the power plugs facing outward and slide it into the chassis until you feel resistance.
8. Push in the two ejector levers on the PDM until they lock in place. Refer to Figure 226 on page 495

Figure 226: Inserting the PDM into the Chassis



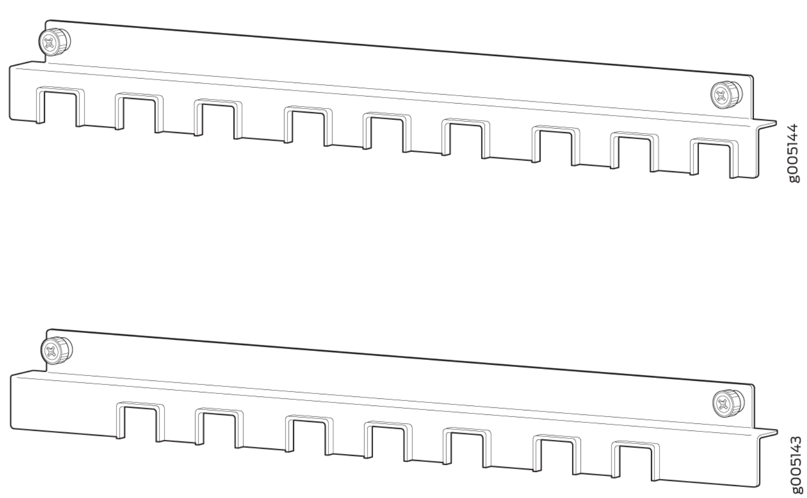
9. Gently push the ejector bar to be sure that the PDM is securely in place.
10. Tighten the two thumbscrews on the ejectors to secure the PDM in the chassis. Apply between 7 lb-in (0.8 Nm) and 9 lb-in. (1.01 Nm) of torque to each screw. Do not overtighten the screws.
11. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Refer to Figure 227 on page 496. Apply slight pressure so that the power cords are firmly seated in the power socket. As you plug in each power cord, the power LED for the socket lights up green.

Figure 227: Plugging into the MX2000 Single-Phase AC Power Distribution Module



12. Attach the power cord retainer to the PDM to ensure that the AC power cords do not touch or block access to router components, and that they do not drape where people could trip on them. Figure 228 on page 496 shows the seven-feed and nine-feed power cord retainer.

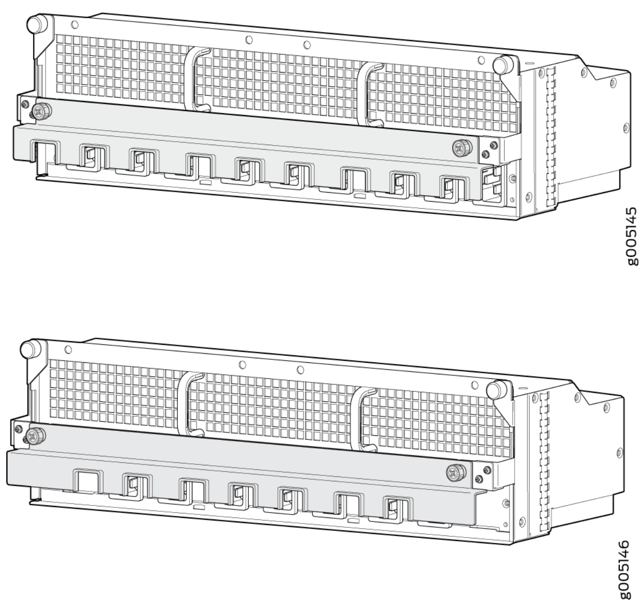
Figure 228: MX2000 Single-Phase AC Power Cord Retainer



- Loosen the two screws at each end of the power cord retainer.

- Position the power cord retainer over the PDM power cords with the power cord retainer prongs facing downward. Refer to Figure 229 on page 497.

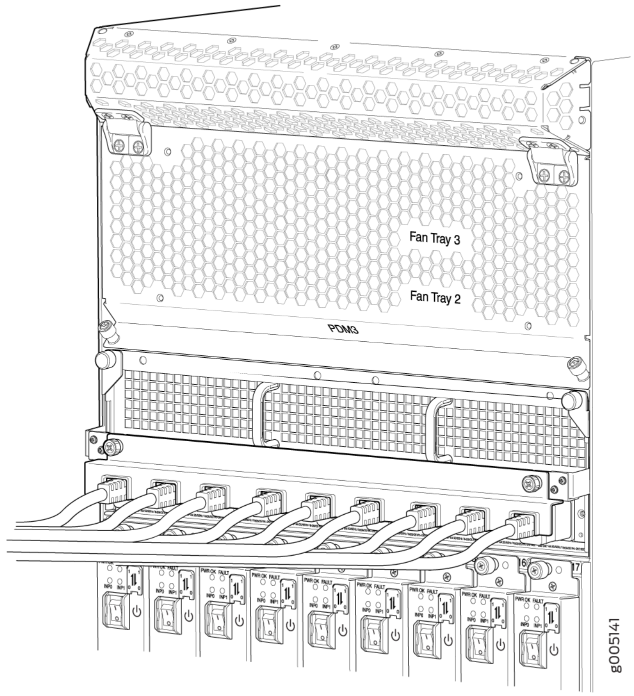
Figure 229: Attaching the Power Cord Retainer



- Secure the power cord retainer to the PDM by threading the two screws at each end of the power cord retainer into the screw holes on the PDM and turning them clockwise to tighten.

- Verify that the PDM looks like the illustration shown in Figure 230 on page 498

Figure 230: Proper Installation of the MX2000 Single-Phase AC Power Distribution Module in Chassis (nine-feed)



13. Flip the power switch on all the PSMs to the on (|) position to provide power to the router components.
14. Verify that the LEDs on the PDM faceplate are lit steadily green, indicating that the AC terminal block is receiving power.
15. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.

RELATED DOCUMENTATION

MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description | 134
MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description | 135
MX2000 Single-Phase AC Power Distribution Module Electrical Specifications | 224
Troubleshooting the MX2000 Router Power System
Removing an MX2000 Single-Phase AC Power Distribution Module

Installing an SFP or XFP into an MX2000 MPC or MIC

To install an SFP or XFP:

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. Take each transceiver to be installed out of its electrostatic bag, and identify the slot on the component where it will be installed.
3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.
4. Carefully align the transceiver with the slots in the component. The connectors should face the component.
5. Slide the transceiver until the connector is seated in the component slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.
6. Close the ejector handle of the transceiver.
7. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

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

8. Verify that the status LEDs on the component faceplate indicate that the SFP or XFP is functioning correctly. For more information about the component LEDs, see the *MX Series Interface Module Reference*.

RELATED DOCUMENTATION

Removing an SFP or XFP from an MX2010 MPC or MIC | 656

Removing an SFP or XFP Transceiver from an MX2020 MPC or MIC

Prevention of Electrostatic Discharge Damage

CHAPTER 23

Replacing Components

IN THIS CHAPTER

- Tools and Parts Required for Replacing MX2010 Hardware Components | **501**
- Tools and Parts Required to Remove Components from an MX2010 Router | **504**
- Removing a CB-RE from an MX2000 Router | **504**
- Upgrading to the Control Board-Routing Engine REMX2K-X8-64G in a Redundant Host Subsystem | **508**
- Upgrading to the REMX2K-X8-64G CB-RE in a Nonredundant Host Subsystem | **512**
- Replacing a Cable on an MX2010 MPC or MIC | **516**
- Replacing the MX2010 Air Filters | **522**
- Replacing the MX2010 Standard Cable Managers | **535**
- Replacing the MX2010 Extended Cable Manager | **541**
- Replacing the MX2010 Craft Interface | **547**
- Replacing an MX2010 DC Power Supply Module (-48 V) | **555**
- Replacing an MX2000 DC Power Supply Module (240 V China) | **559**
- Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module | **563**
- Replacing an MX2000 DC Power Distribution Module (-48 V) | **571**
- Replacing an MX2000 DC Power Distribution Module (240 V China) | **578**
- Replacing an MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module | **584**
- Replacing an MX2010 DC Power Distribution Module Cable | **593**
- Connecting an MX2000 DC Router Power Distribution Module (240 V China) Cable | **596**
- Replacing the MX2010 Standard EMI Cover | **598**
- Replacing the MX2010 Extended EMI Cover | **601**
- Replacing an MX2010 Fan Tray | **606**
- Replacing the MX2010 Air Baffle | **610**
- Replacing an MX2010 MIC | **613**
- Replacing an MX2010 MPC and Adapter Card | **625**
- Replacing an MX2000 SFB | **637**

- Replacing an MX2000 CB-RE | 647
- Replacing an SFP or XFP Transceiver on an MX2010 MPC or MIC | 656
- Replacing an MX2000 AC Power Supply Module | 659
- Replacing an MX2010 Three-Phase Delta AC Power Cord | 667
- Replacing an MX2000 Three-Phase Delta AC Power Distribution Module | 675
- Replacing an MX2010 Three-Phase Wye AC Power Cord | 688
- Replacing an MX2020 Three-Phase Wye AC Power Distribution Module | 696

Tools and Parts Required for Replacing MX2010 Hardware Components

To replace hardware components, you need the tools and parts listed in Table 109 on page 501.

Table 109: Tools and Parts Required for Component Replacement

Components	Tool or Part
All	Electrostatic discharge (ESD) grounding wrist strap
AC power supply module	Phillips (+) screwdrivers, number 1 and 2
AC power distribution module Three-phase delta AC PDM Three-phase wye AC PDM	Phillips (+) screwdriver, number 2 to access the metal AC wiring compartment 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) to attach the ground wire. 1/4-in. slotted screwdriver and 5/32-in. (4 mm) Allen wrench to attach input terminal wires of the AC power cord.

Table 109: Tools and Parts Required for Component Replacement *(Continued)*

Components	Tool or Part
AC power cord	Phillips (+) screwdrivers, numbers 1 and 2 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) to attach the ground wire. 1/4-in. slotted screwdriver and 5/32-in. (4 mm) Allen wrench to attach input terminal wires of the AC power cord.
Craft interface	Phillips (+) screwdrivers, numbers 1 and 2
DC power distribution module	Phillips (+) screwdrivers, numbers 1 and 2 7/16-in. (11 mm) hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) to attach the ground wire. 1/4-in. slotted screwdriver and 5/32-in. (4 mm) Allen wrench to attach input terminal wires of the AC power cord.
DC power supply cable	7/16-in. (11 mm) nut driver or socket wrench **CAUTION**: You must use an appropriate torque-controlled tool to tighten the nuts. Apply excessive torque damages the terminal studs and the PDM. The absolute maximum that may be applied to this nut is between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm).
Fan trays (upper and lower)	Phillips (+) screwdrivers, numbers 1 and 2
Air Baffle	Phillips (+) screwdrivers, numbers 1 and 2
MPC	Phillips (+) screwdrivers, numbers 1 and 2 Blank panels (if component is not reinstalled) Electrostatic bag or antistatic mat

Table 109: Tools and Parts Required for Component Replacement *(Continued)*

Components	Tool or Part
MIC	Phillips (+) screwdrivers, numbers 1 and 2 Rubber safety cap for fiber-optic MICs Flat-blade (–) screwdriver Electrostatic bag or antistatic mat Blank panels (if component is not reinstalled)
Routing Engine and Control Board (CB-RE)	Phillips (+) screwdrivers, numbers 1 and 2 Electrostatic discharge (ESD) grounding wrist strap Blank panels (if component is not reinstalled)
SFB	Phillips (+) screwdrivers, numbers 1 and 2 Electrostatic discharge (ESD) grounding wrist strap Blank panels (if component is not reinstalled)
Serial cable to Auxiliary or Console Routing Engine port	Flat-blade (–) screwdriver
PSM air filter	Phillips (+) screwdrivers, numbers 1 and 2
Card-cage air filter	Phillips (+) screwdrivers, numbers 1 and 2
Air filter (lower)	Phillips (+) screwdrivers, numbers 1 and 2

RELATED DOCUMENTATION

MX2010 Field-Replaceable Units | 19
Replacing the MX2010 Craft Interface | 547
Replacing an MX2010 Fan Tray | 606
Replacing the MX2010 Air Filters | 522

Tools and Parts Required to Remove Components from an MX2010 Router

To remove components from the router or the router 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
- EMI (electromagnetic interference) covers—shipped with router
- Electrostatic bag or antistatic mat, for each component
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (–) screwdriver
- Pallet jack with attachment—recommended
- Phillips (+) screwdrivers, numbers 1 and 2
- Rubber safety cap for fiber-optic interfaces or cable
- Wire cutters

RELATED DOCUMENTATION

Packing the MX2010 Router for Shipment | 808
Contact Customer Support | 838

Removing a CB-RE from an MX2000 Router

To remove a CB-RE:

NOTE: You can remove the CB-RE as a unit.

> **CAUTION**: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

> **CAUTION**: Before you replace a CB-RE, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

1. Take the host subsystem offline.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Open the ejector handles outward simultaneously to unseat the CB-RE.
5. Grasp the ejector handles, and slide the CB-RE about halfway out of the chassis.
6. Place one hand underneath the CB-RE to support it, and slide it completely out of the chassis.
7. Place the CB-RE on the antistatic mat or into an antistatic bag.
8. If you are not replacing the CB-RE immediately, install a blank panel over the empty slot.

Figure 231: Removing a CB-RE (MX2010)

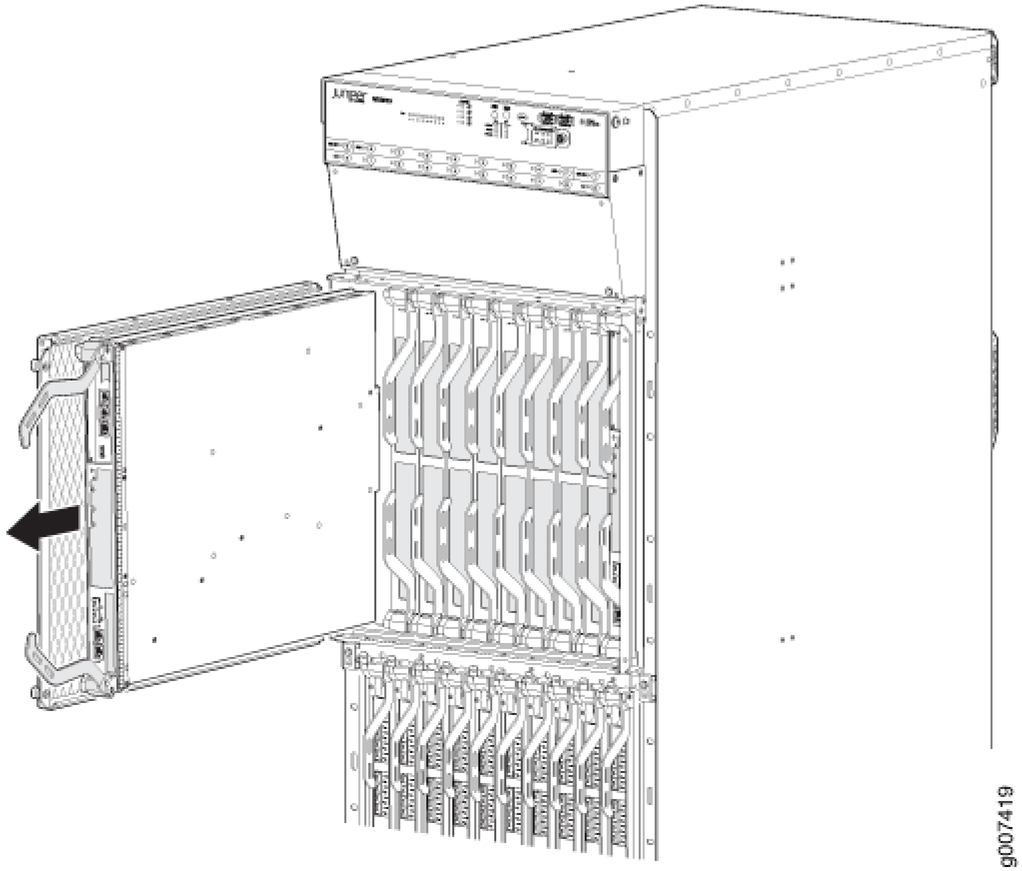
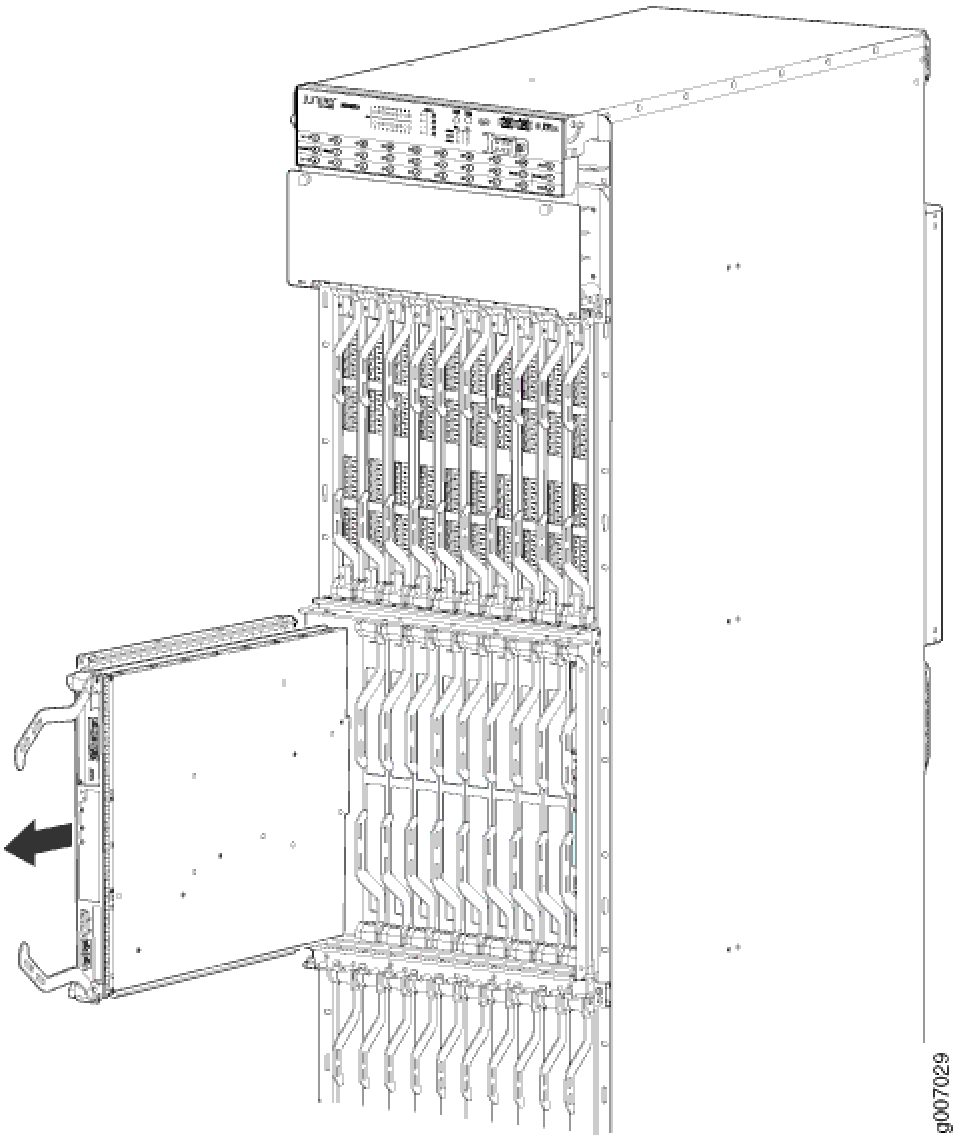


Figure 232: Removing a CB-RE (MX2020)



RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage | 894
Taking an MX2000 Host Subsystem Offline | 800
Installing an MX2010 CB-RE | 470

Upgrading to the Control Board-Routing Engine REMX2K-X8-64G in a Redundant Host Subsystem

IN THIS SECTION

- Taking the Host Subsystem Offline | 508
- Removing the Backup CB-RE | 509
- Installing the REMX2K-X8-64G CB-RE | 510
- Verifying and Configuring the Upgraded CB-RE as the Primary | 511
- Verifying and Configuring the Upgraded CB-RE as the Backup | 511

A redundant host subsystem consists of a primary Routing Engine-Control Board (CB-RE) (RE0) and a backup CB-RE (RE1). To upgrade the host subsystem to use the REMX2K-X8-64G CB-RE, you must first uninstall the backup CB-RE and install the REMX2K-X8-64G CB-RE, which then becomes the backup CB-RE. Configure this backup CB-RE as the primary CB-RE. Then replace the other CB-RE and configure it as the backup CB-RE.

> **NOTE**: Save the router configuration before upgrading the CB-RE.

Taking the Host Subsystem Offline

To take the host subsystem offline perform the following steps:

1. On the external management device connected to the CB-RE, issue the `request system halt other-routing-engine` operational mode command to offline the backup CB-RE. The command shuts down the CB-RE cleanly by preserving the state information.

   ```
   user@host> request system halt other-routing-engine
   ```

   Wait until a message appears on the console confirming that the operating system has halted.

2. Take the Control board offline by using the `request chassis cb slot 0/1 offline` operational mode command. The command shuts down the CB-RE completely.

```
user@host> request chassis cb slot 1 offline
```

Removing the Backup CB-RE

To remove a CB-RE (see Figure 233 on page 510):

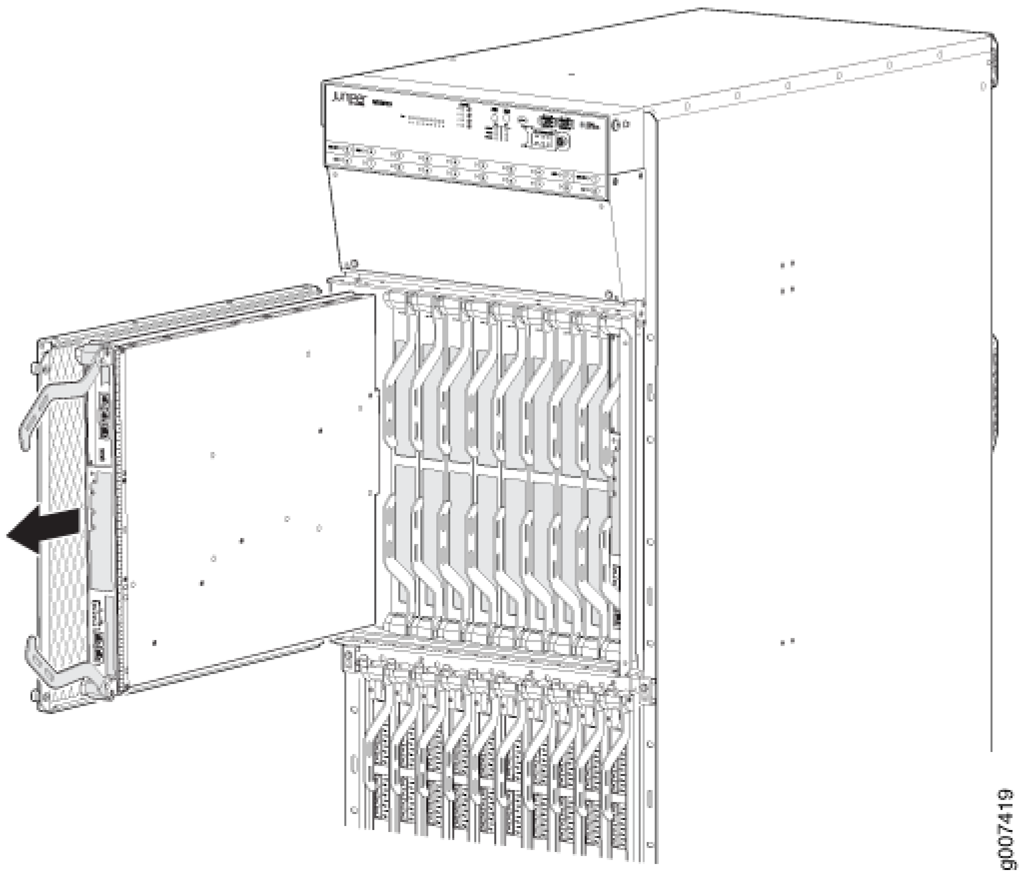
NOTE: Remove the CB-RE as a unit.

CAUTION: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

CAUTION: Before you replace a CB-RE, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

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. Open the ejector handles outward simultaneously to unseat the CB-RE.
4. Grasp the ejector handles, and slide the CB-RE about halfway out of the chassis.
5. Place one hand underneath the CB-RE to support it, and slide it completely out of the chassis.
6. Place the CB-RE on the antistatic mat or inside an antistatic bag.
7. If you are not replacing the CB-RE immediately, install a blank panel over the empty slot.

Figure 233: Removing a CB-RE



Installing the REMX2K-X8-64G CB-RE

To install a CB-RE:

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 CB-RE from the electrostatic bag.
3. Carefully align the sides of the CB-RE with the guides inside the chassis.
4. Slide the CB-RE into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.
6. Check the LEDs on the CB-RE faceplate to verify that it is functioning normally.
   - The green **ONLINE** LED should blink green initially and light steadily a few minutes after the CB-RE is installed.

- If the **OK/FAIL** LED is yellow, remove and install the CB-RE again. If the **OK/FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative. See *Contact Customer Support*.

7. Check the status of the CB-RE by using the `show chassis environment cb` command.

The CB-RE might require several minutes to boot. After the CB-RE boots, verify that it is installed correctly by checking the **FAIL**, **RE0**, and **RE1** LEDs on the craft interface. If the router is operational and the CB-RE is functioning properly, the green **ONLINE** LED on the CB-RE lights steadily. If the red **FAIL** LED on the CB-RE lights steadily instead, remove and install the CB-RE again. If the red **FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative.

Verifying and Configuring the Upgraded CB-RE as the Primary

After replacing the backup CB-RE with the REMX2K-X8-64G CB-RE, perform the following steps:

1. Verify that the REMX2K-X8-64G CB-RE is online by issuing the `show chassis hardware` and `show chassis routing-engine |no-more` commands.

   Verify the software by using the `show vmhost status` and `show vmhost version` commands.
2. After you install the REMX2K-X8-64G CB-RE, the CB-RE is automatically powered on and comes up in *amnesiac* mode as it is loaded with factory defaults. After the CB-RE comes up in amnesiac mode, load the base configuration and commit.
3. Configure the backup CB-RE by using the `commit synchronize` command to copy the configuration to the backup CB-RE.
4. Use the `request chassis routing-engine master switch` command to make the REMX2K-X8-64G CB-RE (RE1) the primary CB-RE. All FPCs reboot after this step.

Verifying and Configuring the Upgraded CB-RE as the Backup

After replacing the primary CB-RE with the REMX2K-X8-64G CB-RE, perform the following steps:

1. Use the `request chassis routing-engine master switch` command to make the newly installed REMX2K-X8-64G CB-RE (RE0) the backup CB-RE.
2. Use the `commit synchronize` command to copy the active configuration from the primary CB-RE to the backup CB-RE.

SEE ALSO

REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description | 62

Upgrading to the REMX2K-X8-64G CB-RE in a Nonredundant Host Subsystem

IN THIS SECTION

- Taking the Host Subsystem Offline | 512
- Removing the CB-RE | 513
- Installing the REMX2K-X8-64G CB-RE | 514
- Verifying and Configuring the Upgraded CB-RE | 516

In a nonredundant host subsystem, only one Routing Engine-Control Board (CB-RE) is present in the chassis. When you upgrade the CB-RE, taking the host subsystem offline shuts down the router. To upgrade the host subsystem with the REMX2K-X8-64G CB-RE, you must uninstall the existing CB-RE and install the REMX2K-X8-64G CB-RE.

> **NOTE**: Save the router configuration before proceeding with the REMX2K-X8-64G CB-RE upgrade.

Taking the Host Subsystem Offline

To take the host subsystem offline perform the following steps:

1. On the external management device connected to the Routing Engine, issue the `request system halt` operational mode command. The command shuts down the Routing Engines cleanly by preserving their state information.

   ```
   user@host> request system halt
   ```

   Wait until a message appears on the console confirming that the operating system has halted.
2. Take the Control board offline by using the `request chassis cb slot 0/1 offline` operational mode command. The command shuts down the CB-RE completely.

   ```
   user@host> request chassis cb slot 1 offline
   ```

Removing the CB-RE

To remove a CB-RE (see Figure 234 on page 514):

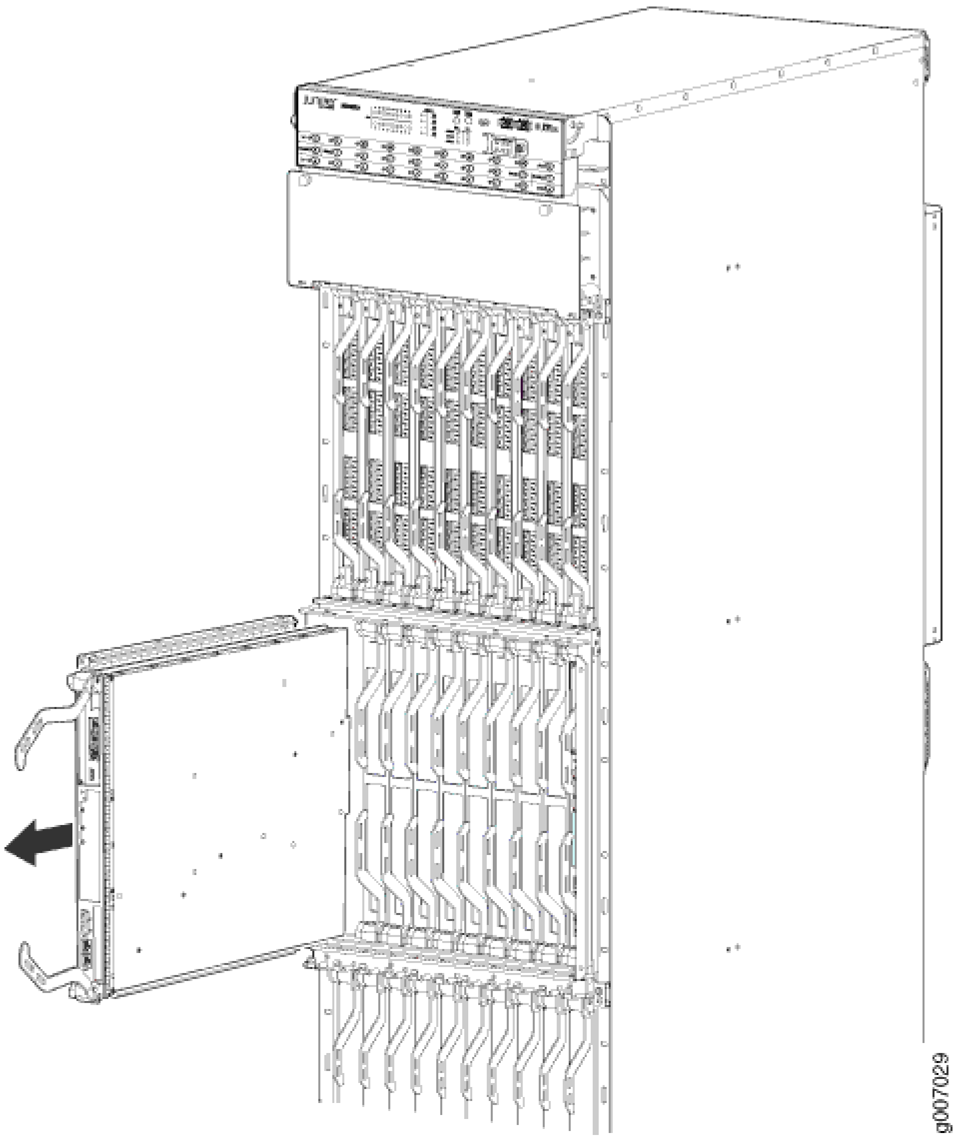
NOTE: Remove the CB-RE as a unit.

CAUTION: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

CAUTION: Before you replace a CB-RE, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

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. Open the ejector handles outward simultaneously to unseat the CB-RE.
4. Grasp the ejector handles, and slide the CB-RE about halfway out of the chassis.
5. Place one hand underneath the CB-RE to support it, and slide it completely out of the chassis.
6. Place the CB-RE on the antistatic mat or inside an antistatic bag.
7. If you are not replacing the CB-RE immediately, install a blank panel over the empty slot.

Figure 234: Removing a CB-RE



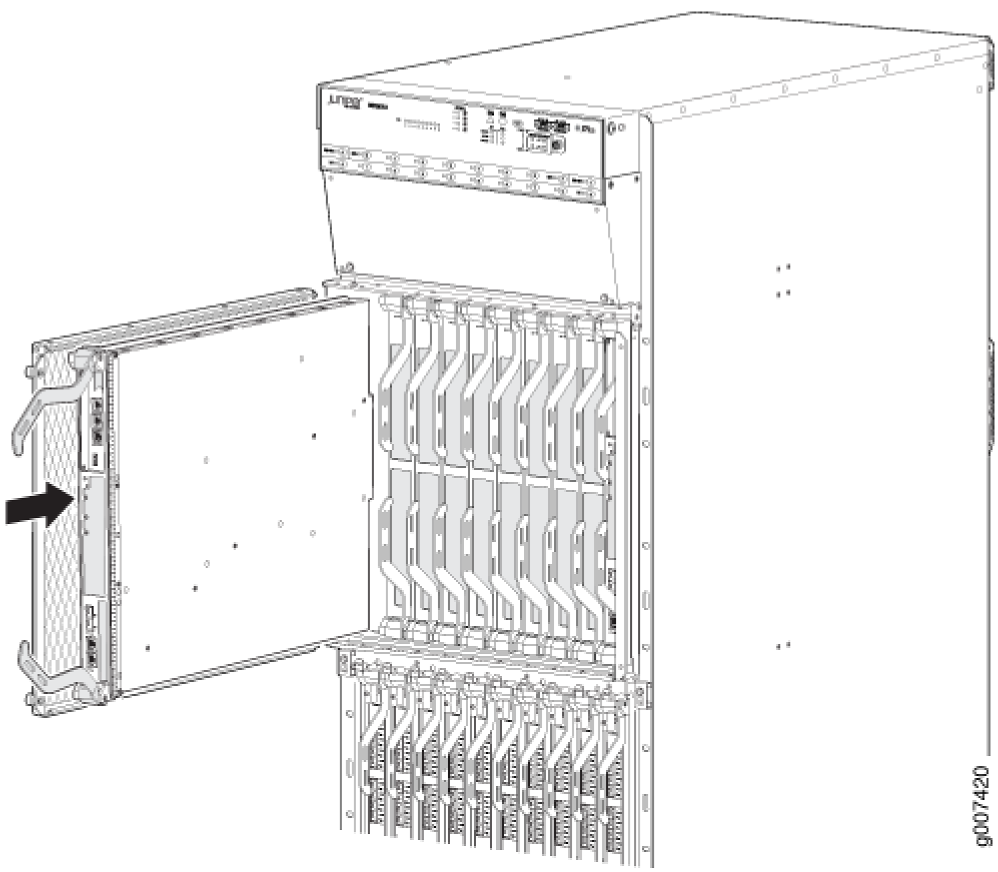
Installing the REMX2K-X8-64G CB-RE

To install the new REMX2K-X8-64G CB-RE (see Figure 235 on page 515):

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 CB-RE from the electrostatic bag.
3. Carefully align the sides of the CB-RE with the guides inside the chassis.
4. Slide the CB-RE into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.

5. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.
6. Check the LEDs on the CB-RE faceplate to verify that it is functioning normally.
   - The green **ONLINE** LED should blink green initially and light steadily a few minutes after the CB-RE is installed.
   - If the **OK/FAIL** LED is yellow, remove and install the CB-RE again. If the **OK/FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative. See *Contact Customer Support*.
7. Check the status of the CB-RE by using the `show chassis environment cb` command.

Figure 235: Installing a CB-RE



The CB-RE might require several minutes to boot. After the CB-RE boots, verify that it is installed correctly by checking the **FAIL**, **RE0**, and **RE1** LEDs on the craft interface. If the router is operational and the CB-RE is functioning properly, the green **ONLINE** LED on the CB-RE lights steadily. If the red **FAIL** LED lights steadily instead, remove the CB-RE and reinstall it. If the red **FAIL** LED on the CB-RE still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative.

Verifying and Configuring the Upgraded CB-RE

After replacing the CB-RE with the REMX2K-X8-64G CB-RE, perform the following steps:

1. Verify that the REMX2K-X8-64G CB-RE is online by issuing the `show chassis hardware` and `show chassis routing-engine |no-more` commands.

   Verify the software by using the `show vmhost status` and `show vmhost version` commands.
2. After you install the REMX2K-X8-64G CB-RE, the CB-RE gets automatically powered on and comes up in *amnesiac* mode as it is loaded with factory defaults. After the CB-RE comes up in amnesiac mode, load the base configuration and commit.

SEE ALSO

REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description | 62

Replacing a Cable on an MX2010 MPC or MIC

IN THIS SECTION

- Removing a Cable on an MX2010 MPC or MIC | 516
- Installing a Cable on an MX2010 MPC or MIC | 518

Removing a Cable on an MX2010 MPC or MIC

Removing and installing cables on an MPC or a MIC does not affect router function, except that the component does not receive or transmit data while its cable is disconnected.

To remove a fiber-optic cable:

1. If the component connects to fiber-optic cable, have ready a rubber safety cap for each cable and transceiver.
2. If you are removing all cables connected to the component, use one of the following methods to take the component offline:

   - To take an MPC offline:

- Press and hold the corresponding online button on the craft interface. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off.
- Issue the following CLI command:

```
user@host>request chassis fpc slot slot-number offline
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

NOTE: When you issue the `request chassis fpc slot slot-number offline` command, the FRU loses power, and the system's total power increases.

- To take a MIC offline:
  - Press the online/offline button on the MIC. Use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the MIC LED goes off (about 5 seconds).
  - Issue the following CLI command:

```
user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot offline
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

3. Unplug the cable from the cable connector port. If the MIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

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

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

4. Remove the cable from the cable manager, and detach it from the destination port.

SEE ALSO

Installing a Cable on an MX2010 MPC or MIC | 518
Preventing Electrostatic Discharge Damage to an MX Series Router

Installing a Cable on an MX2010 MPC or MIC

To install a MIC cable or an MPC cable (see Figure 236 on page 519 and Figure 237 on page 520):

1. Have ready a length of the type of cable used by the component. For cable specifications, see the *MX Series Interface Module Reference*.
2. If the cable connector port is covered by a rubber safety cap, remove the 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.

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

Figure 236: Installing a MIC Cable

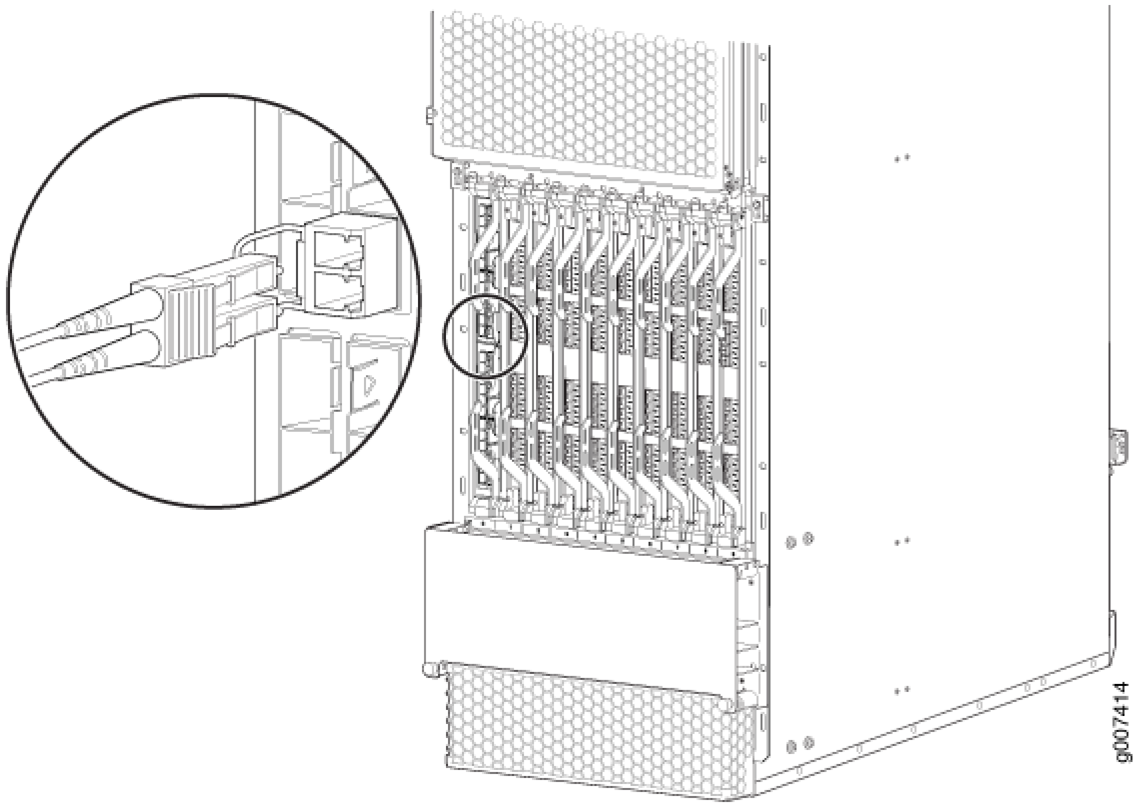
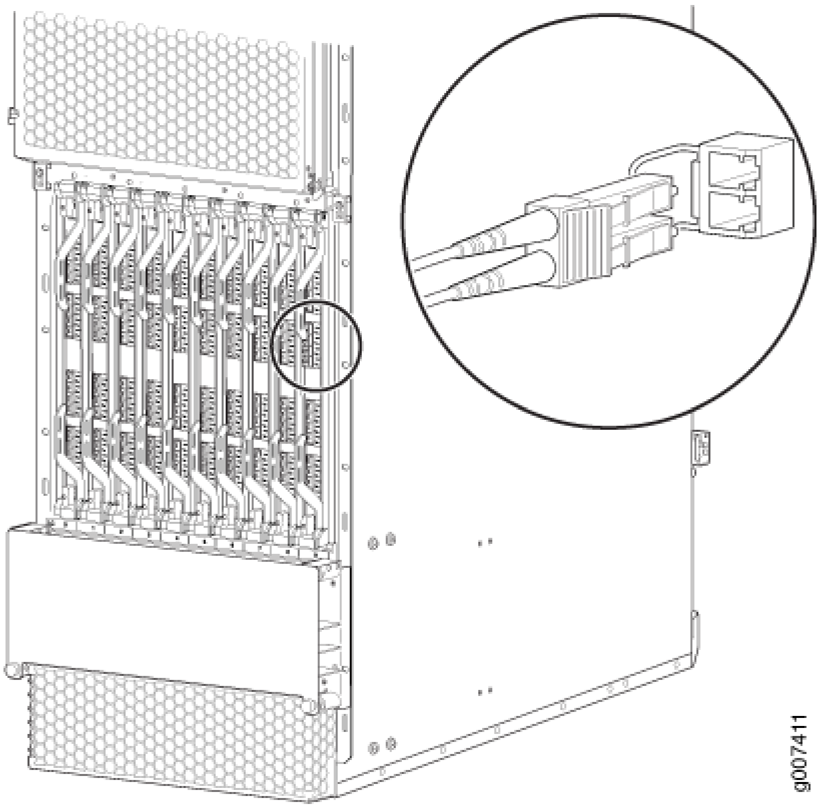


Figure 237: Installing an MPC Cable



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

> **CAUTION**: 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 component is offline (its failure indicator LED is lit), use one of the following methods to bring it online.
   - To bring an MPC online:

- Press and hold the corresponding online button on the craft interface 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
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

NOTE: When you issue the `request chassis fpc slot slot-number online` command, the FRU gets power, and the system's total power decreases.

- To bring a MIC online:
  - Press the MIC offline/online button until the MIC LED lights green.
  - Issue the following CLI command:

```
user@host>request chassis mic fpc-slot fpc-slot mic-slot mic-slot online
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

The normal functioning indicator LED confirms that the component is online. You can also verify correct MPC functioning by issuing the `show chassis fpc` command or the correct MIC functioning by issuing the `show chassis fpc pic-status` command.

SEE ALSO

Removing a Cable on an MX2010 MPC or MIC | 516
Preventing Electrostatic Discharge Damage to an MX Series Router

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
Replacing an MX2010 MIC | 613
Replacing an MX2010 MPC and Adapter Card | 625

Replacing an SFP or XFP Transceiver on an MX2010 MPC or MIC | 656
Maintaining Cables That Connect to MX2010 MPCs or MICs | 713

Replacing the MX2010 Air Filters

IN THIS SECTION

- Removing the MX2010 Air Filter | 522
- Installing the MX2010 Air Filter | 529

Removing the MX2010 Air Filter

CAUTION: Do not run the router for more than a few minutes without the air filter in place.

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

To remove the lower air filter—MX2010-MID-FLTR-PNL-S:

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 located on either side of the fan tray and air filter access door.

   NOTE: Removing the cables from the DC cable manager is not necessary to access the air filter.

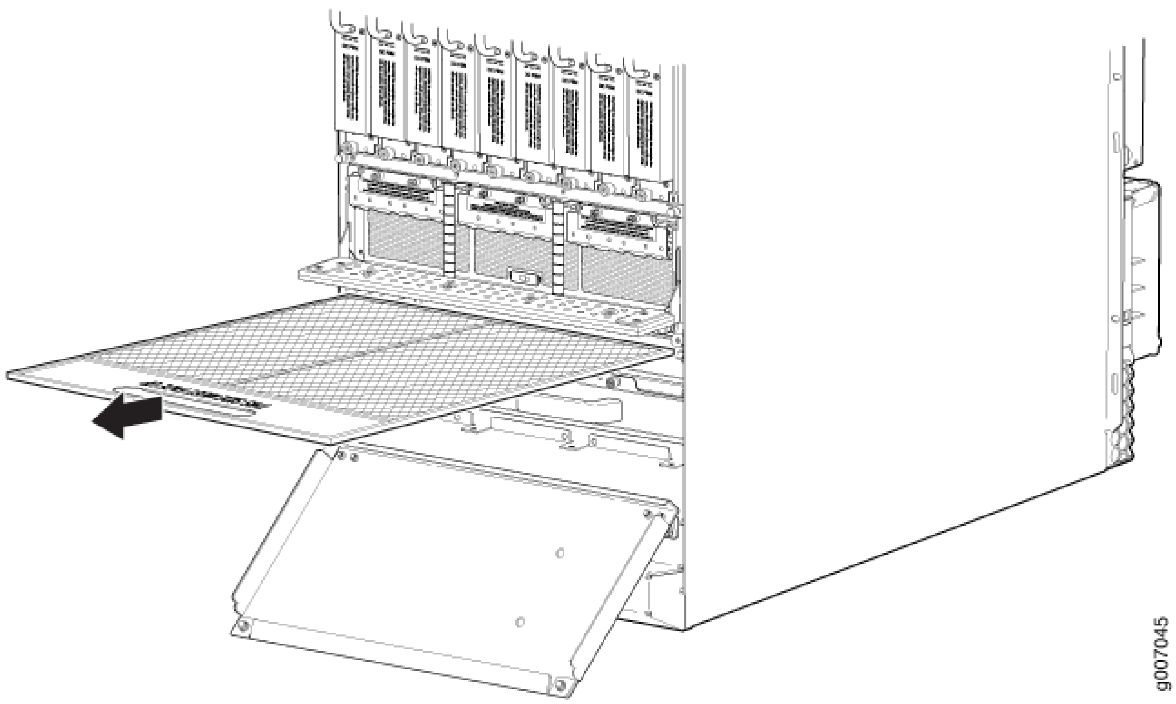
   CAUTION: Do not run the router for more than 2 minutes without the air filter in place.

3. Grasp the handle on the air filter, and pull the air filter straight out from the chassis.

> **NOTE**: The air filter has a built-in handle.

4. Slide the air filter out of the chassis as shown in Figure 238 on page 523.

Figure 238: Removing the Lower Air Filter from the Chassis



To remove the card-cage cable manager air filter—MX2000-CBL-MID:

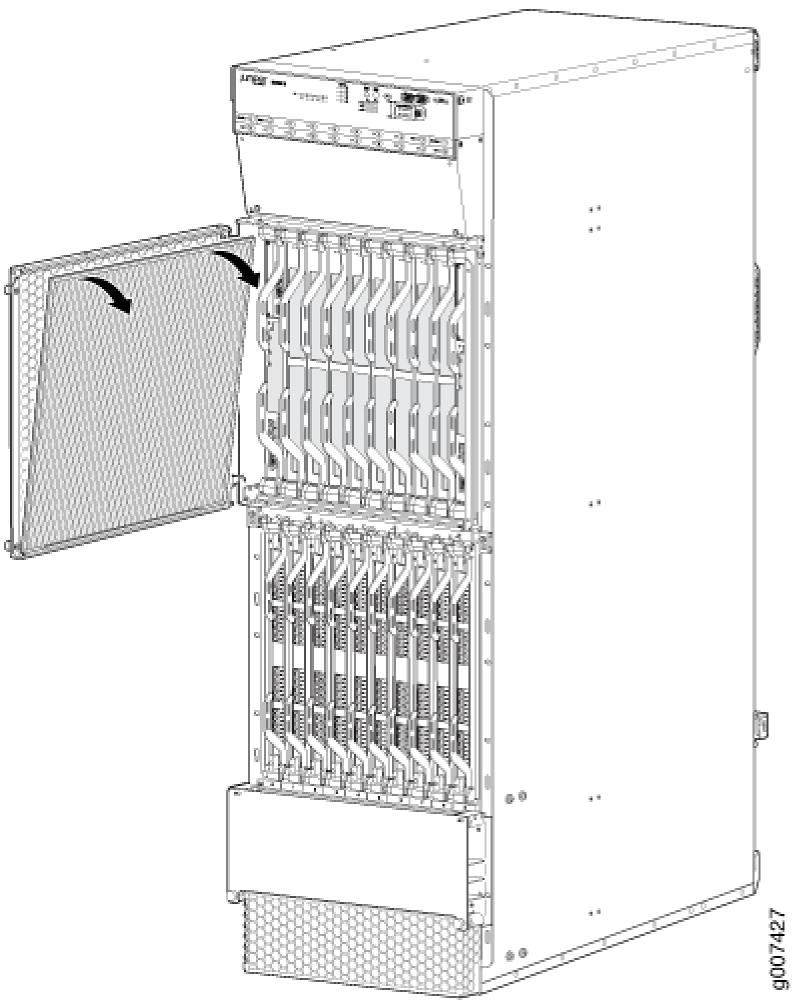
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the card-cage cable manager, if necessary.
3. Loosen the two captive screws located on the front of the card-cage cable manager door.

> **CAUTION**: Do not run the router for more than 2 minutes without the air filter in place.

4. Open the cable manager door to get access to the air filter.

5. Grasp the air filter, and pull the air filter straight out from the access door (see Figure 239 on page 524).

Figure 239: Removing the Card-Cage Cable Manager Air Filter



To remove the PSM air filter—MX2000-FLTR-PWR:

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 located on either side of the air filter and pull slightly out of the chassis.

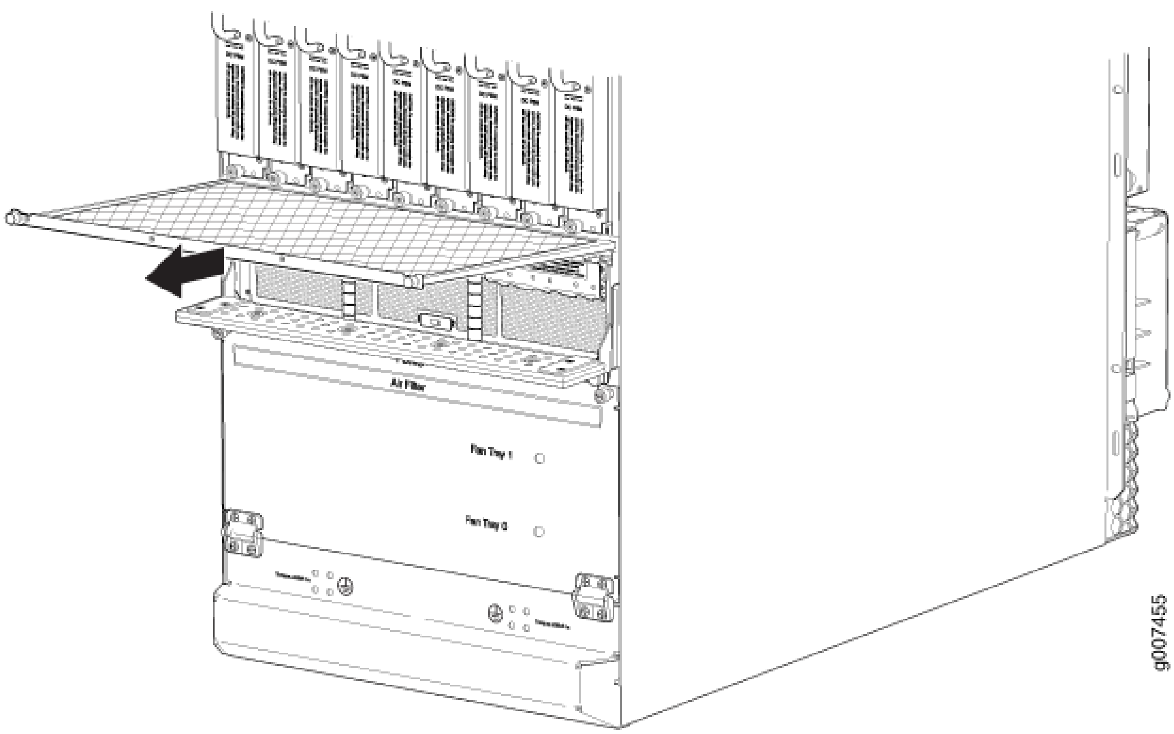
CAUTION: Do not run the router for more than 2 minutes without the air filter in place.

3. Grasp the PSM air filter, and pull the air filter straight out from the chassis.

4. Slide the air filter out of the chassis as shown in Figure 240 on page 525.

NOTE: The AC–powered MX2010 router has the same air filter.

Figure 240: Removing the PSM Air Filter from the Chassis



To remove the PSM air filter—MX2000-FLTR-PWR for a chassis with the DC PDM (240 V China) or universal HVAC/HVDC PDM installed:

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 screws from the mechanical interlock bracket to remove it. SeeFigure 241 on page 526 and Figure 242 on page 526 .

Figure 241: Removing the bracket from the DC PDM (240 V China) PDM

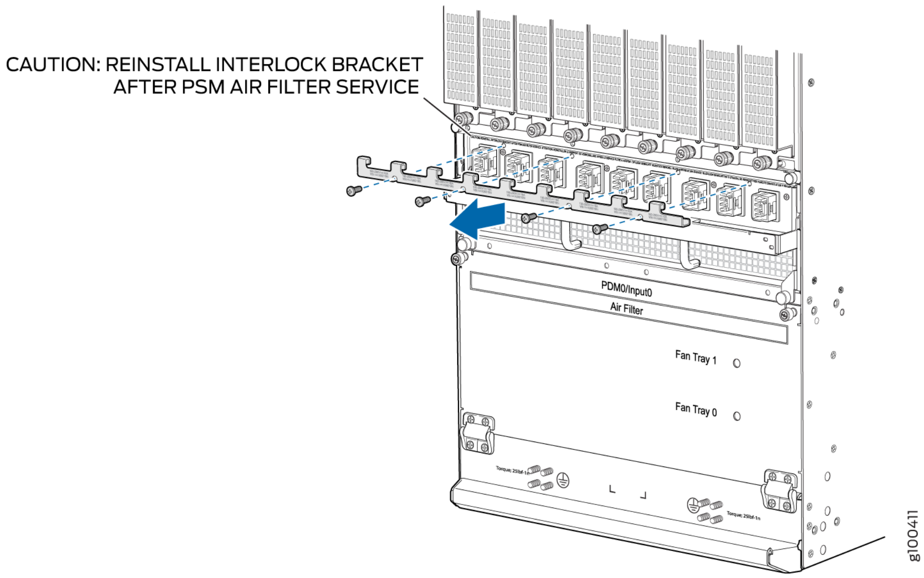
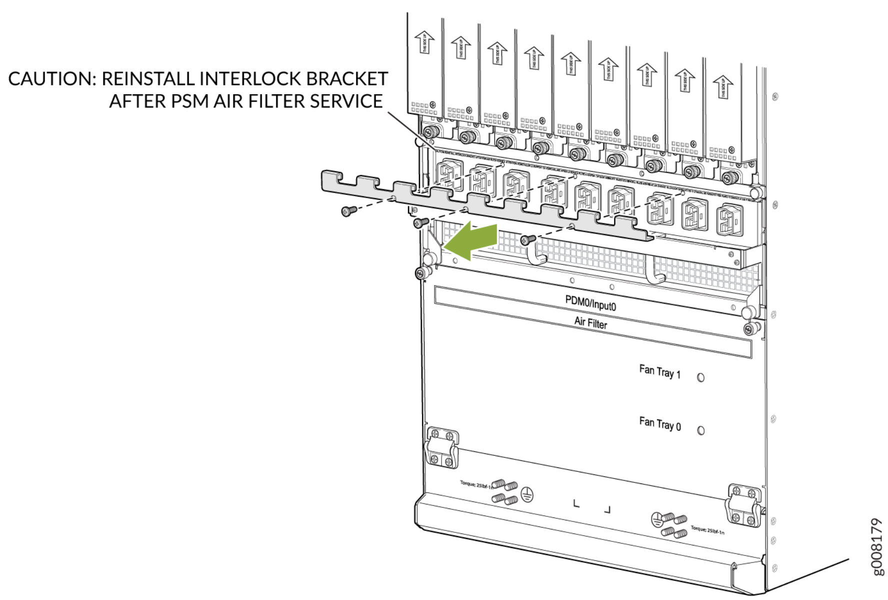


Figure 242: Removing the Bracket from the Universal (HVAC/HVDC) PDM



3. Loosen the two captive screws located on either side of the air filter and pull slightly out of the chassis.

CAUTION: Do not run the router for more than 2 minutes without the air filter in place.

4. Grasp the PSM air filter, and pull the air filter straight out from the chassis.
5. Slide the air filter out of the chassis as shown in Figure 243 on page 527 and Figure 244 on page 528.

Figure 243: Removing the PSM (DC PDM (240 V China) Air Filter from the Chassis

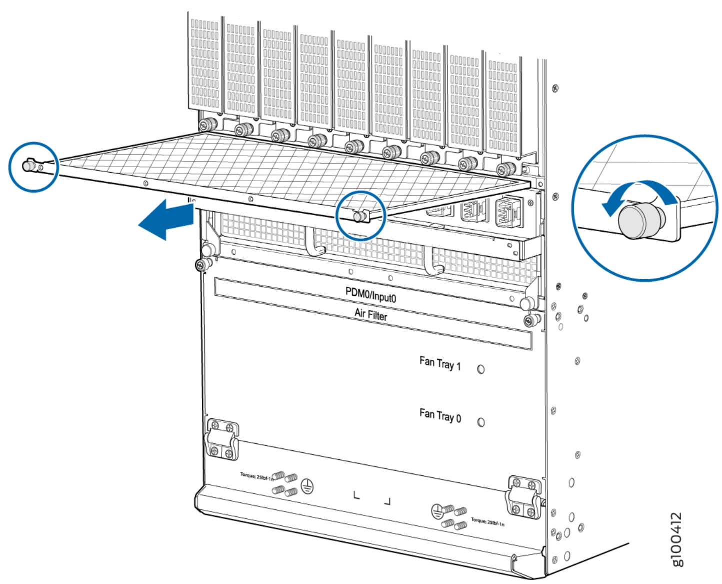
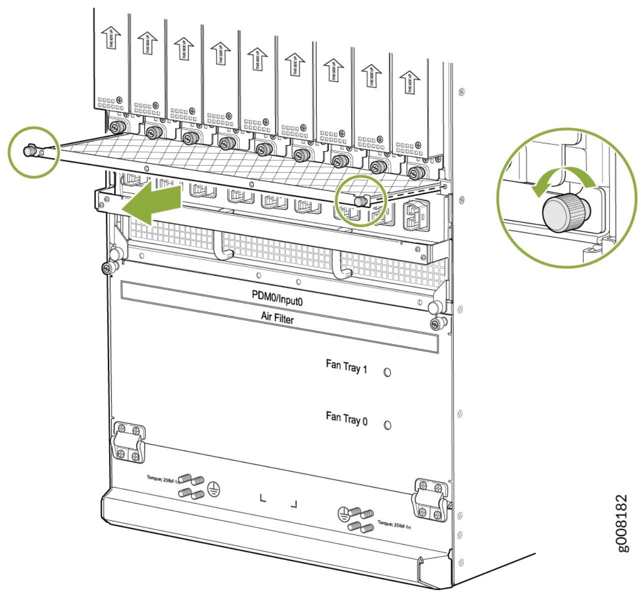


Figure 244: Removing the PSM (for the Universal HVAC/HVDC) Air Filter from the Chassis



6. Make sure to re-install the mechanical interlock bracket after you remove the filter. Secure the screws on the mechanical interlock bracket.

Figure 245: Installing the Mechanical Interlock Bracket (with the DC PDM 240 V China PSM Installed)

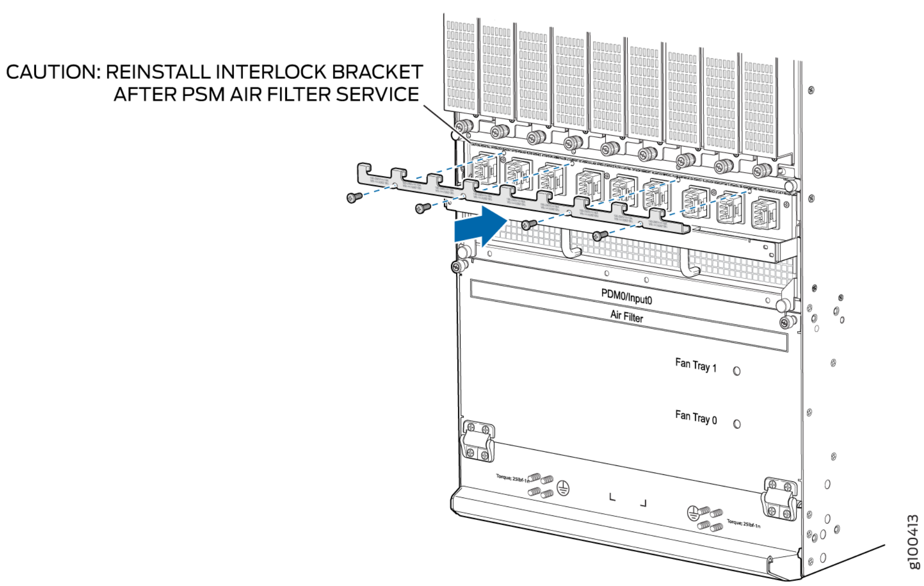
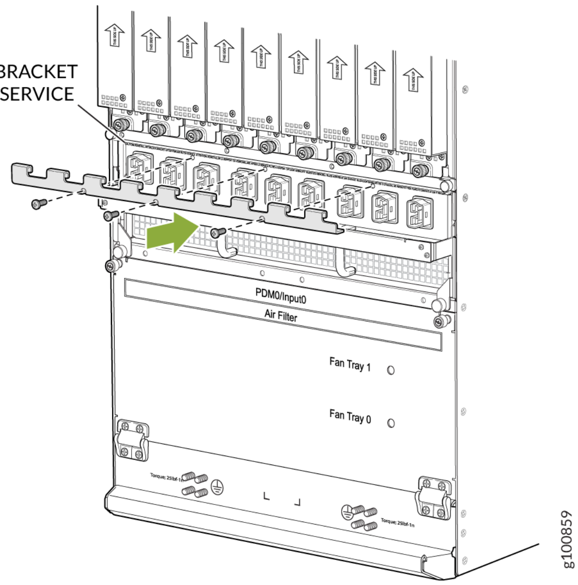


Figure 246: Installing the Mechanical Interlock Bracket (with Universal HVAC/HVDC PSM Installed)



SEE ALSO

Maintaining the MX2010 Air Filters | 716

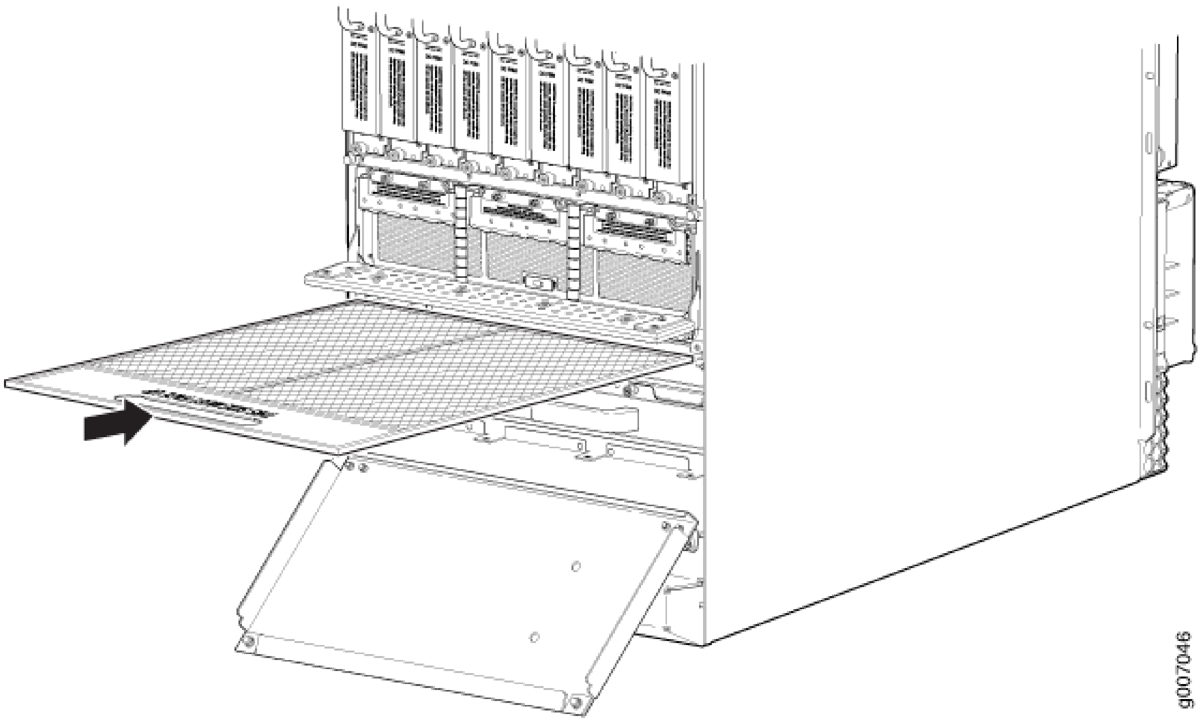
Installing the MX2010 Air Filter | 422

Installing the MX2010 Air Filter

To install the lower air filter—MX2010-FLTR-KIT-S:

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 air filter is right side up.
3. Open the fan tray and air filter access door, located at the bottom of the chassis.
4. Grasp the handle on the air filter and insert into the chassis until it stops (see Figure 247 on page 530).
5. Close the access door and tighten the two captive screws to secure.
6. Lower the cable manager back into position, and rearrange the cables in the cable manager.

Figure 247: Installing the Air Filter



To install the card-cage cable manager air filter—MX2010-MID-FLTR-PNL-S:

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.

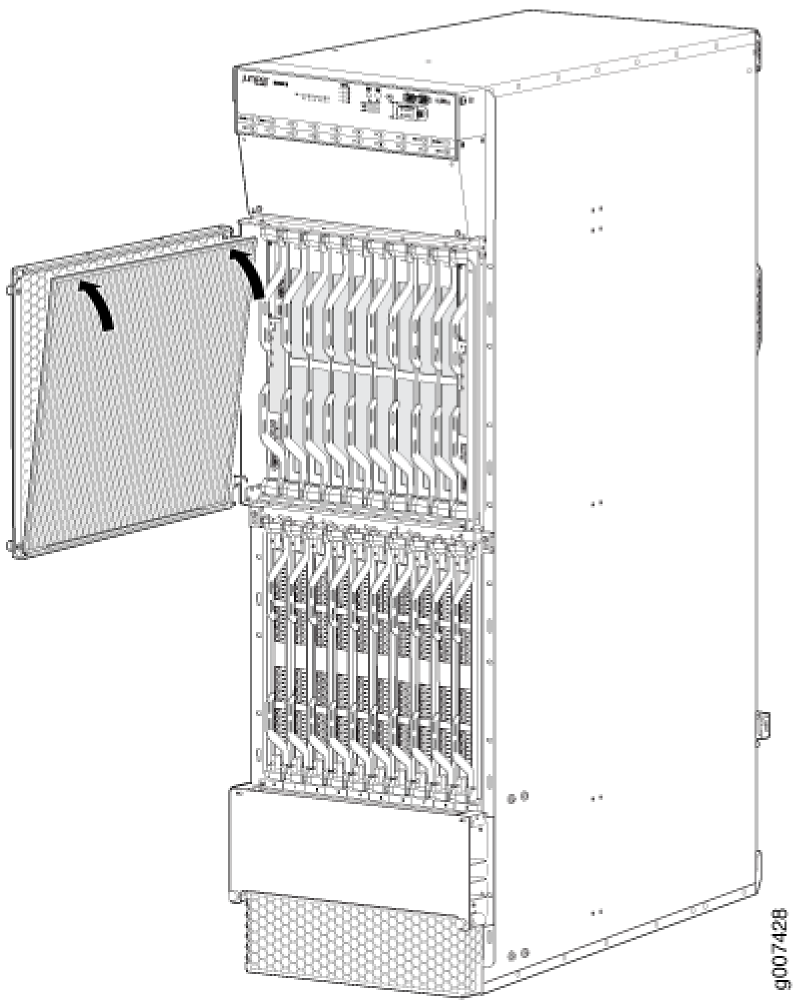
2. Move the cables from the card-cage cable manager, if necessary.

3. Loosen the two captive screws located on the front of the card-cage cable manager door, and open.

> **CAUTION**: Do not run the router for more than 2 minutes without the air filter in place.

4. Grasp the air filter, and slide the bottom of the air filter into the channel of the access door, (see Figure 248 on page 531).

Figure 248: Installing the Card-Cage Cable Manager Air Filter



5. Push the air filter in place, close the door, and tighten the two captive screws.

6. Replace the cables in the card-cage cable manager, if necessary.

To install the PSM air filter—MX2000-FLTR-PWR:

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.

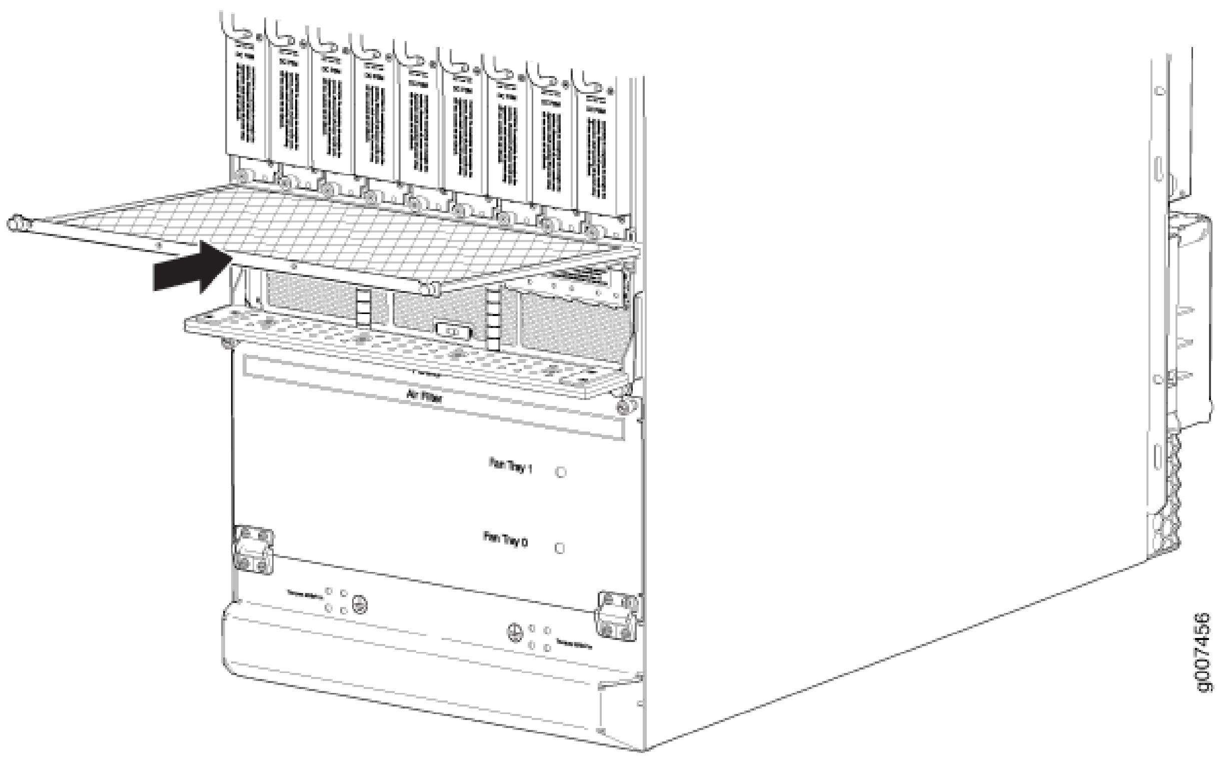
2. Ensure that the air filter is right side up.

3. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 249 on page 532).

4. Tighten the two captive screws to secure.

NOTE: The AC–powered MX2010 router has the same air filter.

Figure 249: Installing the PSM Air Filter



To install the PSM air filter—MX2000-FLTR-PWR for chassis with 240 V China power supplies and universal (HVAC/HVDC) power supplies:

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. Unscrew the mechanical interlock bracket from the PDM (see Figure 250 on page 533 and Figure 251 on page 533).

Figure 250: Removing the Bracket from the 240 V China PDM

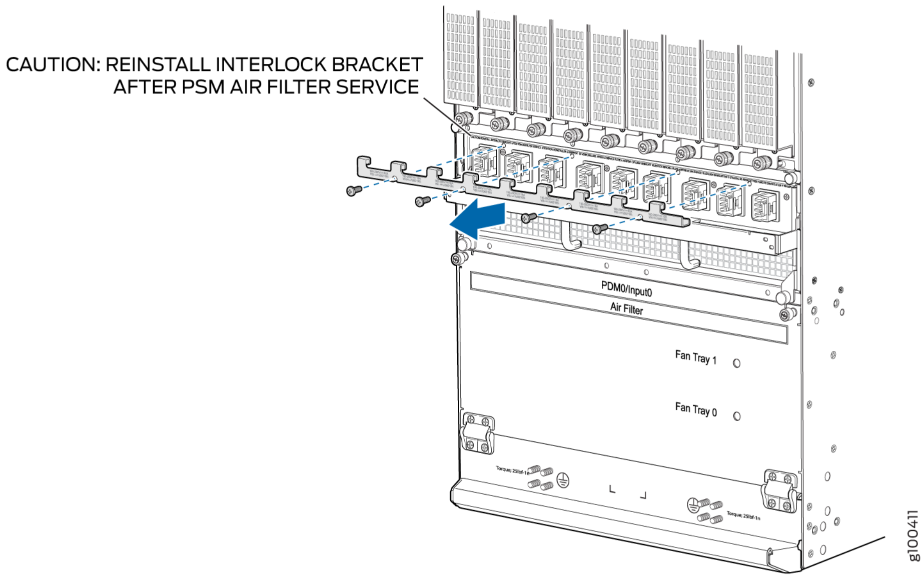
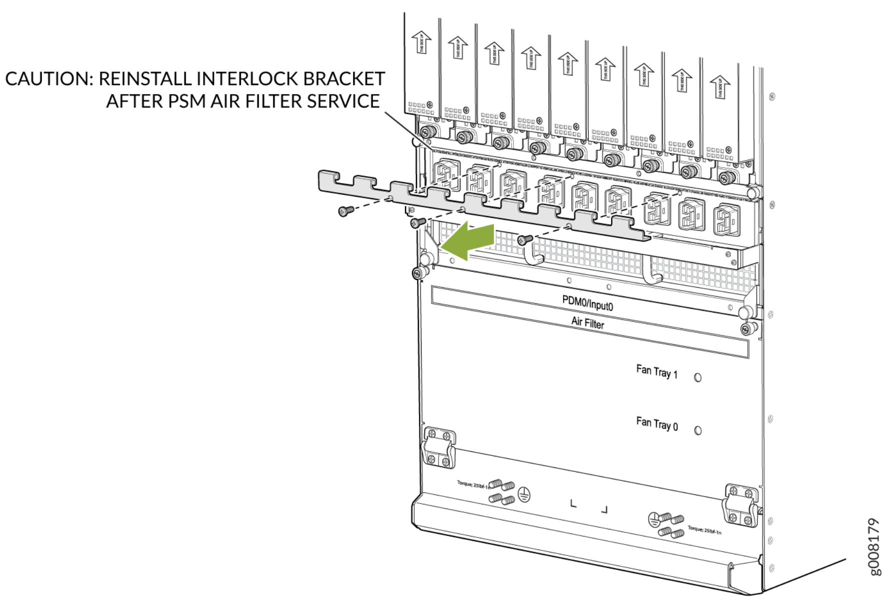


Figure 251: Removing the Bracket from the Universal (HVAC/HVDC) PDM

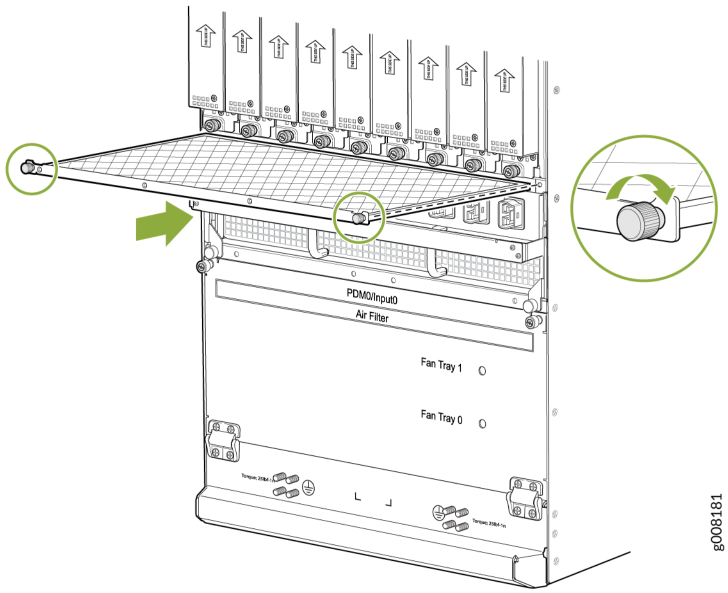


3. Ensure that the air filter is right side up.

4. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 252 on page 534).

5. Tighten the two captive screws to secure.

Figure 252: Installing the PSM Filter



6. Install the mechanical interlock bracket and tighten the screws. See Figure 253 on page 534 and Figure 254 on page 535.

Figure 253: Installing the Bracket (with 240 V China PSM Installed)

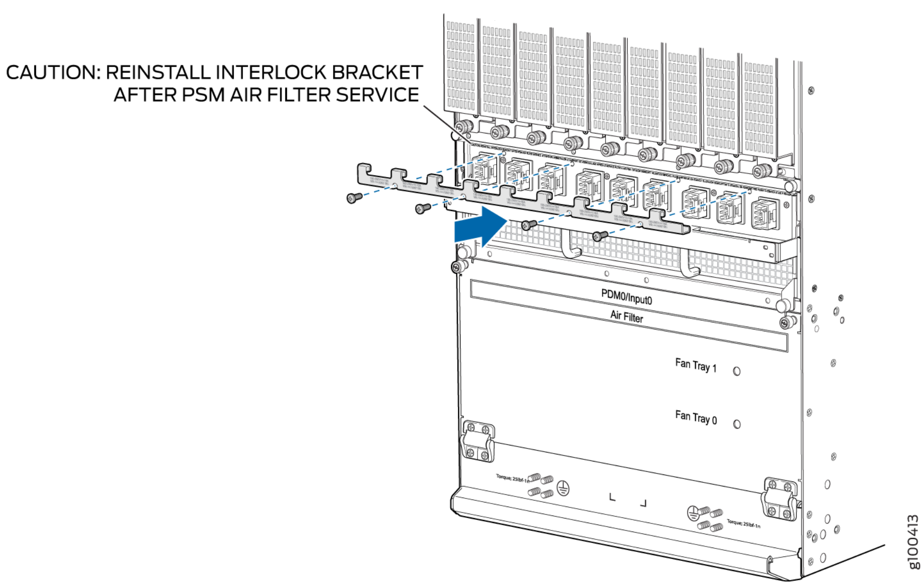
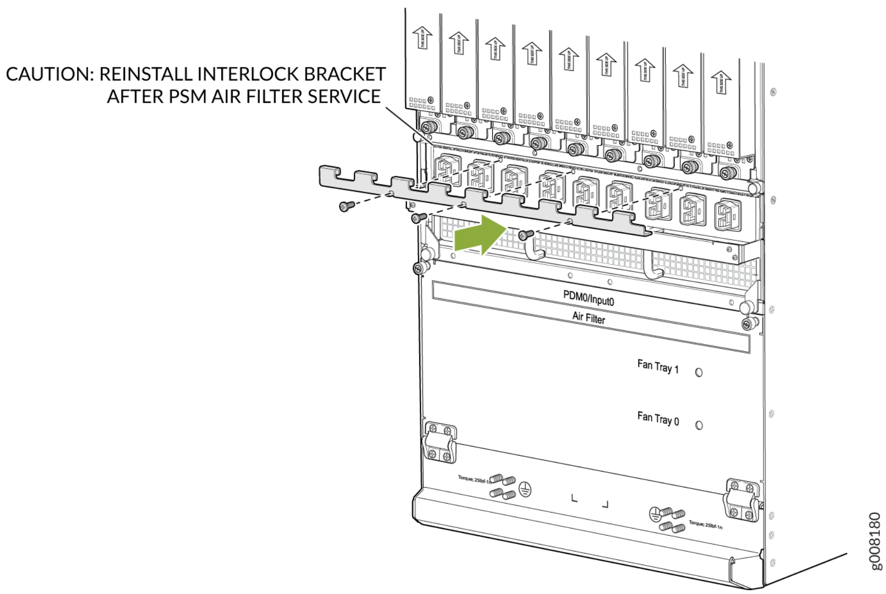


Figure 254: Installing the Mechanical Interlock Bracket (with Universal HVAC/HVDC PSM Installed)



SEE ALSO

Maintaining the MX2010 Air Filters | 716
Removing the MX2010 Air Filter | 522

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
Removing the MX2010 Air Filter | 522
Maintaining the MX2010 Air Filters | 716

Replacing the MX2010 Standard Cable Managers

IN THIS SECTION

- Removing the MX2010 Standard Cable Manager | 536

- Installing the MX2010 Standard Cable Manager | 537
- Removing the MX2010 Standard DC Cable Manager | 538
- Installing the MX2010 Standard DC Cable Manager | 539

The MX2010 router has the following types of cable manager systems used for routing and securing cables away from system components:

- Card cage

> **NOTE**: The card-cage cable manager is permanently installed onto the MX2010 system chassis, and cannot be removed.

- Standard and Extended

> **NOTE**: The MX2010 comes equipped with a standard lower cable manager. The extended lower cable manager can be ordered from Juniper Networks.

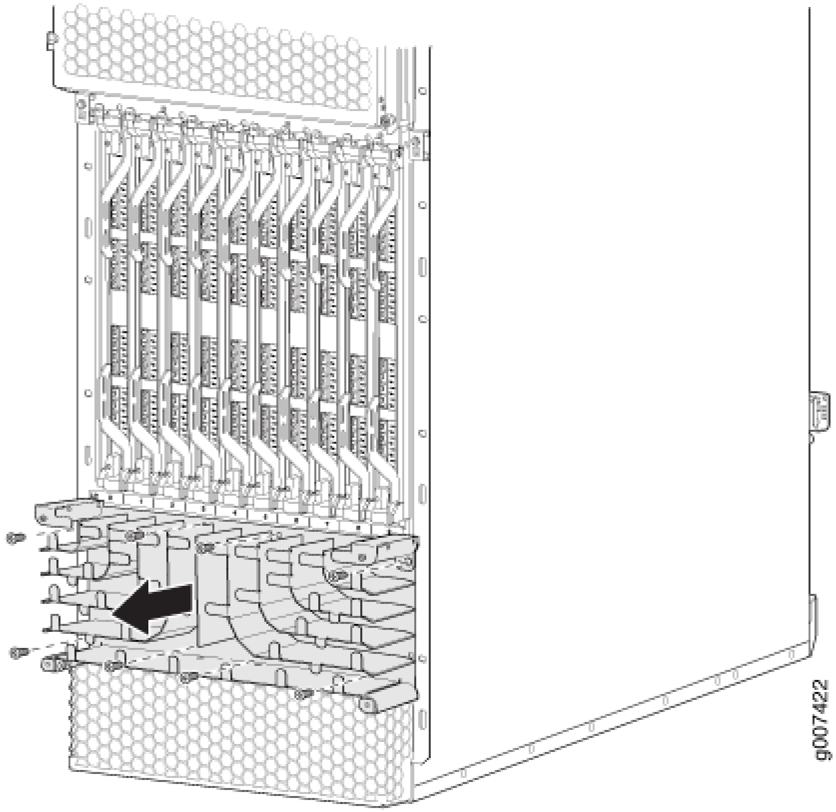
- Standard DC and Extended DC

Removing the MX2010 Standard Cable Manager

To remove the standard cable manager (see Figure 255 on page 537):

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 lower cable manager cover, and remove it.
3. Using a Phillips (+) screwdriver (number 1 or 2), loosen the mounting screws on the lower cable manager.
4. Grasp the lower cable manager, and pull it straight out from the studs on the front of the chassis.

Figure 255: Removing the Standard Cable Manager



SEE ALSO

Installing the MX2010 Standard Cable Manager | 455

Installing the MX2010 Standard Cable Manager

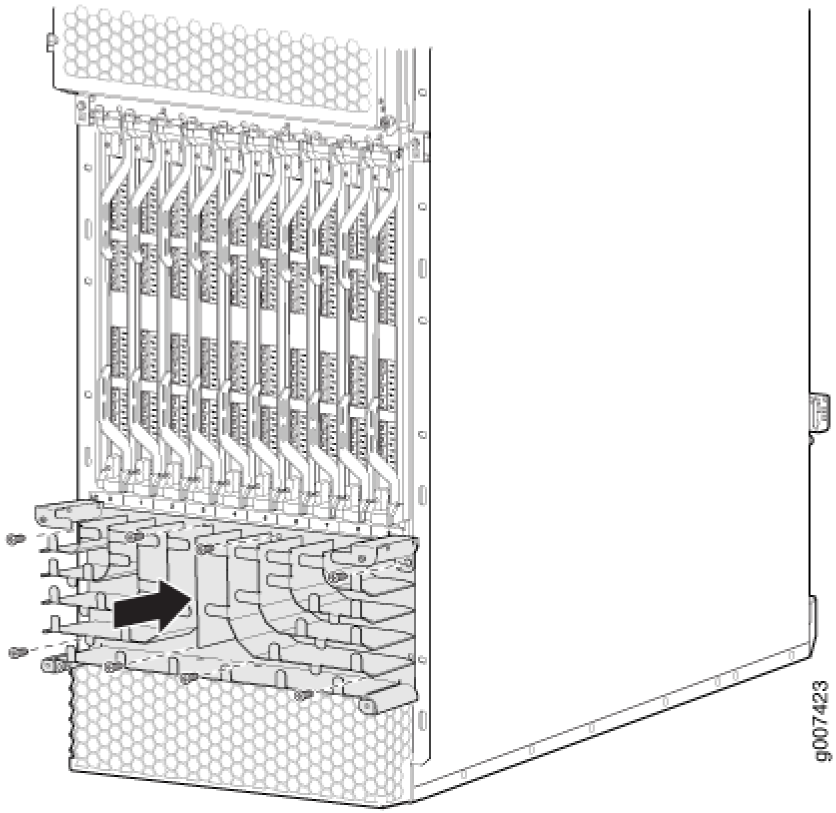
To install the standard cable manager (see Figure 256 on page 538):

> **NOTE**: The MX2010 comes equipped with a standard lower cable manager. The extended lower cable manager can be ordered from Juniper Networks.

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. Position the lower cable manager on the studs on the lower front of the chassis, just below the MPCs.
3. Insert the screws into the corners in the lower cable manager onto the studs on the chassis.

4. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.
5. Replace the cable manager cover, and secure it with the two captive screws.

Figure 256: Installing the Standard Cable Manager



SEE ALSO

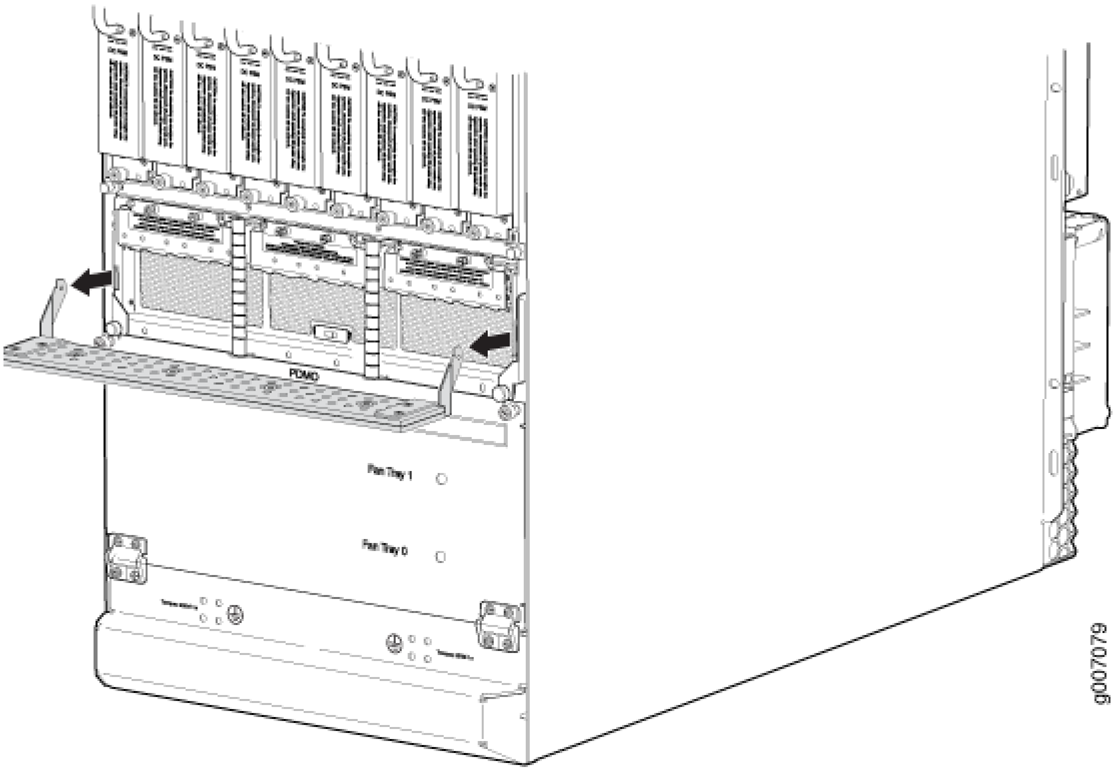
Replacing the MX2010 Standard Cable Managers | 535

Removing the MX2010 Standard DC Cable Manager

To remove the standard DC cable manager (see Figure 257 on page 539):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Grasp the DC cable manager, lift up and pull straight out from the DC PDM on the rear of the chassis.
3. Place the DC cable manager into an electrostatic bag and set it aside.

Figure 257: Removing the DC Cable Manager



SEE ALSO

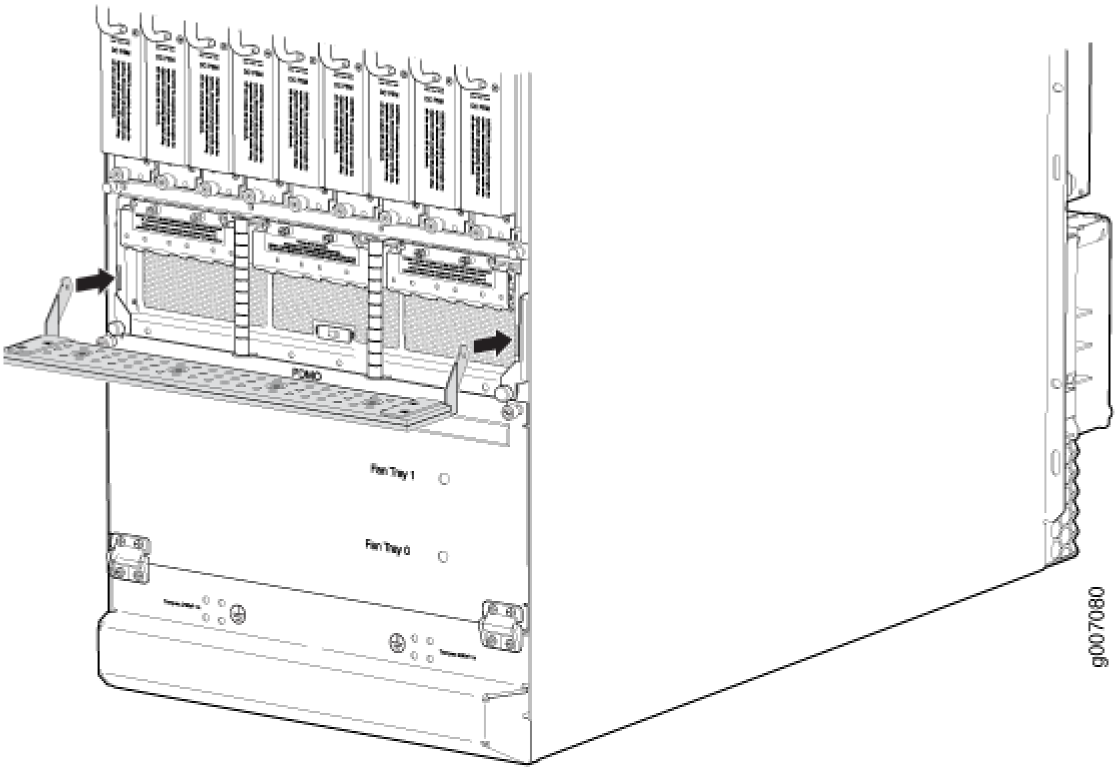
Installing the MX2010 Standard DC Cable Manager | 430

Installing the MX2010 Standard DC Cable Manager

To install the standard DC cable manager (see Figure 258 on page 540):

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. Position the DC cable manager over the two slots located on both sides of the DC PDM.
3. Lift the DC cable manager slightly up while inserting the two flanges into the slots on both sides of the DC PDM.
4. Push down to secure the DC cable manager in place.

Figure 258: Installing the Standard DC Cable Manager



SEE ALSO

Removing the MX2010 Standard DC Cable Manager | 538

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

MX2010 Cable Manager Description | 42

Replacing the MX2010 Extended Cable Manager

IN THIS SECTION

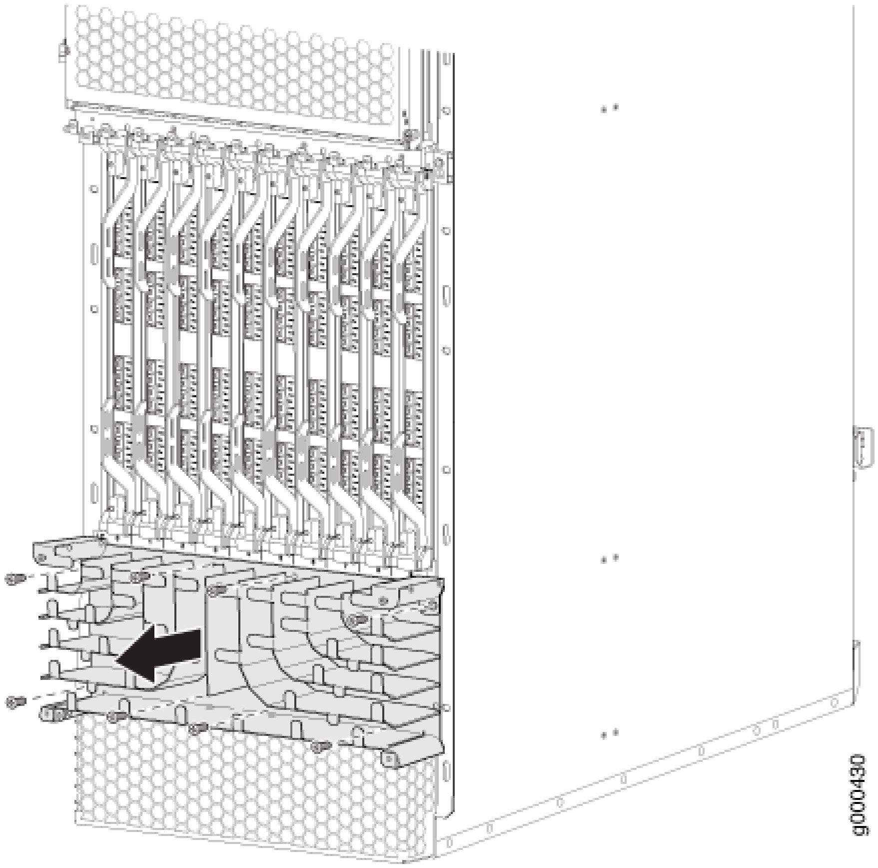
- Removing the MX2010 Extended Cable Manager | 541
- Removing the MX2010 Extended DC Cable Manager | 542
- Installing the MX2010 Extended Cable Manager | 544
- Installing the MX2010 Extended DC Cable Manager | 545

Removing the MX2010 Extended Cable Manager

To remove the extended cable manager:

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. To remove the cover, loosen the two captive screws on the extended cable manager cover. Set the extended cable manager cover aside.
3. Remove the eight screws that secure the extended cable manager to the chassis as shown in Figure 259 on page 542.
4. Pull the extended cable manager away from the chassis.

Figure 259: Removing the Extended Cable Manager

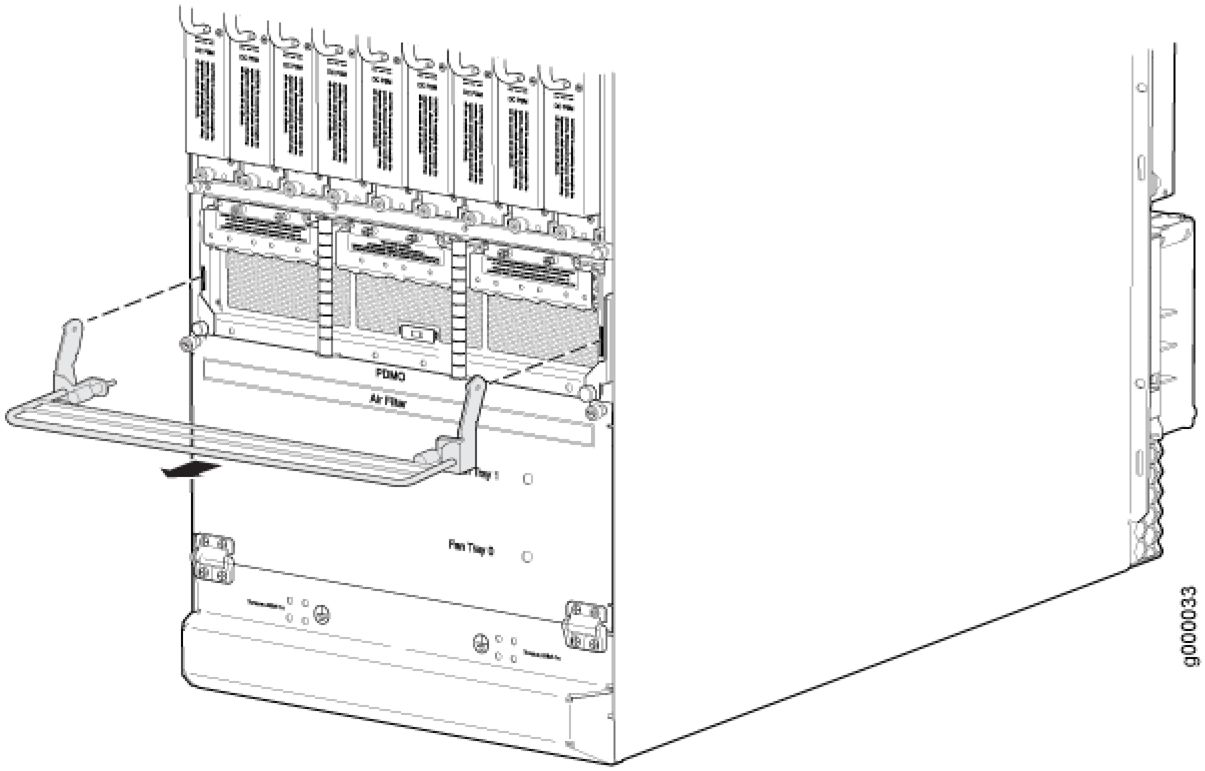


Removing the MX2010 Extended DC Cable Manager

To remove the extended DC cable manager (see Figure 260 on page 543):

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 a Phillips (+) screwdriver (number 1 or 2), loosen the two captive screws on the DC cable manager.
3. Grasp the extended DC cable manager, lift up and pull straight out from the DC PDM on the rear of the chassis.
4. Place the extended DC cable manager into an electrostatic bag and set it aside.

Figure 260: Removing the Extended DC Cable Manager

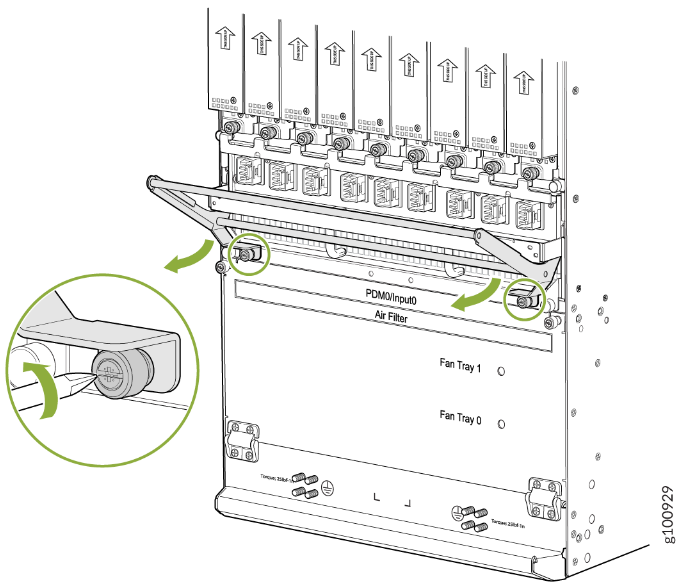


To remove the cable manager for the DC PDM (240 V China) and the universal (HVAC/HVDC) PDM (see Figure 261 on page 544):

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

2. Using a screwdriver, loosen the two screws on each side of the cable manager (see Figure 261 on page 544

Figure 261: Removing the Extended Cable Manager for DC PDM (240 V China) and the Universal (HVAC/HVDC) PDM



3. Grasp the cable manager, lift up and pull straight out from the PDM on the rear of the chassis.

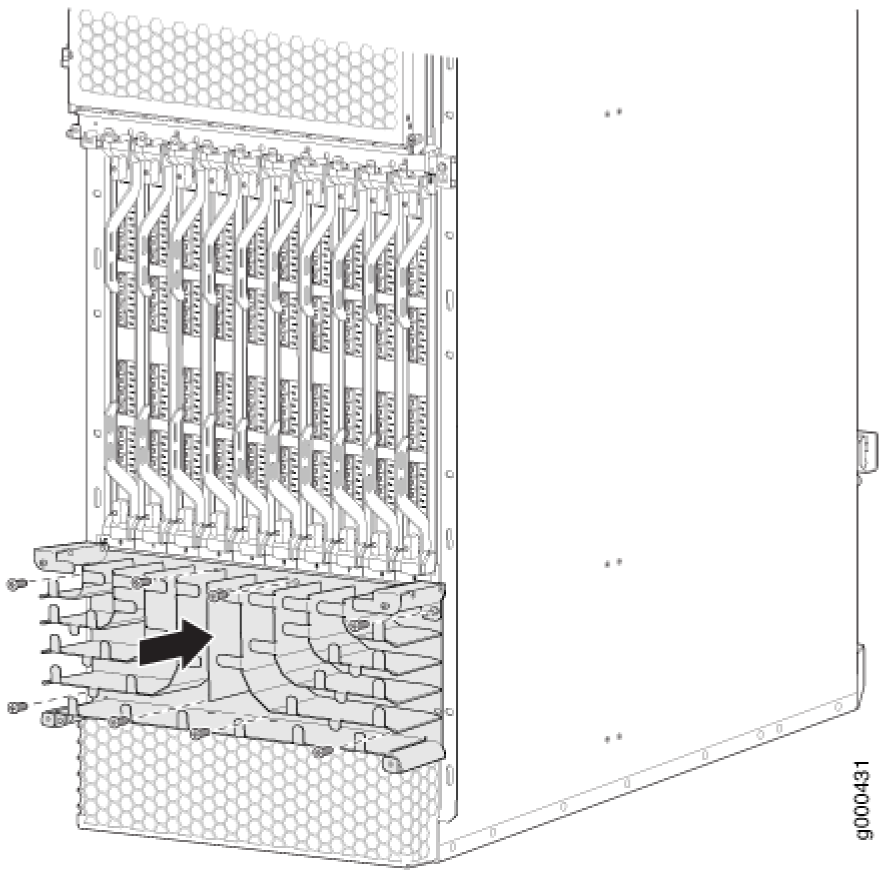
4. Place the cable manager into an electrostatic bag and set it aside.

Installing the MX2010 Extended Cable Manager

To install the extended cable manager (see Figure 262 on page 545):

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. Position the extended cable manager on the studs below the lower card cage.
3. Attach the extended cable manager using eight screws as shown in Figure 262 on page 545.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 262: Installing the Extended Lower Cable Manager

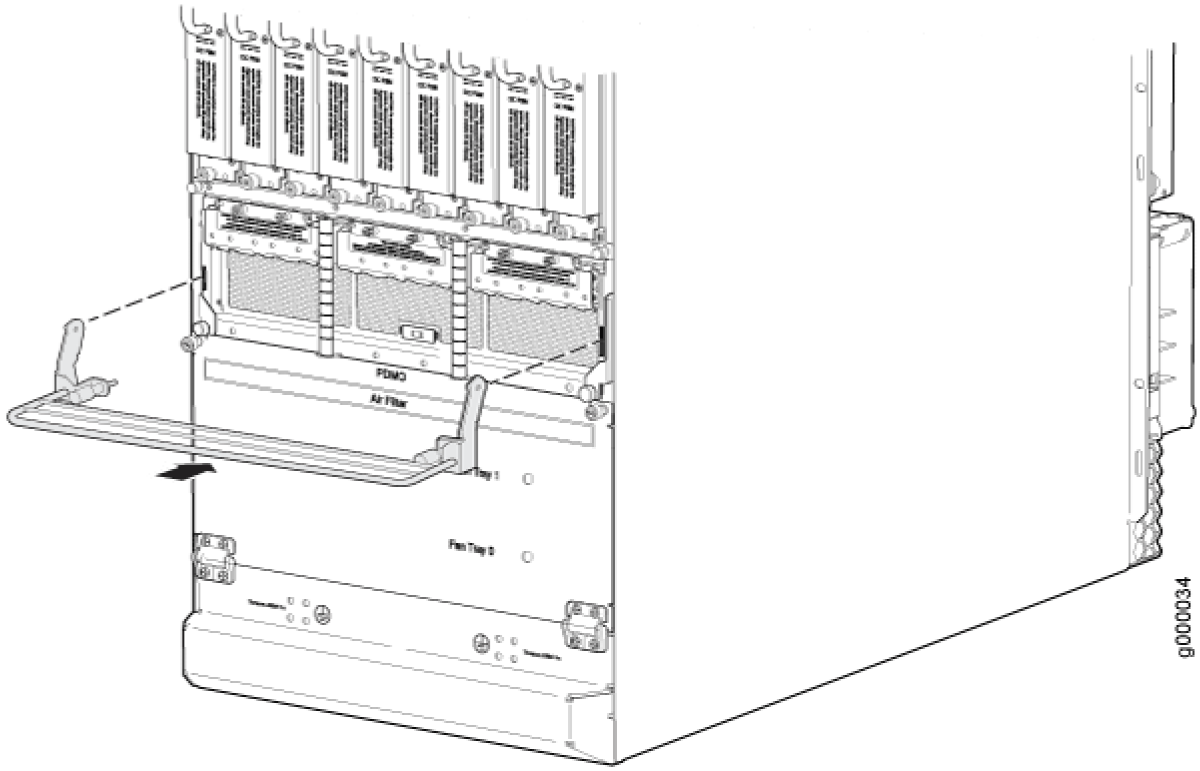


Installing the MX2010 Extended DC Cable Manager

To install the extended DC cable manager (see Figure 263 on page 546):

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. Position the extended DC cable manager over the two slots located on both sides of the DC PDM.
3. Lift the extended DC cable manager slightly up while inserting the two flanges into the slots on both sides of the DC PDM.
4. Push the extended DC cable manager into place.
5. Tighten the two captive screws to secure the extended DC cable manager.

Figure 263: Installing the Extended DC Cable Manager



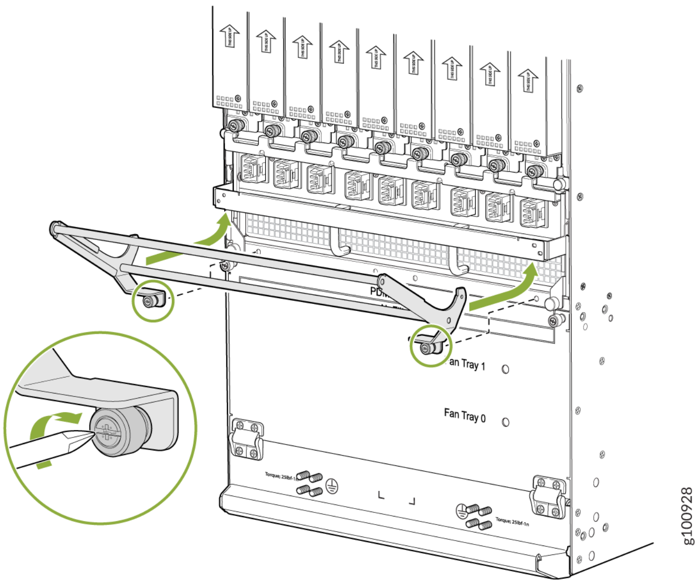
To install the extended cable manager for the DC PDM (240 V China) or the universal (HVAC/HVDC) PDM (see Figure 264 on page 547):

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. Position the cable manager over the two slots located on both sides of the PDM.

3. Lift the cable manager slightly up while inserting the two flanges into the slots on both sides of the PDM.

Figure 264: Installing the Extended Rear Cable Manager on the DC PDM (240 V China) and Universal (HVAC/HVDC) PDM



4. Push down to secure the extended cable manager in place. Tighten the screws using a screwdriver. See Figure 264 on page 547.

Replacing the MX2010 Craft Interface

IN THIS SECTION

- Disconnecting the Alarm Relay Wires from the MX2010 Craft Interface | 547
- Removing the MX2010 Craft Interface | 548
- Installing the MX2010 Craft Interface | 552
- Connecting the Alarm Relay Wires to the MX2010 Craft Interface | 553

Disconnecting the Alarm Relay Wires from the MX2010 Craft Interface

Here's how to disconnect the alarm relay wires from the MX2010 and an alarm-reporting device (see Figure 265 on page 548):

1. Disconnect the existing wire at the external device.
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. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block (see Table 110 on page 548).

Figure 265: Alarm Relay Contacts

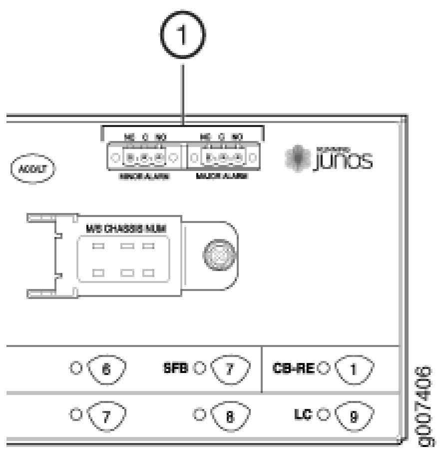


Table 110: Alarm Relay Contacts on the Craft Interface

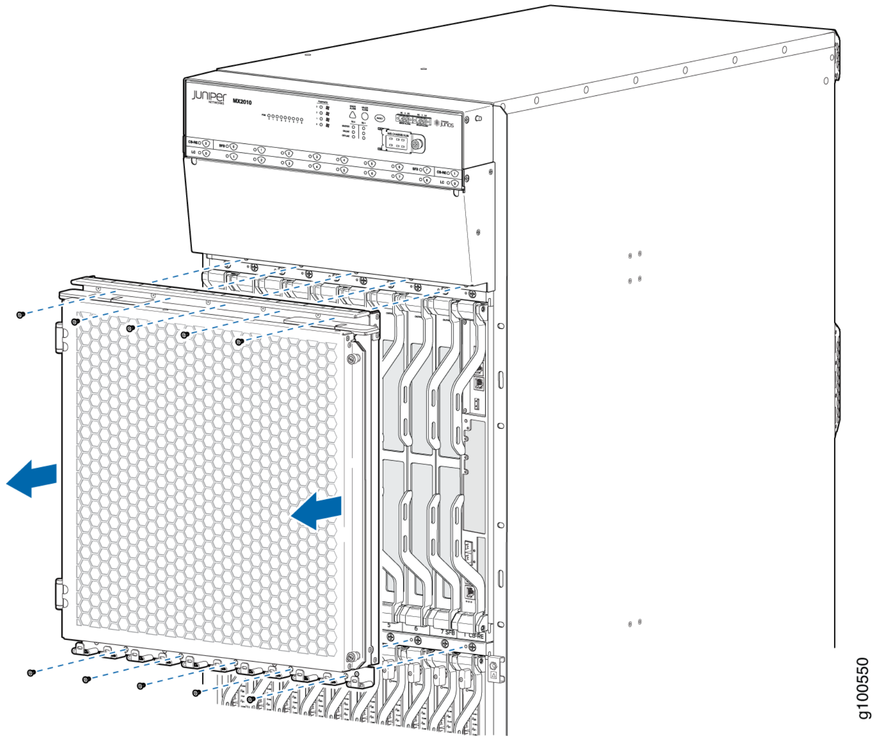
Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with a normal closed (NC), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

Removing the MX2010 Craft Interface

Here's how to remove the MX2010 craft interface:

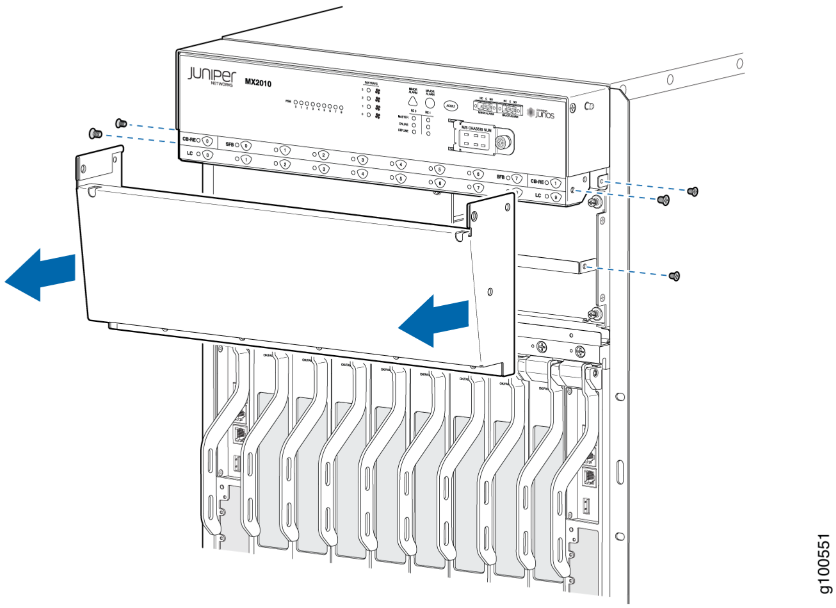
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Detach any external devices connected to the craft interface.
3. Remove the 10 screws holding the EMI door in place and remove the EMI door. Refer to Figure 266 on page 549.

Figure 266: Removing the EMI Door



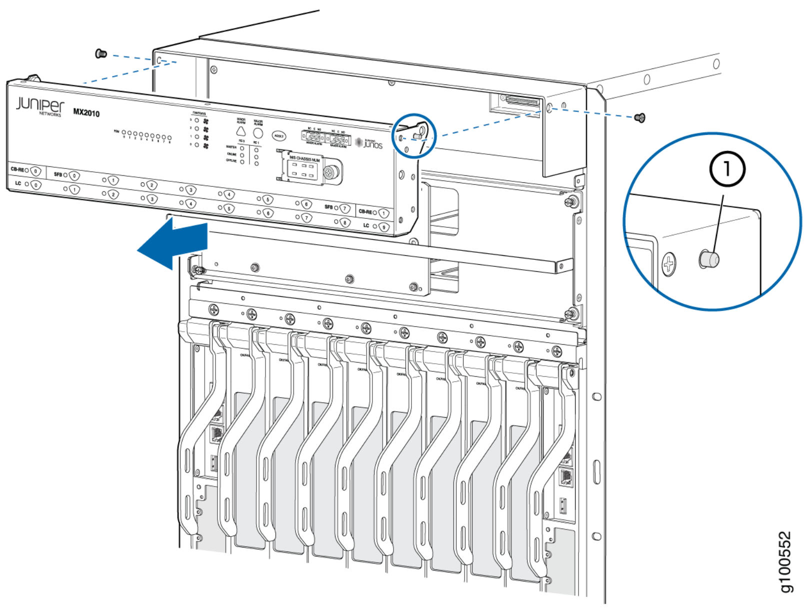
4. Remove the four screws holding the sheet metal cover in place and remove the sheet metal cover. Refer to Figure 267 on page 550.

Figure 267: Removing the Sheet Metal Cover



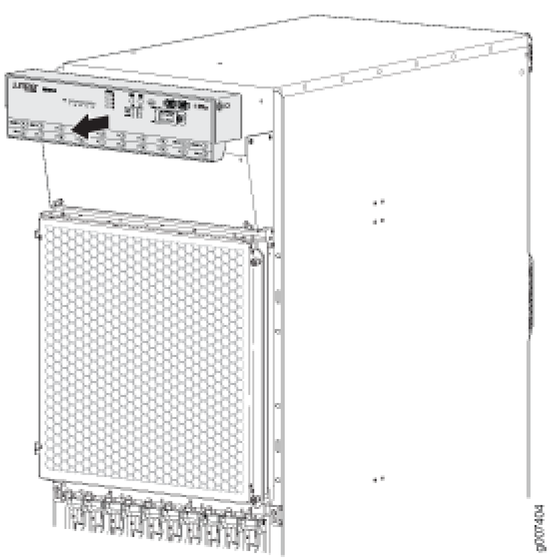
5. Loosen the two captive screws at the left and right sides of the craft interface faceplate by using the Torx (T10) screwdriver.
6. Grasp the craft interface faceplate and carefully tilt it toward you until it is horizontal.
7. Disconnect the ribbon cable from the back of the faceplate by gently pressing on both sides of the latch with your thumb and forefinger.
8. Gently slide the left end of the craft interface out of the housing. The pin at the right end of the craft interface will auto-slide out of the dedicated hole. Refer to Figure 268 on page 551.

Figure 268: Sliding the Craft Interface Out of the Housing



9. Remove the craft interface from the chassis. See Figure 269 on page 551.

Figure 269: Removing the Craft Interface



SEE ALSO

MX2010 Craft Interface Description | 34

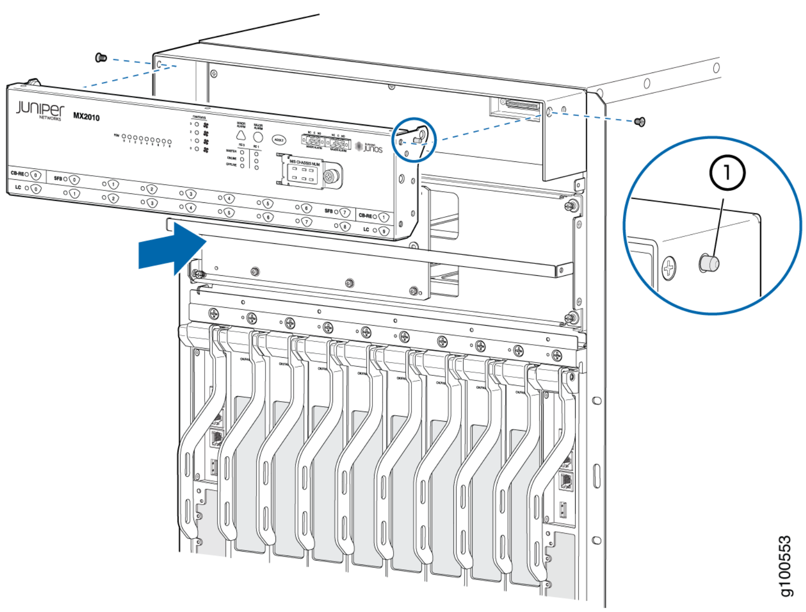
Maintaining and Verifying the Status of the MX2010 Craft Interface | 798

Installing the MX2010 Craft Interface

Here's how to install the MX2010 craft interface:

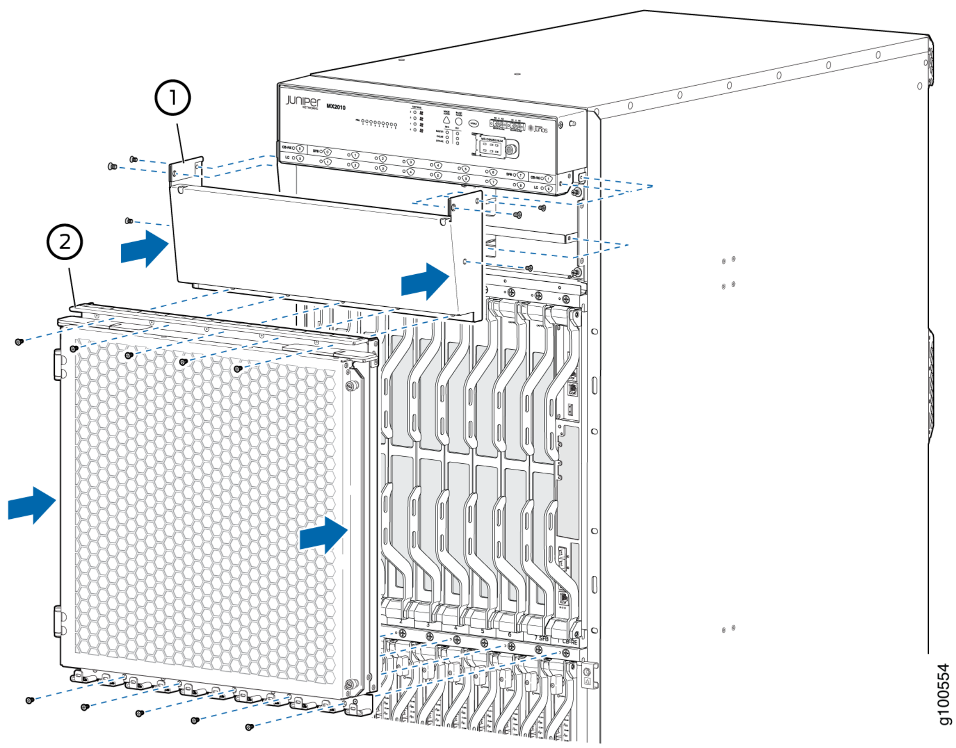
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the craft interface with one hand, and hold the bottom edge of the craft interface with the other hand to support its weight.
3. Orient the ribbon cable so that it plugs into the connector socket. The connector is keyed and can be inserted only one way. The pin on the right side of the craft interface indicates the positioning.
4. Align the pin on the right side of the craft interface with the dedicated hole in the housing and gently slide the craft interface into the housing. See Figure 270 on page 552.

Figure 270: Installing the Craft Interface into the Housing



5. Reattach the craft interface faceplate by positioning it in place and then tightening the two screws on the left and right sides using the Torx (T10) screwdriver.
6. Reattach the sheet metal cover and EMI door by positioning them in place and then tightening the screws using a Torx (T10) screwdriver. See Figure 271 on page 553.

Figure 271: Reattaching the Sheet Metal Cover and EMI Door



7. Reattach any external devices connected to the craft interface.

SEE ALSO

MX2010 Craft Interface Description | 34
Maintaining and Verifying the Status of the MX2010 Craft Interface | 798

Connecting the Alarm Relay Wires to the MX2010 Craft Interface

Here's how to connect the alarm relay wires between a router and an alarm-reporting device (see Figure 272 on page 554):

1. Prepare the required length of replacement wire with gauge between 28 AWG (0.08 mm^2) and 14 AWG (2.08 mm^2).
2. Insert the replacement wires into the slots in the front of the block (see Table 111 on page 554). Use a 2.5-mm flat-blade screwdriver to tighten the screws and secure the wire.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. 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.

Figure 272: Alarm Relay Contacts

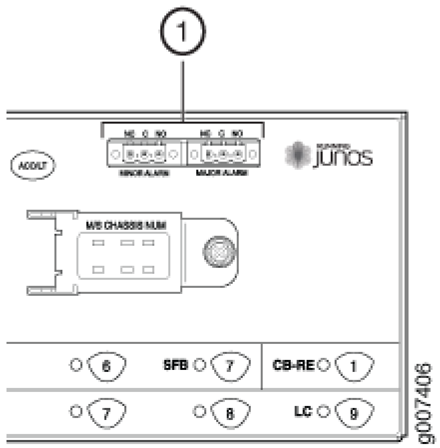


Table 111: Connecting Alarm Relay Contacts

Function No.	Label	Description
1	MINOR ALARM—[NC C NO] MAJOR ALARM—[NC C NO]	The alarm relays consist of three terminal contacts with a normal closed (NC), a common (C), and a normal open (NO) relay that signal a minor or major alarm when broken.

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34

MX2010 Craft Interface Serial Number Label | 850

Replacing an MX2010 DC Power Supply Module (-48 V)

IN THIS SECTION

- Removing an MX2010 DC Power Supply Module (-48 V) | 555
- Installing an MX2010 DC Power Supply Module (-48 V) | 556

Removing an MX2010 DC Power Supply Module (-48 V)

Before you remove a PSM, be aware of the following:

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To remove a DC PSM (see Figure 273 on page 556):

NOTE: The DC PSM is hot-swappable, with a minimum number of PSMs installed.

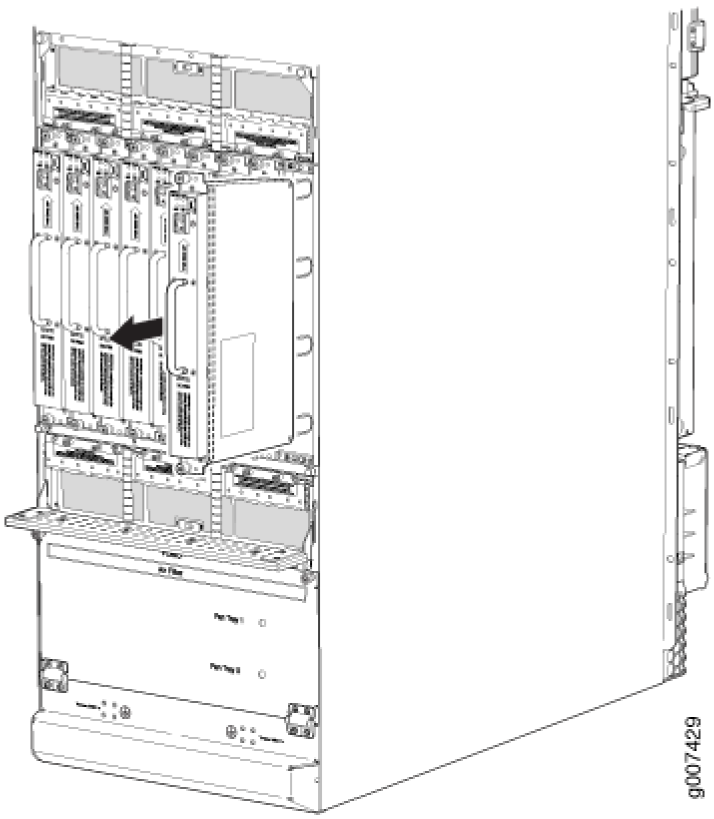
1. With one PSM installed and operational, remove any additional PSM by turning the power switch to the off (**O**) position.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Loosen the two captive screws on the PSM faceplate.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull the PSM straight out of the chassis.

   WARNING: Do not touch the power connectors on back of the PSM. They can get damaged.

6. Place the PSM module into an antistatic bag.

> **NOTE**: Each PSM slot not occupied by a DC PSM must be covered by a PSM blank panel.

Figure 273: Removing a DC Power Supply Module from the MX2010 Router



SEE ALSO

MX2010 DC Power Supply Module (-48 V) Description | 147
Installing an MX2010 DC Power Supply Module (-48 V) | 438

Installing an MX2010 DC Power Supply Module (-48 V)

Before you install a PSM, be aware of the following:

NOTE: The DC PSM is hot-swappable when a minimum number of PSMs installed and operational.

WARNING: The DC PSMs have no circuit breakers that can physically disconnect DC line from the router. After DC feeds have been connected to the PDM, the DC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

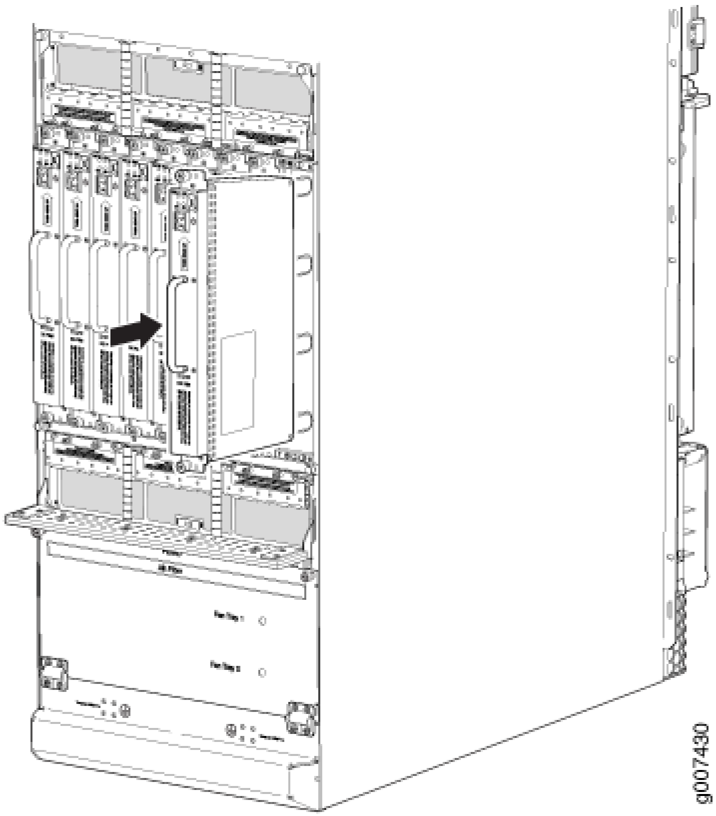
To install a DC PSM (see Figure 274 on page 558):

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**) or in the on (|) position.

   CAUTION: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate.
5. Turn on the power switch to the on (|) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 274: Installing a DC Power Supply Module



SEE ALSO

MX2010 DC Power Supply Module (-48 V) Description | 147
Removing an MX2010 DC Power Supply Module (-48 V) | 555

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
MX2010 DC Power Distribution Module (-48 V) Description | 142
MX2010 DC Power Electrical Safety Guidelines
MX2010 DC Power (-48 V) System Electrical Specifications | 246

Replacing an MX2000 DC Power Supply Module (240 V China)

IN THIS SECTION

- Removing an MX2000 Router DC Power Supply Module (240 V China) | **559**
- Installing an MX2000 Router DC Power Supply Module (240 V China) | **561**

Removing an MX2000 Router DC Power Supply Module (240 V China)

Before you remove a PSM, be aware of the following:

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To remove a DC PSM (see Figure 275 on page 560):

NOTE: The minimum number of DC PSMs change, based on the configuration.

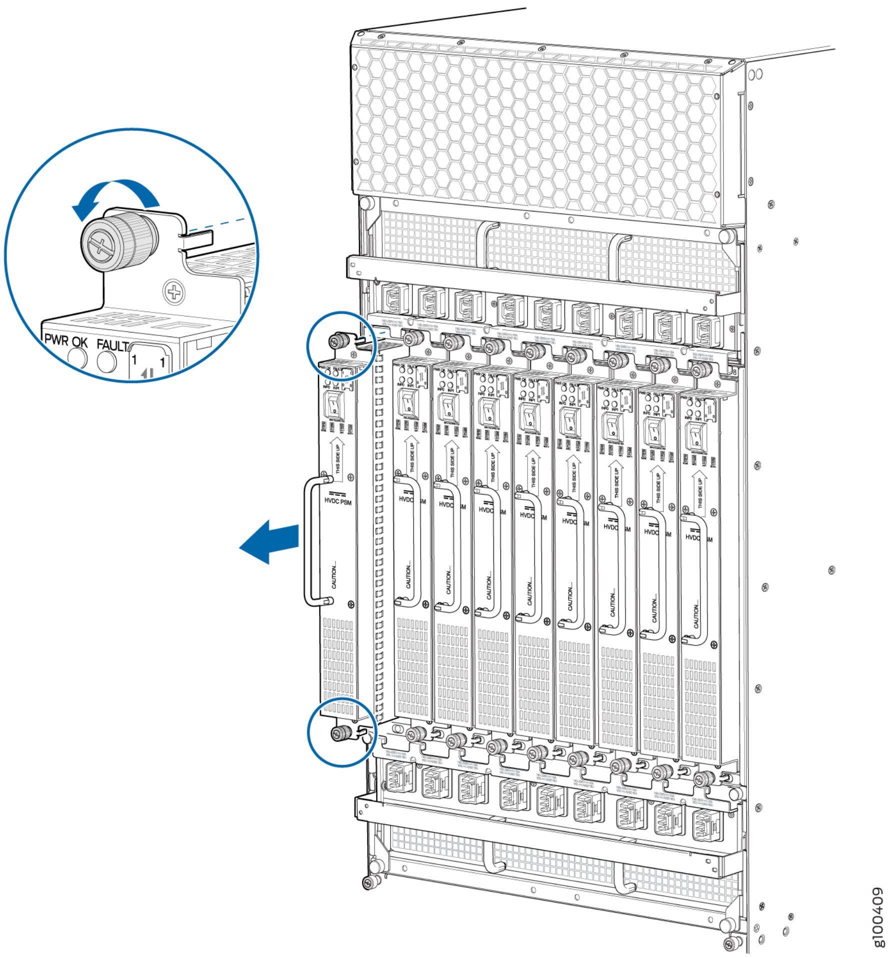
1. With one PSM installed and operational, remove any additional PSM by turning the power switch to the off (**O**) position.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Loosen the two captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull the PSM straight out of the chassis.

WARNING: To avoid damage, do not touch the power connectors in back of the PSM.

6. Place the PSM module into an antistatic bag.

> **NOTE**: Each PSM slot not occupied by a DC PSM must be covered by a PSM blank panel.

Figure 275: Removing an MX2000 Router DC Power Supply Module (240 V China)



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description

MX2010 DC Power Supply Module (-48 V) Description | 147

Installing an MX2020 DC Power Supply Module (-48 V)

Installing an MX2010 DC Power Supply Module (-48 V) | 438

Installing an MX2000 Router DC Power Supply Module (240 V China)

Before you install a DC PSM (240 V China), be aware of the following:

NOTE: The DC PSM is hot-swappable when a minimum number of PSMs installed and operational.

WARNING: The DC PSMs have no circuit breakers that can physically disconnect DC current from the router. After DC feeds have been connected to the PDM, the DC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

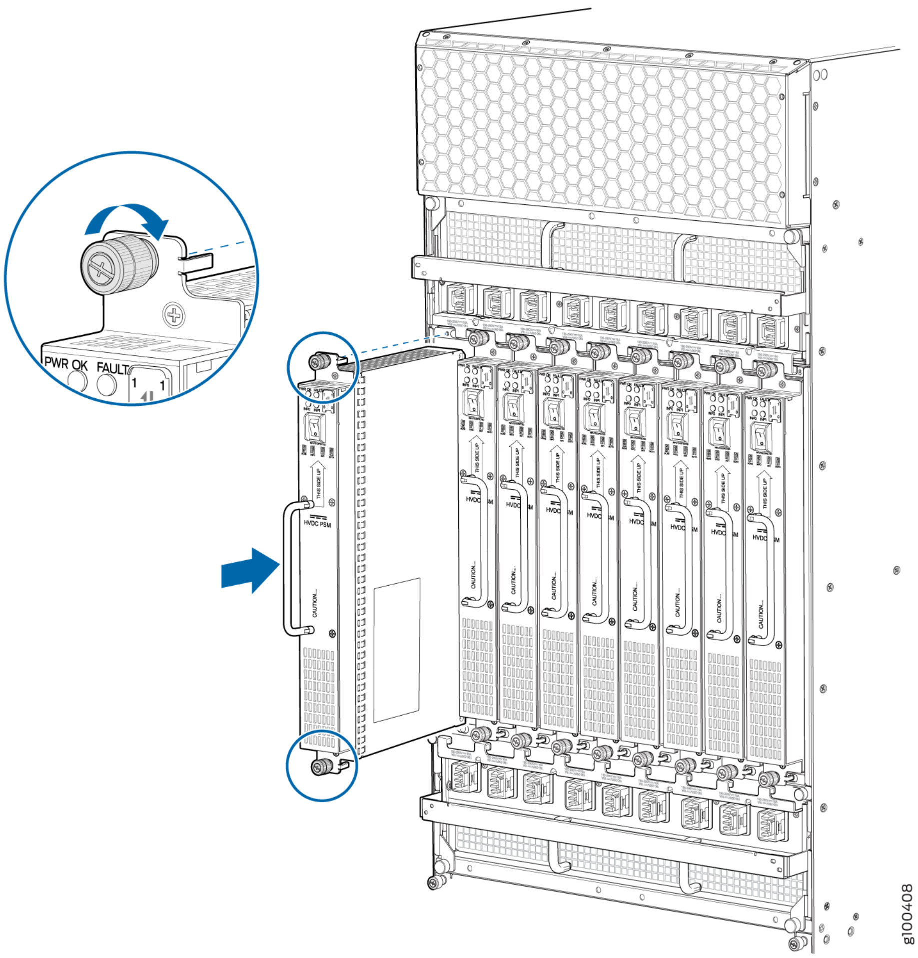
To install a DC PSM (see Figure 276 on page 562):

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**) or in the on (|) position.

   CAUTION: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
5. Turn on the power switch to the on (|) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 276: Installing a DC Power Supply Module (240 V China)



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router
Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | 813
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Maintaining the Power Supply Modules on the MX2000 Line of Routers | 779
MX2020 DC Power Distribution (240 V China) Description

MX2020 DC Power Electrical Safety Guidelines

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications

Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module

IN THIS SECTION

- Removing an MX2000 Router High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module | 563
- Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Supply Module | 567

Removing an MX2000 Router High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module

Before you remove a PSM, be aware of the following:

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To remove a universal HVAC/HVDC PSM (see Figure 277 on page 565, Figure 278 on page 566, and Figure 279 on page 567):

NOTE: The minimum number of PSMs change, based on the configuration.

1. With one PSM installed and operational, remove any additional PSM by turning the power switch to the off (**O**) position.
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. Loosen the two captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull the PSM straight out of the chassis.

> **WARNING**: To avoid damage, do not touch the power connectors in back of the PSM.

6. Place the PSM module into an antistatic bag.

> **NOTE**: Each PSM slot not occupied by a universal (HVAC/HVDC) PSM must be covered by a PSM blank panel.

Figure 277: Removing an MX2020 Router Universal (HVAC/HVDC) Power Supply Module

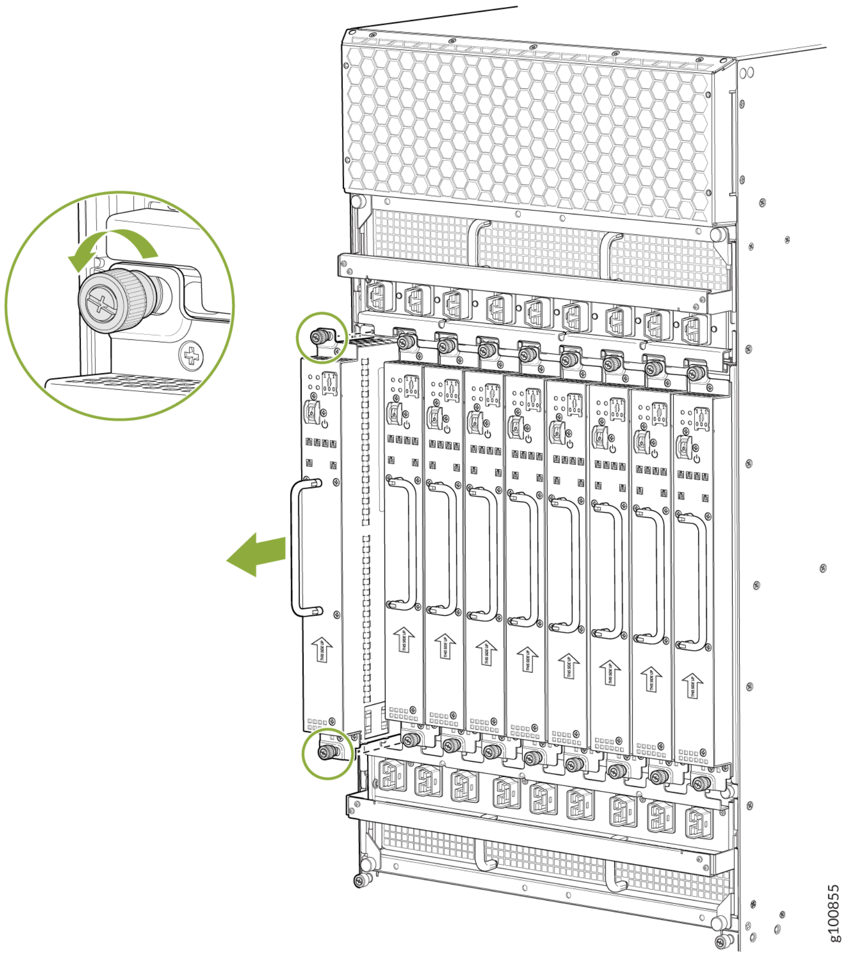


Figure 278: Removing an MX2010 Router Universal (HVAC/HVDC) Power Supply Module

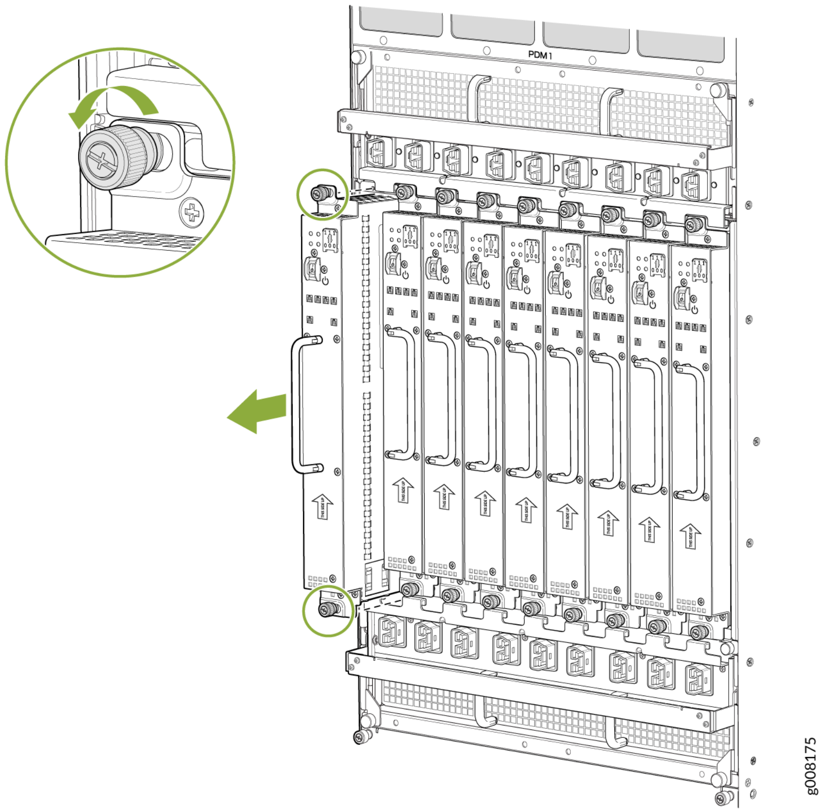
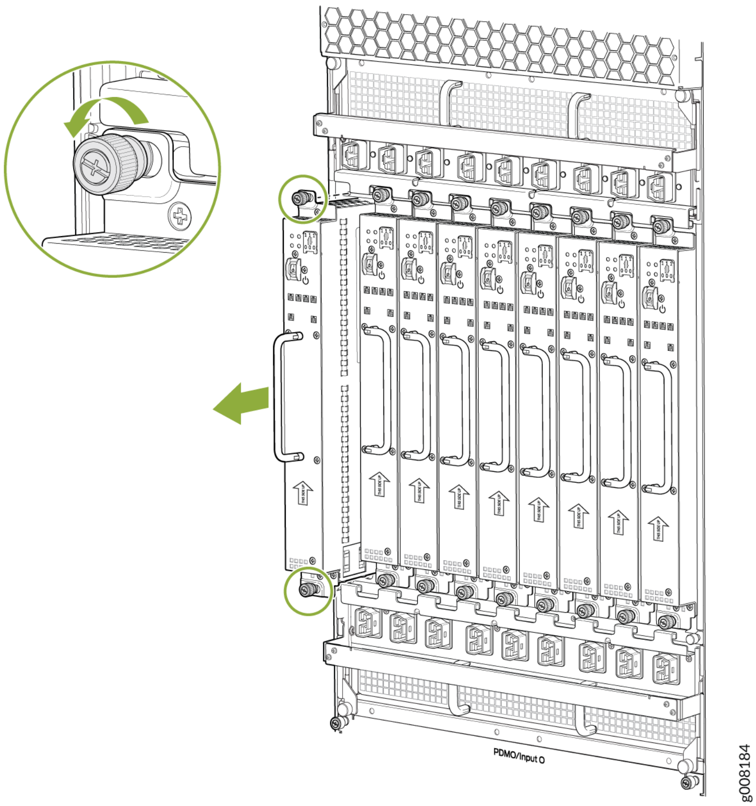


Figure 279: Removing an MX2008 Router Universal (HVAC/HVDC) Power Supply Module



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description

MX2010 DC Power Supply Module (-48 V) Description | 147

Installing an MX2020 DC Power Supply Module (-48 V)

Installing an MX2010 DC Power Supply Module (-48 V) | 438

Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Supply Module

Before you install a universal (HVAC/HVDC) PSM, be aware of the following:

> **NOTE**: The universal (HVAC/HVDC) PSM is hot-swappable when a minimum number of PSMs installed and operational.

Depending on whether you are connecting to AC or DC power, these warnings apply to the universal HVAC/HVDC power distribution module (PDM):

WARNING: The DC PSMs have no circuit breakers that can physically disconnect DC current from the router. After DC feeds have been connected to the PDM, the DC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

WARNING: The AC PSMs have no circuit breakers that can physically disconnect AC current from the router. After AC feeds have been connected to the PDM, the AC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To install a universal (HVAC/HVDC) PSM (see Figure 280 on page 569, Figure 281 on page 570, and Figure 282 on page 571):

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**) or in the on (|) position.

    CAUTION: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
5. Turn on the power switch to the on (|) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 280: Installing an MX2020 Router Universal (HVAC/HVDC) Power Supply Module

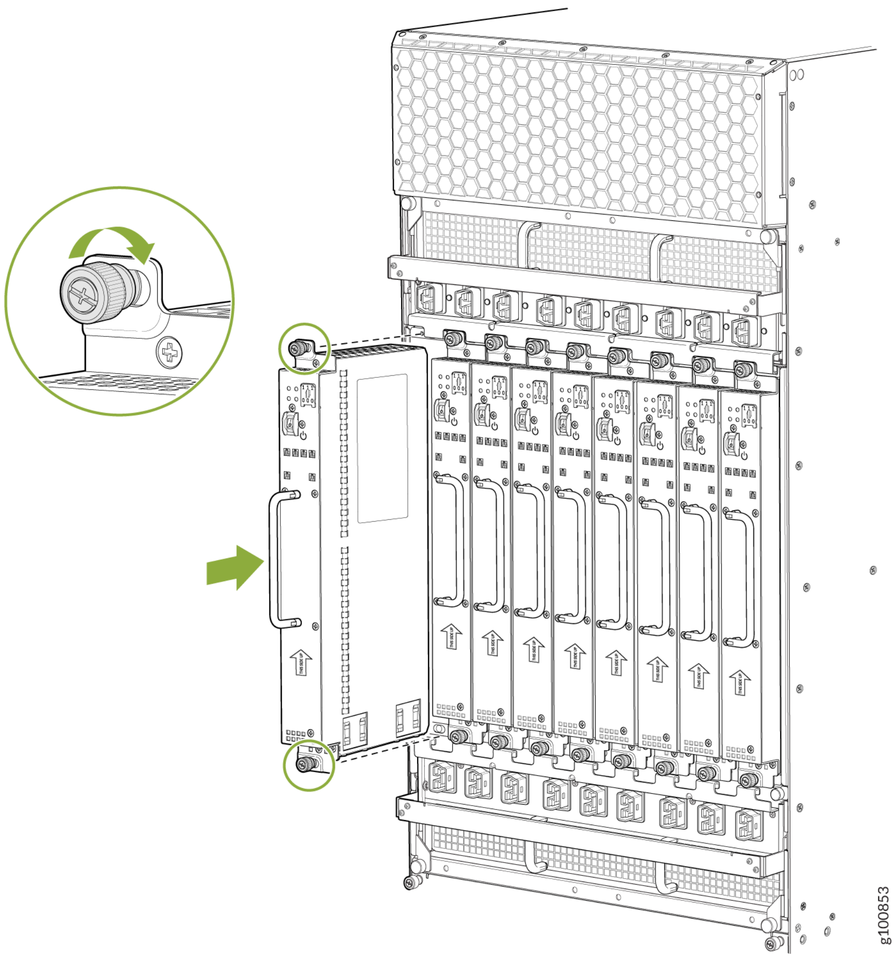


Figure 281: Installing an MX2010 Router Universal (HVAC/HVDC) Power Supply Module

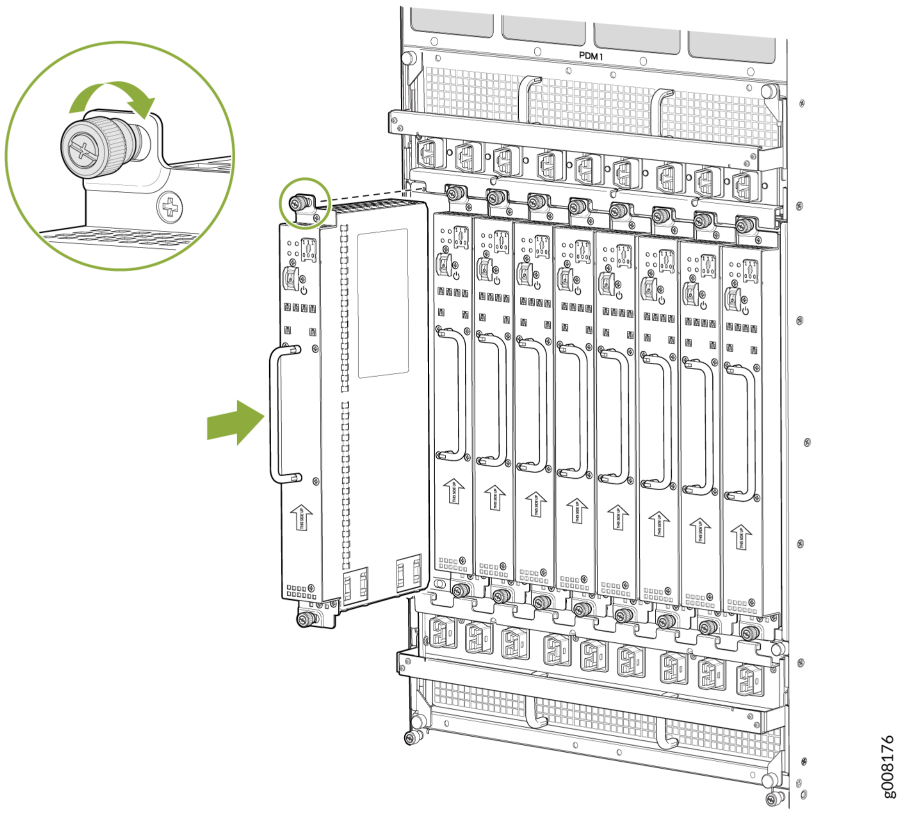
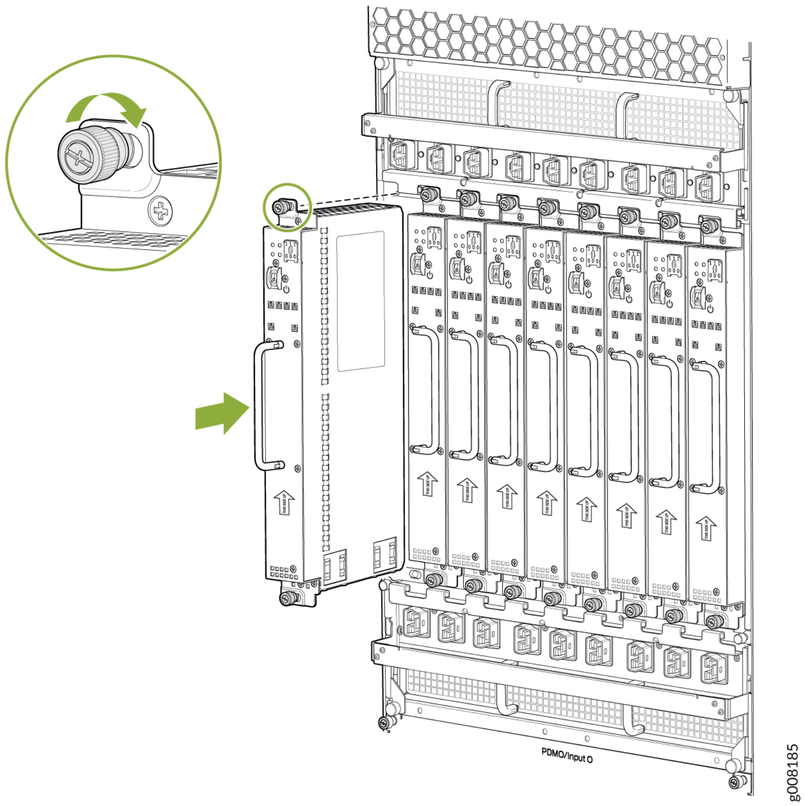


Figure 282: Installing an MX2008 Router Universal (HVAC/HVDC) Power Supply Module



RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Troubleshooting the MX2000 Router Power System

Maintaining the Power Supply Modules on the MX2000 Line of Routers | 779

Replacing an MX2000 DC Power Distribution Module (-48 V)

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- Removing an MX2000 Router DC Power Distribution Module (-48 V) | 572
- Installing an MX2000 Router DC Power Distribution Module (-48 V) | 575

Removing an MX2000 Router DC Power Distribution Module (-48 V)

Before you remove a PDM, be aware of the following:

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

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

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

1. Switch off the dedicated customer site circuit breaker for the PDM being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the **–48V** LEDs on the PDM to be removed are not lit.
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. Move the DC circuit breaker on the power input source to the **OFF** position.
6. Remove the clear plastic covers protecting the terminal studs on the faceplate.
7. Remove the nut and washers from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)
8. Remove the cable lugs from the terminal studs.
9. Carefully move the power cables out of the way.
10. Loosen the two captive screws on the locking levers, and pull away from the chassis.

NOTE: For the MX2020 Router, pull down the **PDM3/Input1** and **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** and **PDM2/Input0** locking levers to release the PDM from the chassis.

NOTE: For the MX2010 and MX2008 Routers, pull down the **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** locking levers to release the PDM from the chassis.

11. The PDM is extended slightly away from the chassis. See Figure 283 on page 573 (MX2020), Figure 284 on page 574 (MX2010), and Figure 285 on page 575 (MX2008)

Figure 283: Removing a DC PDM from an MX2020 Router

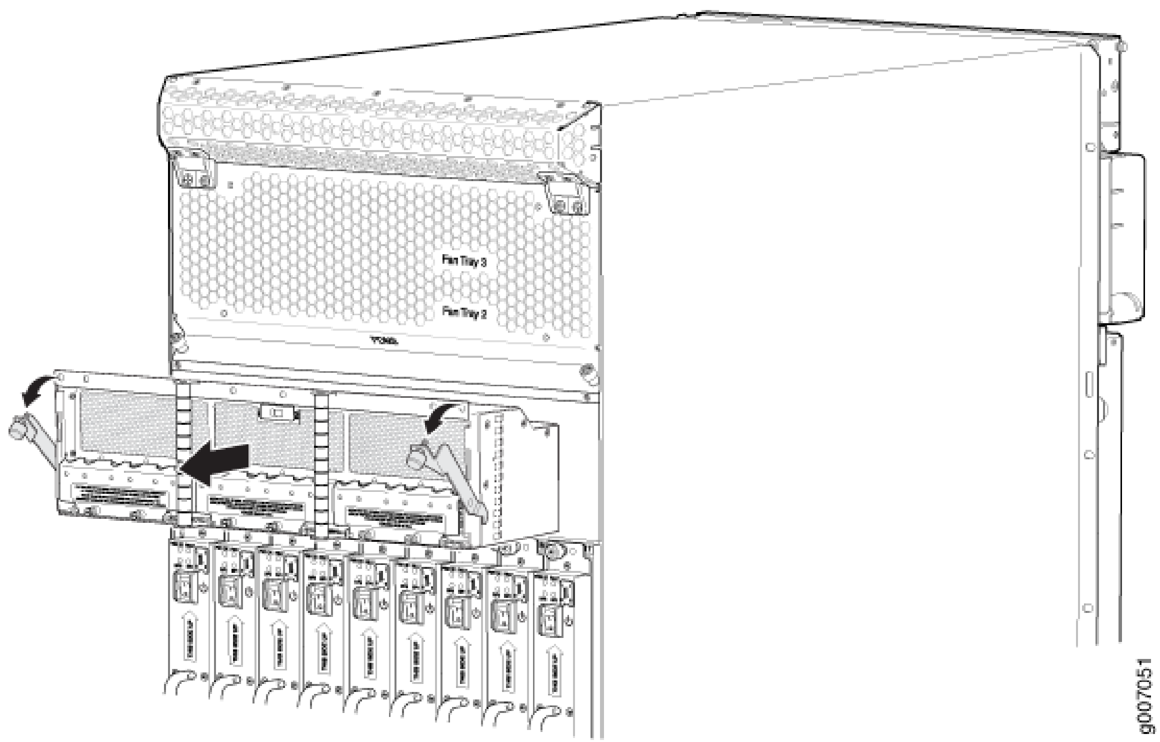


Figure 284: Removing a DC PDM from an MX2010 Router

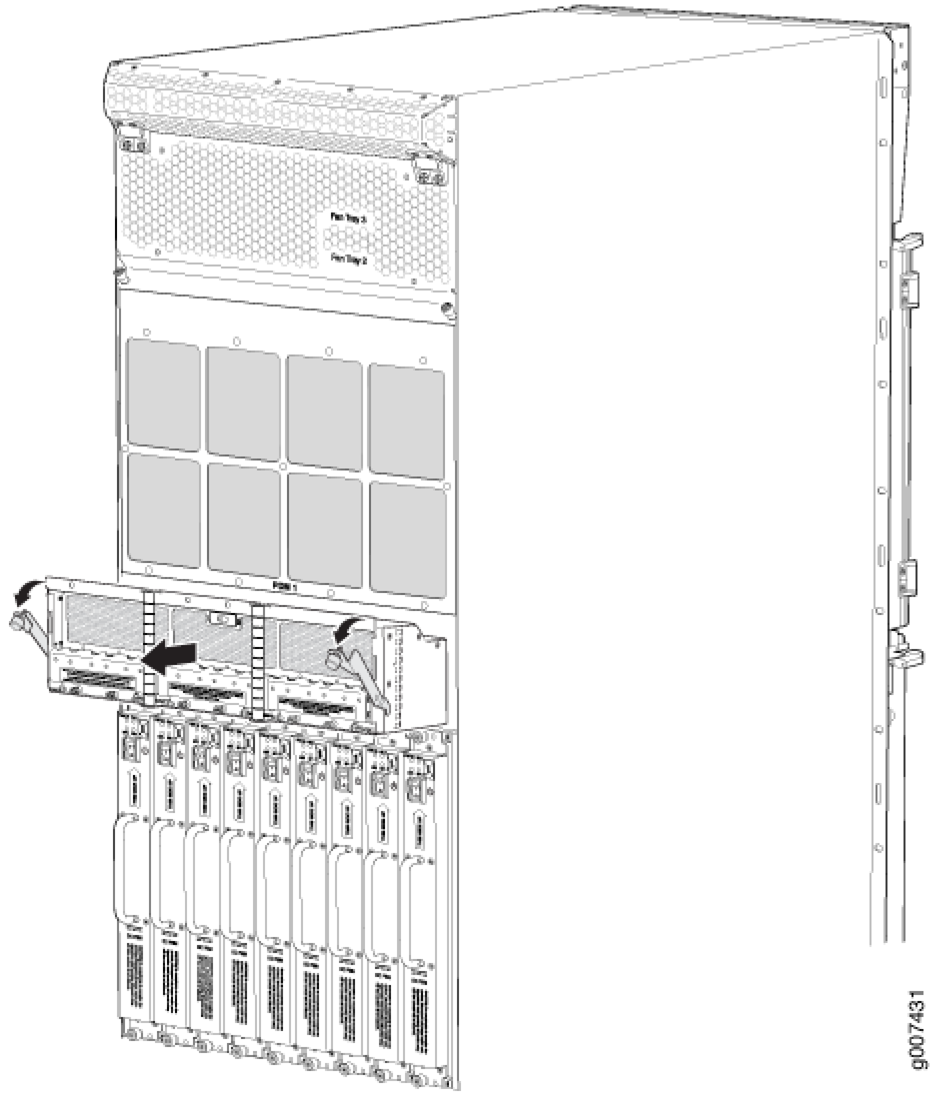
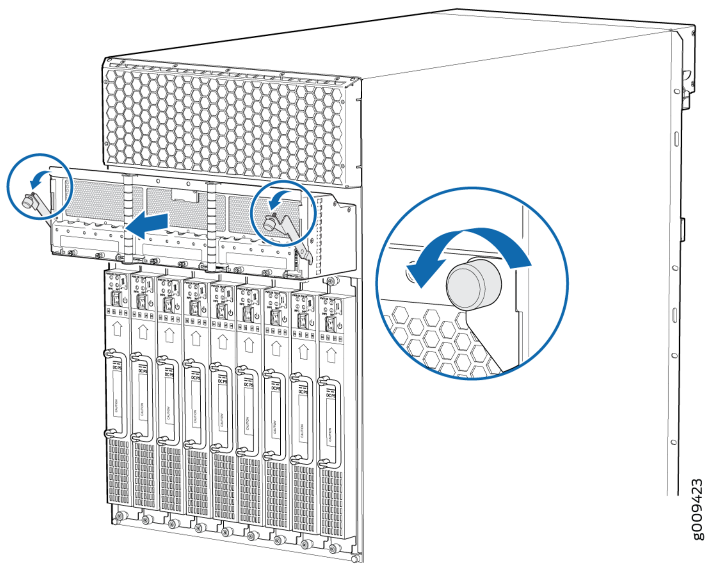


Figure 285: Removing a DC PDM from an MX2008 Router



12. With both hands, grasp the two handles and gently pull the PDM straight out of the chassis.

> **CAUTION**: Do not touch the power connectors on the back of the PDM. It can get damaged.

> **NOTE**: Each PDM slot not occupied by a DC PDM must be covered by a PDM blank panel.

13. Place the PDM onto an antistatic mat or into a ESD bag.

Installing an MX2000 Router DC Power Distribution Module (-48 V)

> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To install a DC power distribution module (PDM) in an MX2000 Router:

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 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 DC circuit breaker on the power input source to the off position.
4. [Optional]—If you are switching from an AC PDM to DC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to DC.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 286 on page 576(MX2020), Figure 287 on page 577(MX2010), or Figure 288 on page 578 (MX2008).

Figure 286: Installing an MX2020 Router DC Power Distribution Module

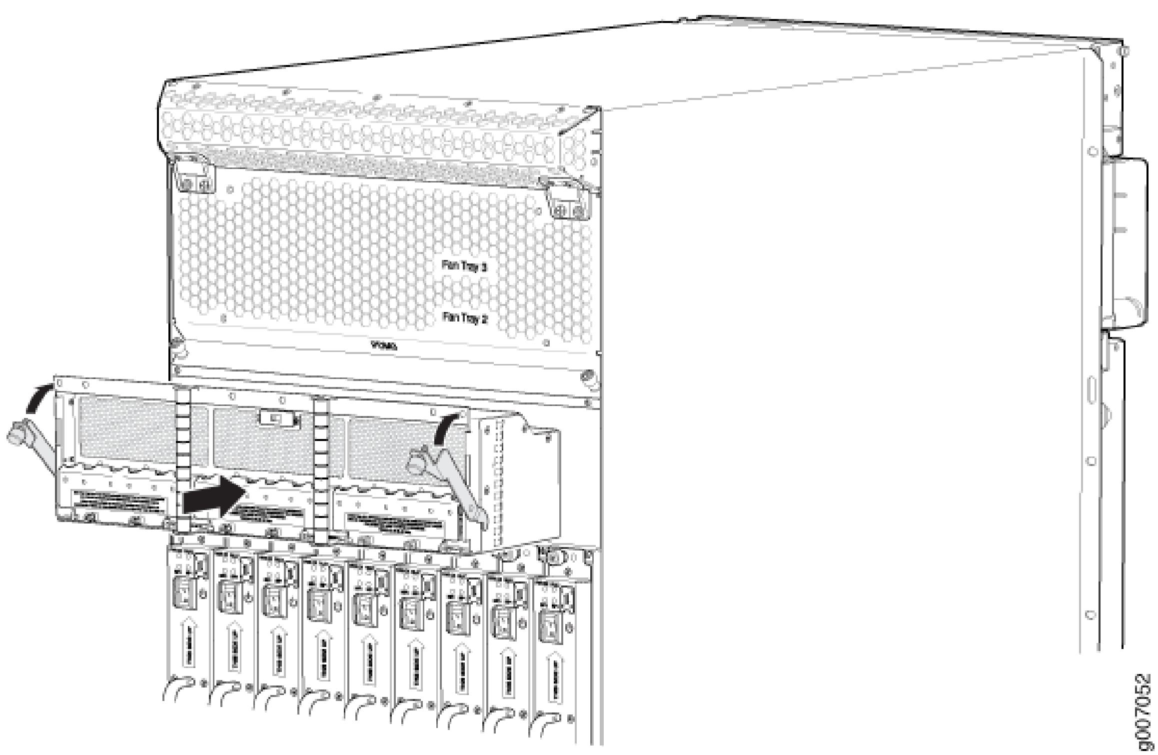


Figure 287: Installing an MX2010 Router DC Power Distribution Module

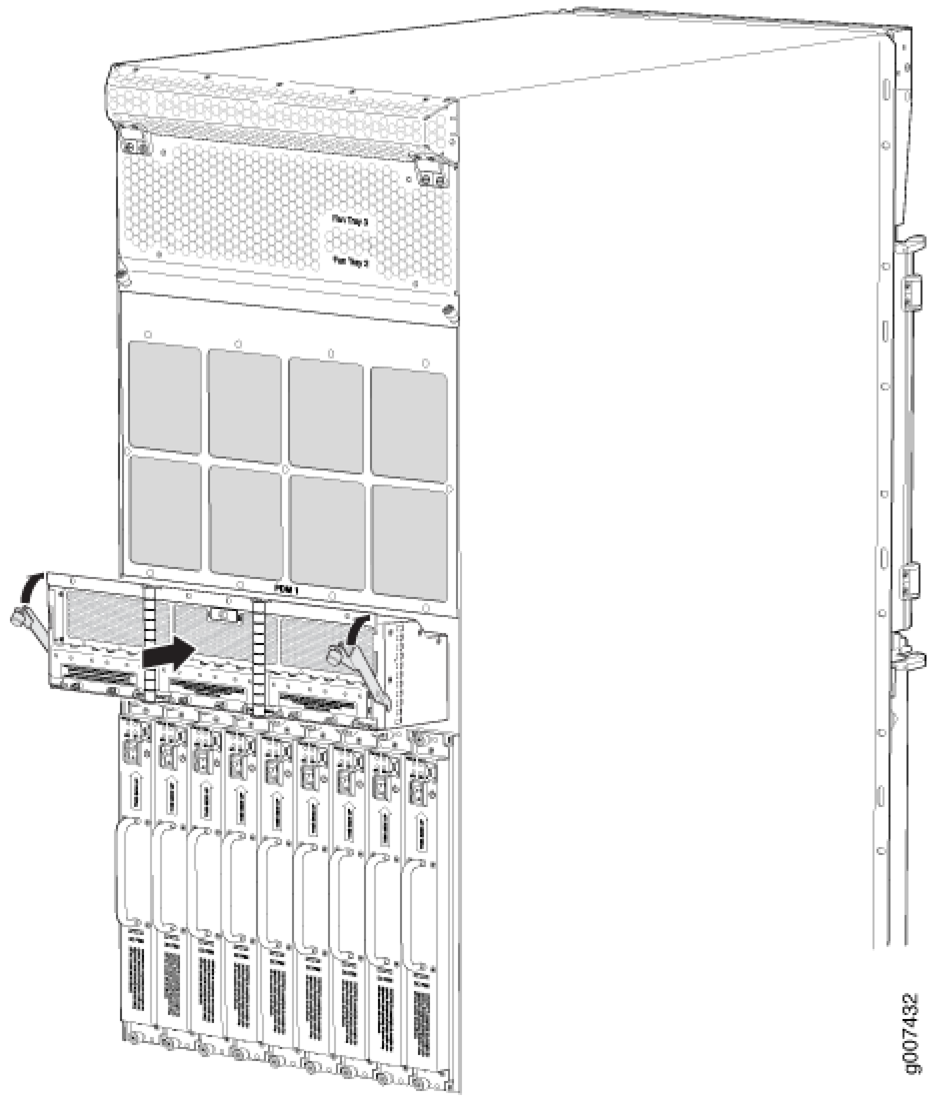
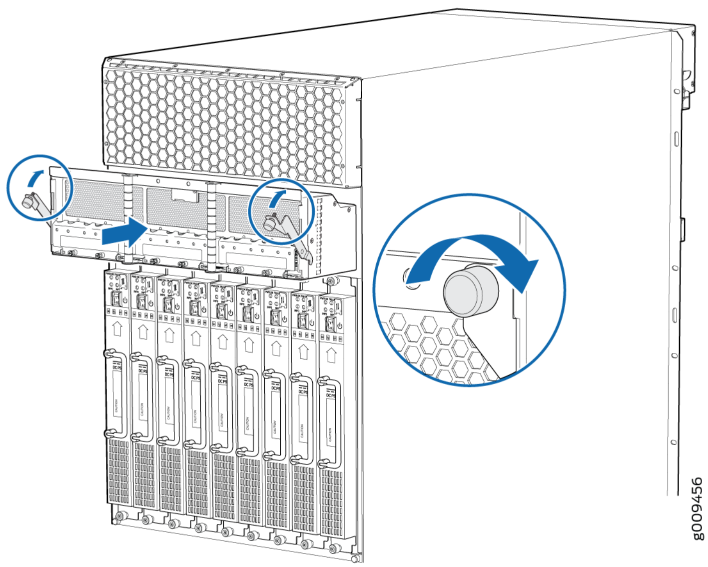


Figure 288: Installing an MX2008 Router Power Distribution Module



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
9. Remove the clear plastic cover protecting the terminal studs on the PDM faceplate.
10. Remove the nut and washers from each of the terminal studs.

RELATED DOCUMENTATION

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | **813**

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications

Troubleshooting the MX2000 Router Power System

Connecting an MX2000 DC Router Power Distribution Module (-48 V) Cable | **384**

Preventing Electrostatic Discharge Damage to an MX Series Router

Replacing an MX2000 DC Power Distribution Module (240 V China)

IN THIS SECTION

- Removing an MX2000 Router DC Power Distribution Module (240 V China) | **579**

- Installing an MX2000 Router DC Power Distribution Module (240 V China) | 581

Removing an MX2000 Router DC Power Distribution Module (240 V China)

Before you remove a PDM, be aware of the following:

> **NOTE**: The minimum number of PDMs must be present in the router at all times.

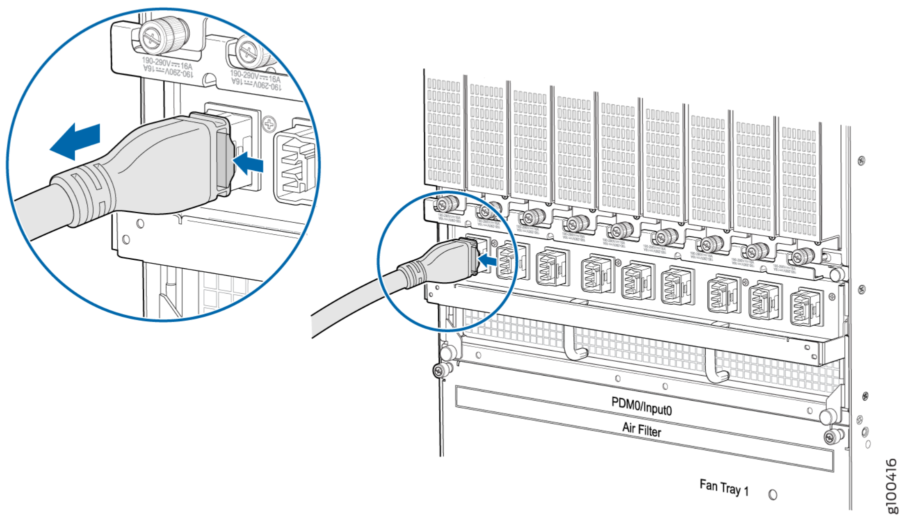
> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the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

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

> **NOTE**: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

1. Switch off the dedicated customer site circuit breaker for the PDM being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the LEDs on the PDM to be removed are not lit.
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. Move the DC circuit breaker on the power input source to the **OFF** position.
6. Starting at one end of the PDM, unplug all the power cords. Press the latch on the side of the power cable before pulling it out. See Figure 289 on page 580.

Figure 289: Unplugging the 240 V China Power Cord an MX2000 Router

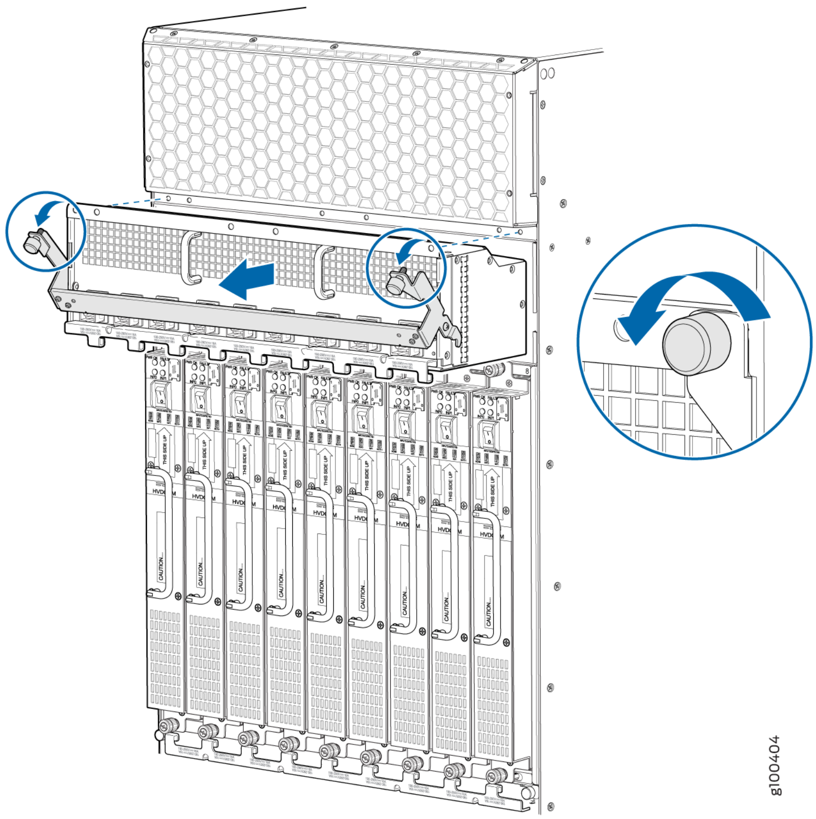


7. Loosen the two captive screws on the locking levers, and pull away from the chassis. See Figure 290 on page 581.

> **NOTE**: For the MX2020 Router, pull down the **PDM3/Input1** and **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** and **PDM2/Input0** locking levers to release the PDM from the chassis.

> **NOTE**: For the MX2010 and MX2008 Routers, pull down the **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** locking levers to release the PDM from the chassis.

Figure 290: Removing a DC PDM (240 V China) from an MX2000 Router



8. The PDM is extended slightly away from the chassis. See Figure 290 on page 581.
9. With both hands, grasp the two handles and gently pull the PDM straight out of the chassis.

> **CAUTION**: Do not touch the power connectors on the back of the PDM. It can get damaged.

> **NOTE**: Each PDM slot not occupied by a DC PDM must be covered by a PDM blank panel.

10. Place the PDM onto an antistatic mat or into a ESD bag.

Installing an MX2000 Router DC Power Distribution Module (240 V China)

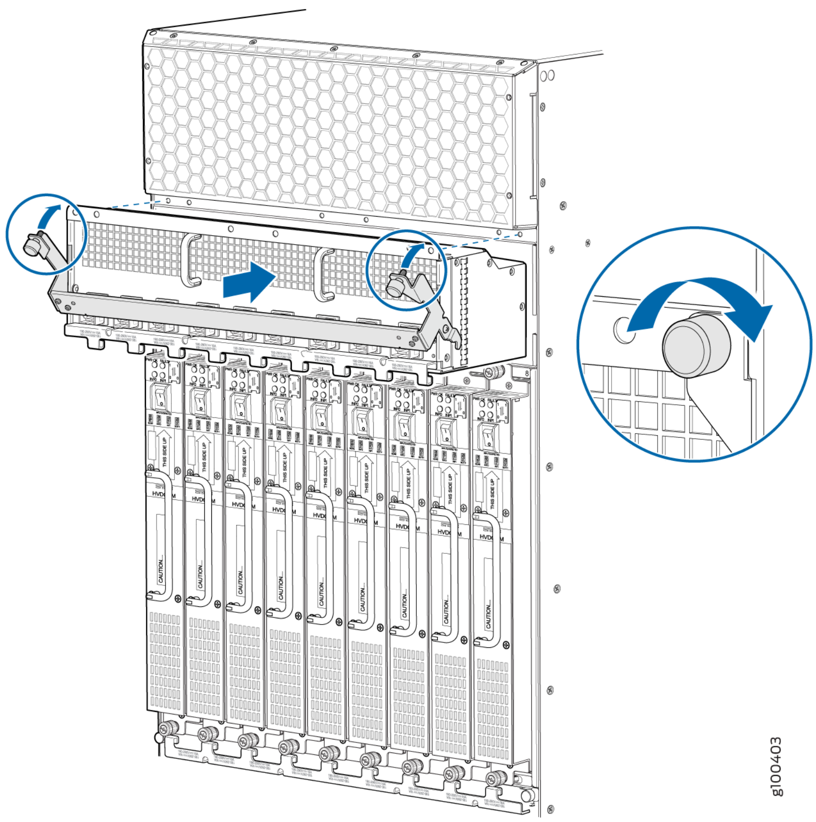
> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services

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

To install a DC power distribution module (PDM) in an MX2000 Router:

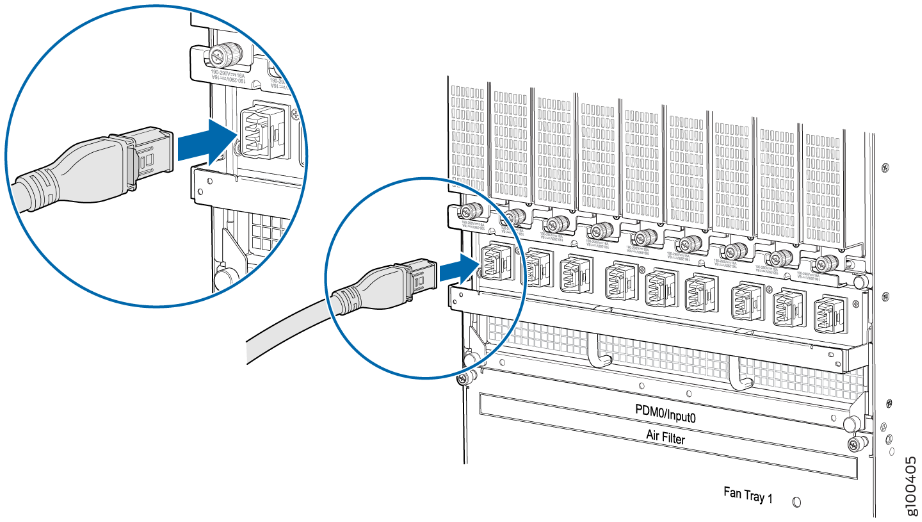
1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Move the DC circuit breaker on the power input source to the off position.
4. [Optional]—If you are switching from an AC PDM to DC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to DC.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 291 on page 583).

Figure 291: Installing an MX2020 Router DC Power Distribution Module (240 V China)



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
9. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green. See Figure 292 on page 584.

Figure 292: Plugging the 240 V China Power Cord an MX2000 Router



RELATED DOCUMENTATION

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | **813**

MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications

Troubleshooting the MX2000 Router Power System

Preventing Electrostatic Discharge Damage to an MX Series Router

Replacing an MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module

IN THIS SECTION

- Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Distribution Module | **585**
- Removing an MX2000 Router High-Voltage Second Generation Universal (HVAC/HVDC) Power Distribution Module | **587**

Installing an MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Distribution Module

Depending on whether you are connecting to AC or DC power, these warnings apply to the universal HVAC/HVDC power distribution module (PDM):

> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

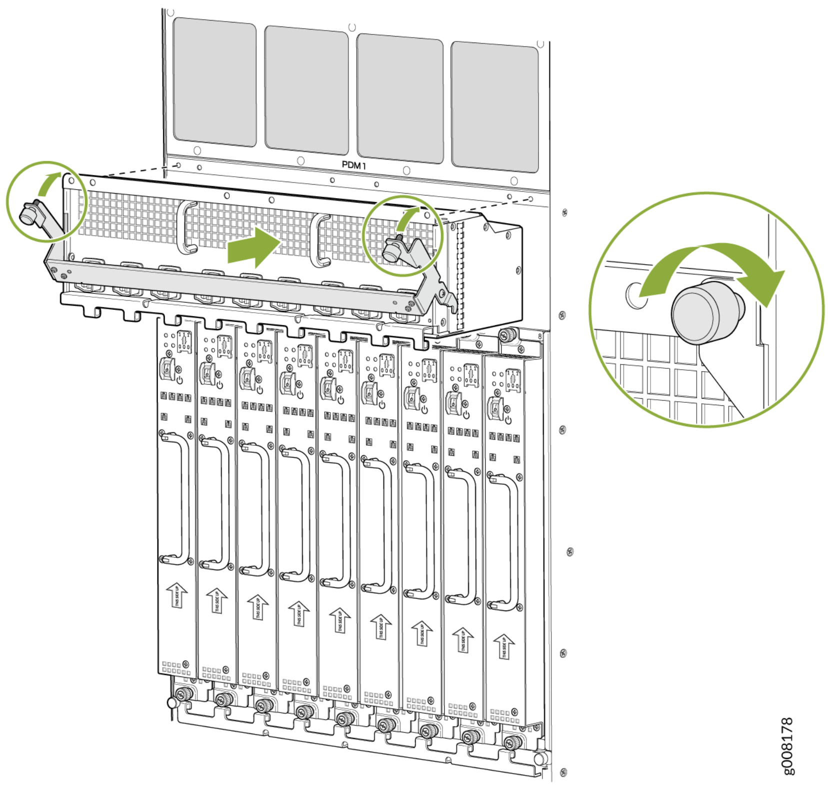
> **WARNING**: Before performing AC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

> **WARNING**: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

To install a universal HVAC/HVDC power distribution module (PDM) in an MX2000 Router:

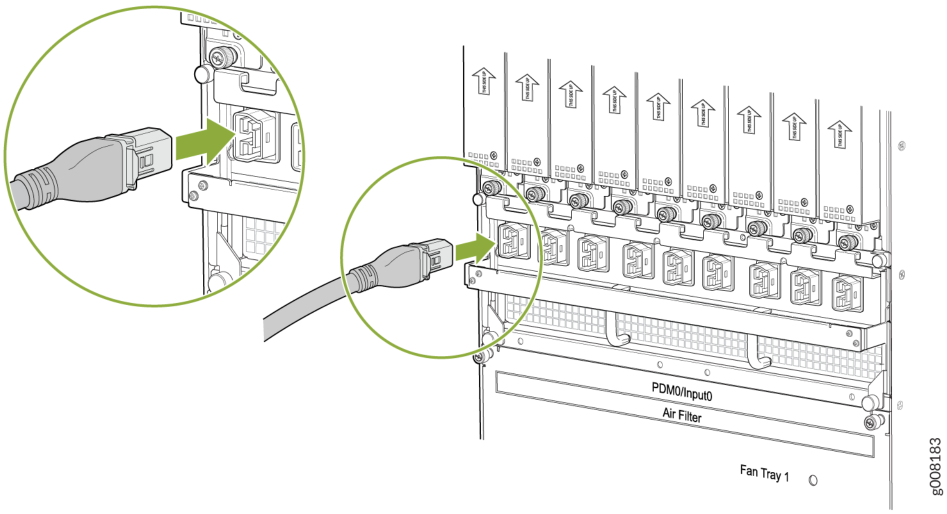
1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Move the DC circuit breaker on the power input source to the off position.
4. [Optional]—If you are switching from an AC PDM or 48V DC PDM to a universal PDM, the universal HVAC/HVDC PSMs and PDMs work with either AC or DC bar setting, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for details.
5. Remove the blank panel covering the PDM slot in the chassis.
6. Open the locking levers on the PDM.
7. While holding both handles, guide the PDM until the locking levers are inserted into the chassis. With both hands push the locking levers simultaneously until the PDM is fully seated into the chassis (see Figure 293 on page 586).

Figure 293: Installing an MX2000 Router Universal (HVAC/HVDC) Power Distribution Module



8. Tighten both captive screws on the PDM. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
9. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green. See Figure 294 on page 587.

Figure 294: Plugging the Universal (HVAC/HVDC) Power Cord an MX2000 Router



Removing an MX2000 Router High-Voltage Second Generation Universal (HVAC/HVDC) Power Distribution Module

Before you remove a PDM, be aware of the following:

NOTE: The minimum number of PDMs must be present in the router at all times while it is operating.

Depending on whether you are connecting to AC or DC power, these warnings apply to the universal HVAC/HVDC power distribution module (PDM):

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

NOTE: These warnings apply to the HVAC/HVDC universal PDM:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

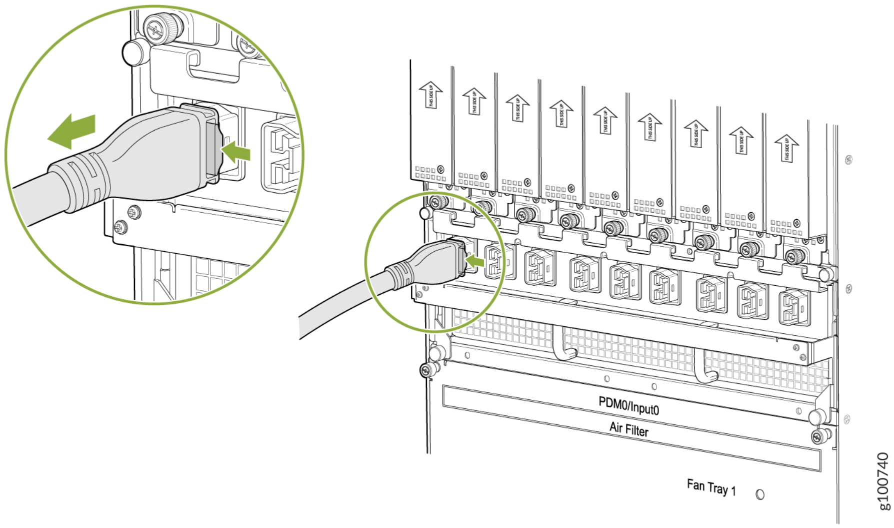
WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

1. Switch off the dedicated customer site circuit breaker for the PDM being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the LEDs on the PDM to be removed are not lit.
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. Move the AC or DC circuit breaker on the power input source to the **OFF** position.
6. Starting at one end of the PDM, unplug all the power cords. Press the latch on the side of the power cable before pulling it out. See Figure 295 on page 589.

Figure 295: Unplugging the Universal HVAC/HVDC Power Cord an MX2000 Router



7. Loosen the two captive screws on the locking levers, and pull away from the chassis. See .

> **NOTE**: For the MX2020 Router, pull down the **PDM3/Input1** and **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** and **PDM2/Input0** locking levers to release the PDM from the chassis.

> **NOTE**: For the MX2010 and MX2008 Routers, pull down the **PDM1/Input1** locking levers to release the PDM from the chassis, and pull up the **PDM0/Input0** locking levers to release the PDM from the chassis.

Figure 296: Removing a Universal (HVAC/HVDC) PDM from an MX2020 Router

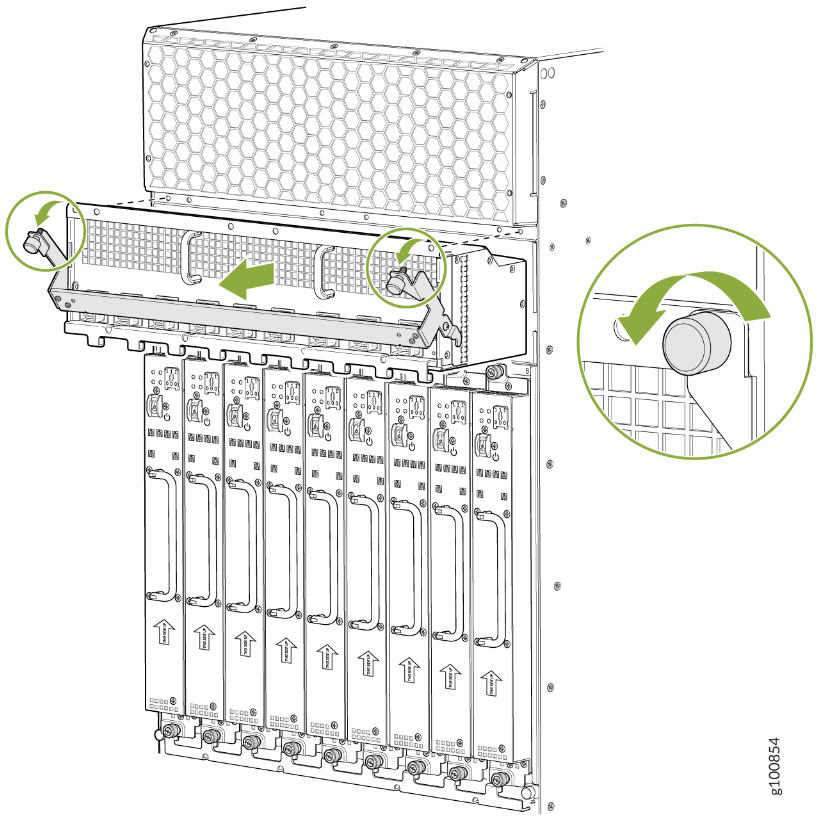


Figure 297: Removing a Universal (HVAC/HVDC) PDM from an MX2010 Router

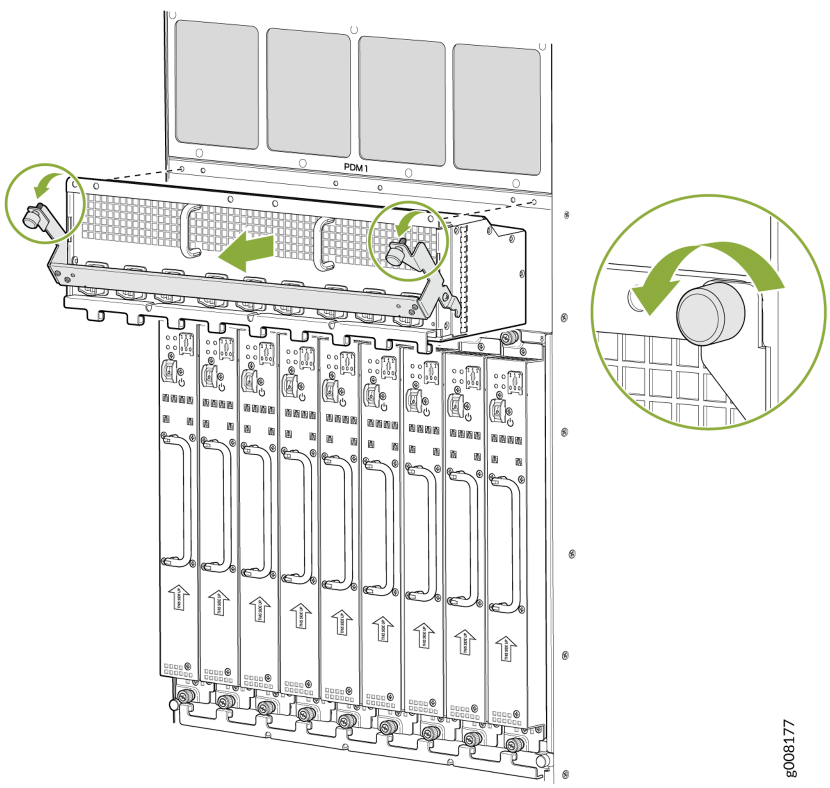
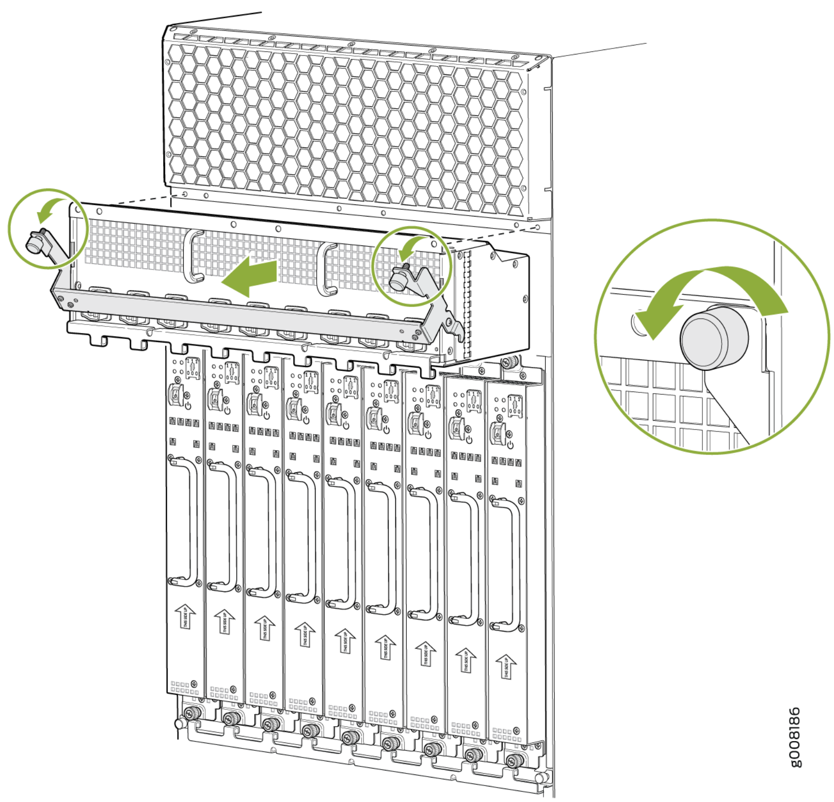


Figure 298: Removing a Universal (HVAC/HVDC) PDM from an MX2008 Router



8. The PDM is extended slightly away from the chassis. See Figure 296 on page 590, Figure 297 on page 591, and Figure 298 on page 592.
9. With both hands, grasp the two handles and gently pull the PDM straight out of the chassis.

> **CAUTION**: Do not touch the power connectors on the back of the PDM. It can get damaged.

> **NOTE**: Each PDM slot not occupied by a PDM must be covered by a PDM blank panel.

10. Place the PDM onto an antistatic mat or into a ESD bag.

RELATED DOCUMENTATION

Troubleshooting the MX2000 Router Power System

MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications

Replacing an MX2010 DC Power Distribution Module Cable

IN THIS SECTION

- Disconnecting an MX2010 DC Power Distribution Module Cable | **593**
- Connecting an MX2010 DC Power Distribution Module Cable | **594**

Disconnecting an MX2010 DC Power Distribution Module Cable

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

To disconnect a power cable for a DC PDM:

1. Switch off the dedicated customer-site circuit breaker for the PDM being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Verify that the **–48V** LED on the PDM is not lit.
4. Remove the power cable from the external DC power source.
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. Remove the clear plastic cover protecting the terminal studs on the faceplate.
7. Remove the nut and washers from each of the terminal studs. (Use a 7/16-in. [11 mm] nut driver or socket wrench.)

   NOTE: The input positions for the **RTN** (return) DC terminal studs and the **-48V** (input) DC terminal studs correspond to the DC Power Supply Module (PSM) directly above and below. The DC PSM slot positions are labeled, but the DC PDM cable positions that correlate to the PSM positions are not labeled.

8. Remove the cable lug from the terminal studs.
9. Carefully move the power cable out of the way.

10. Replace the clear plastic cover protecting the terminal studs on the faceplate.

Connecting an MX2010 DC Power Distribution Module Cable

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

To connect a power cable for a DC PDM:

1. Locate a replacement power cable that meets the specifications defined in "MX2010 DC Power (-48 V) System Electrical Specifications" on page 246.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the **–48V** LED is off.

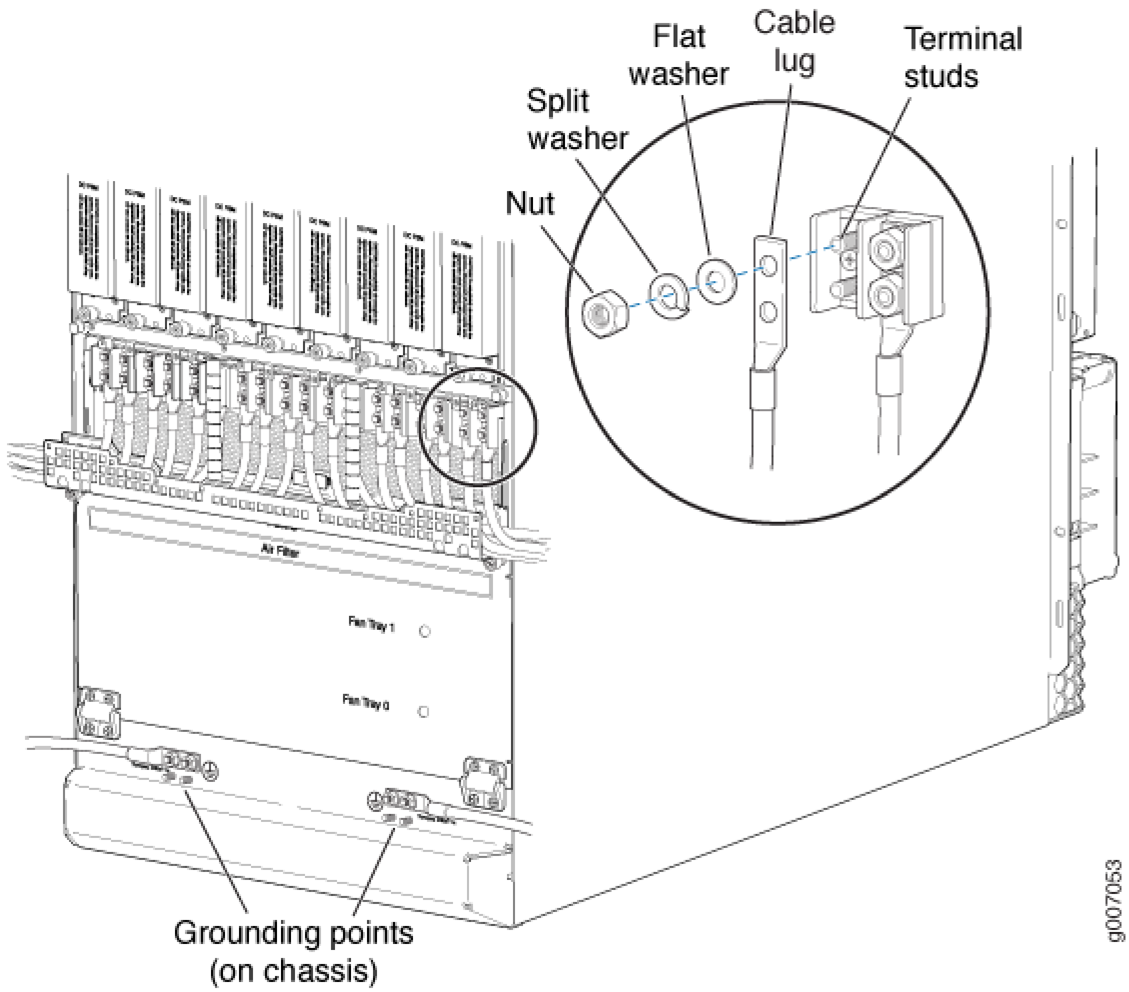
   > **NOTE**: The input positions for the **RTN** (return) DC terminal studs and the **-48V** (input) DC terminal studs correspond to the DC Power Supply Module (PSM) directly above and below. The DC PSM slot positions are labeled, but the DC PDM cable positions that correlate to the PSM positions are not labeled.

4. Secure the power cable lug to the terminal studs, first with the flat washer, then with the split washer, and finally with the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut (see Figure 299 on page 595). Do not overtighten the nut. (Use a 7/16-in. [11 mm)] torque-controlled driver or socket wrench.)

   > **CAUTION**: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when the nut is improperly threaded might result in damage to the terminal stud.

   > **CAUTION**: The maximum torque rating of the terminal studs on the DC PDM is 25 lb-in. (33.89 Nm). The terminal studs might be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC PDM terminal studs.

Figure 299: Connecting Power Cables to the DC Power Distribution Module



5. Route the positive and negative DC power cables through the plastic cable restraint cover. Make sure that the cable does not touch or obstruct any router components.
6. Verify that the DC power cable is connected correctly, that it does not touch or block access to router components, and that it does not drape where people could trip on it.
7. Attach the power cable to the DC power source.
8. Turn on the dedicated customer-site circuit breaker to the PDM.
9. Verify that the **–48V** LED on the PDM is lit steadily.
10. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

NOTE: The circuit breaker might bounce back to the **OFF** position if you move the breaker too quickly.

Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the **–48V** LEDs light green steadily.

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
MX2010 DC Power Distribution Module (-48 V) Description | **142**
DC Power Cable Specifications for the MX2010 Router | **255**
MX2010 DC Power Electrical Safety Guidelines

Connecting an MX2000 DC Router Power Distribution Module (240 V China) Cable

WARNING: Before performing DC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

NOTE: Ensure that you have connected the chassis to earth ground. See "Grounding an MX2000 Router" on page 362.

To connect the DC (240 V China) source power cables (CBL-PWR-240V-CH) to the router:

1. Switch off the dedicated customer site circuit breakers. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

NOTE: If the DC PSMs (240 V China) are installed in the router, make sure the power switches on all PSMs are turned to the off (**O**) position.

3. Plug the power cord into the power sockets on the DC PDM (240 V China). Refer to Figure 1. Press the latch on the side of the power cable before pushing it in. Apply slight pressure so that the power cord is firmly seated in the power socket until you feel it engage. As you plug in each power cord, the power LED for the socket lights up green.

Figure 300: Connecting Power

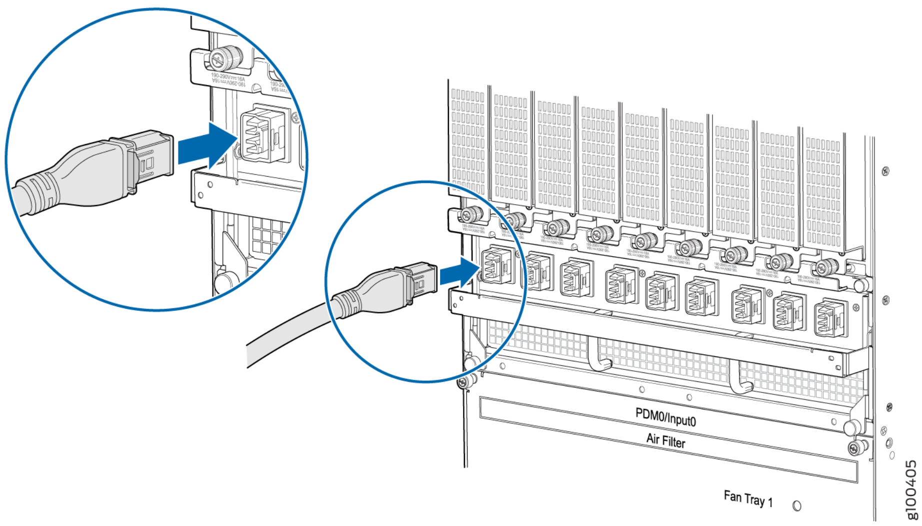
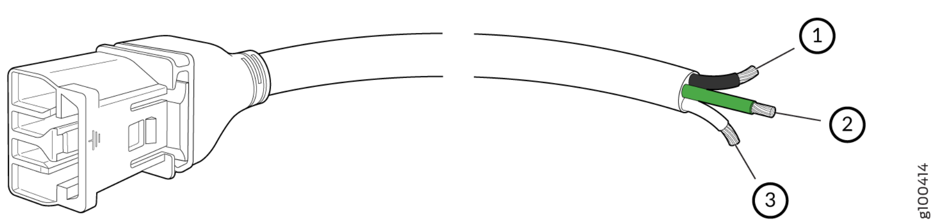


Figure 301: Unplugging the 240 V China Power Cord an MX2000 Router

4. Connect the power cords for the remaining PDMs.
5. Connect the power cable (CBL-PWR-240V-CH) to the DC power source. See Figure 302 on page 597.

Figure 302: 240 V China Power Cable



1– Negative	3– Positive
2– Ground	

6. Switch on the dedicated customer site circuit breaker.
7. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

> **NOTE**: The circuit breaker may bounce back to the off position if you move the breaker too quickly.

8. Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the LEDs light green steadily.
9. On each of the DC PSMs, move the switch to the on (|) position.

Replacing the MX2010 Standard EMI Cover

IN THIS SECTION

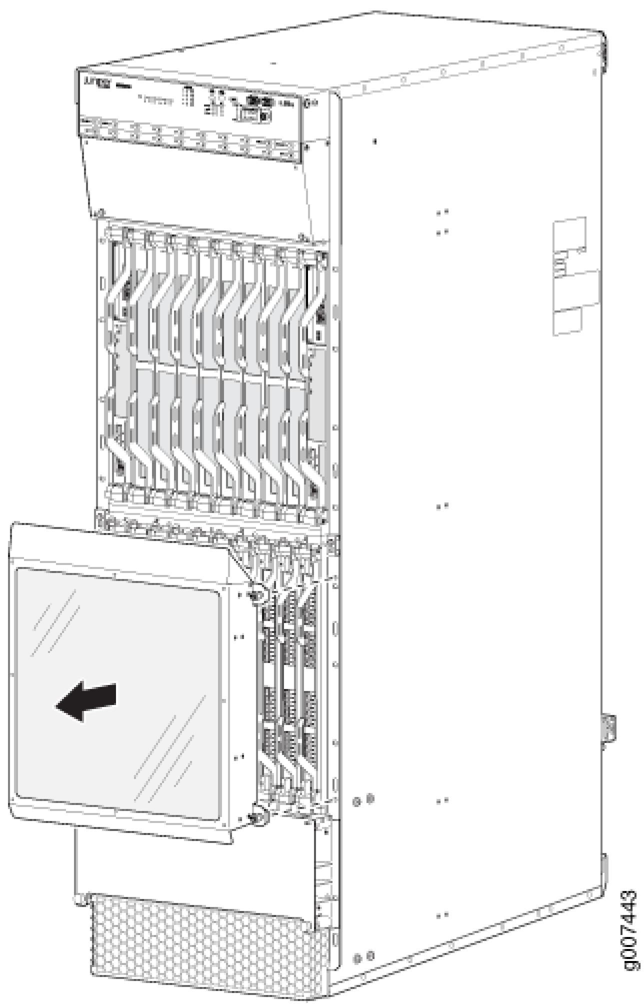
- Removing the MX2010 Standard EMI Cover | **598**
- Installing the MX2010 Standard EMI Cover | **599**

Removing the MX2010 Standard EMI Cover

To remove the electromagnetic interference (EMI) card-cage cover (see Figure 303 on page 599).

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 four captive screws that secure the EMI cover to the router.
3. Pull the cover away from the router toward you to remove it.

Figure 303: Removing the EMI Card-Cage Cover



SEE ALSO

Installing the MX2010 Standard EMI Cover | 449
Preventing Electrostatic Discharge Damage to an MX Series Router

Installing the MX2010 Standard EMI Cover

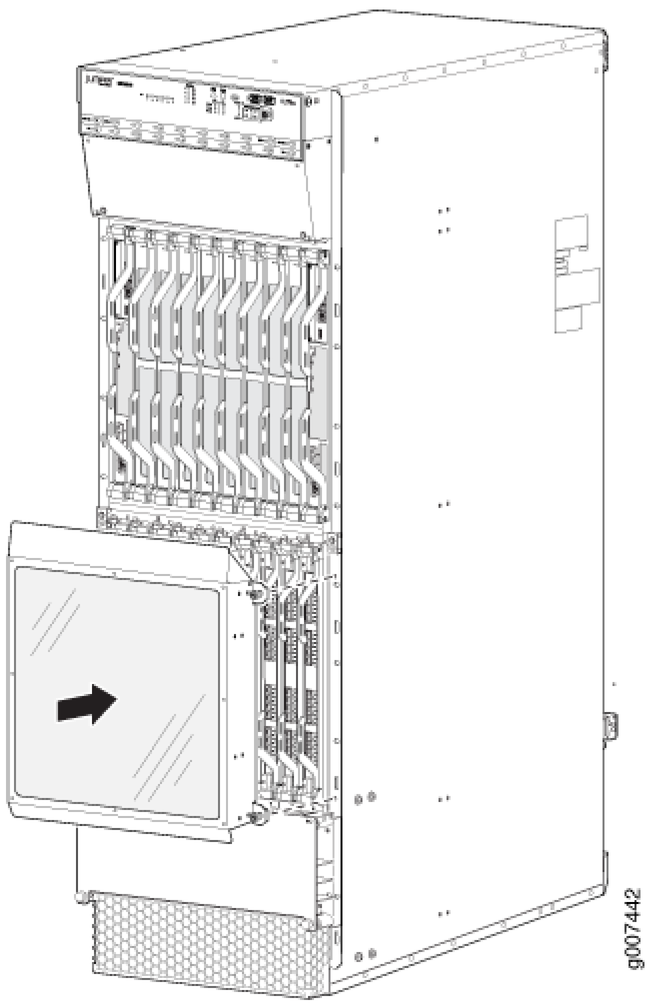
The MPCs require an EMI cover to reduce the risk of radio frequency interference disturbance that affects an electrical circuit because of electromagnetic interference emitted from an external source. The EMI cover is designed to reduce the electromagnetic interference (EMI) to comply with the Federal Communications Commission (FCC) requirements.

To install the EMI card-cage cover (see Figure 304 on page 600):

1. Align the four brackets on either side of the EMI cover with the chassis front-mounting flanges on the outside of the card cage.

   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. Adjust the EMI cover until the four captive screws align with the holes in the front-mounting flanges.
3. Tighten the four captive screws to secure the EMI cover in place.

Figure 304: Installing the EMI Card-Cage Cover



SEE ALSO

Preventing Electrostatic Discharge Damage to an MX Series Router

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
Replacing the MX2010 Extended EMI Cover | 601

Replacing the MX2010 Extended EMI Cover

IN THIS SECTION

- Removing the MX2010 Extended EMI Cover | 601
- Installing the MX2010 Extended EMI Cover | 603

Removing the MX2010 Extended EMI Cover

The extended electromagnetic interference (EMI) cover attaches to the router over the card cage and tilts out from the top.

To remove the extended electromagnetic interference (EMI) card-cage cover (see Figure 306 on page 603):

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. Gripping the flap on the extended EMI cover, tilt it away from the router toward you.
3. Holding the cover on both sides, lift so that the points on the cover lift out of the grooves on the EMI cover brackets.
4. Pull the cover away from the router toward you to remove it.
5. Using a number 2 Phillips (+) screwdriver, remove the two mounting screws from the mounting brackets on either side of the card cage. Then remove the mounting brackets (see Figure 305 on page 602).

Figure 305: Removing the Extended EMI Cover Mounting Brackets

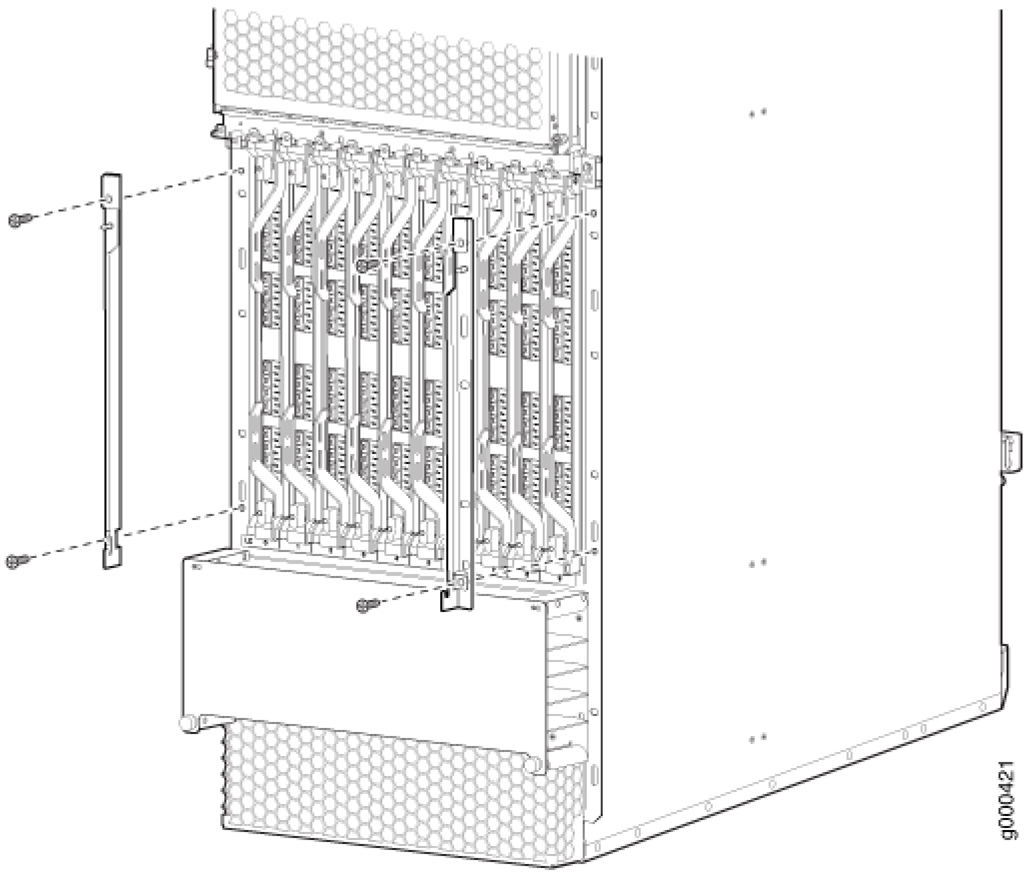
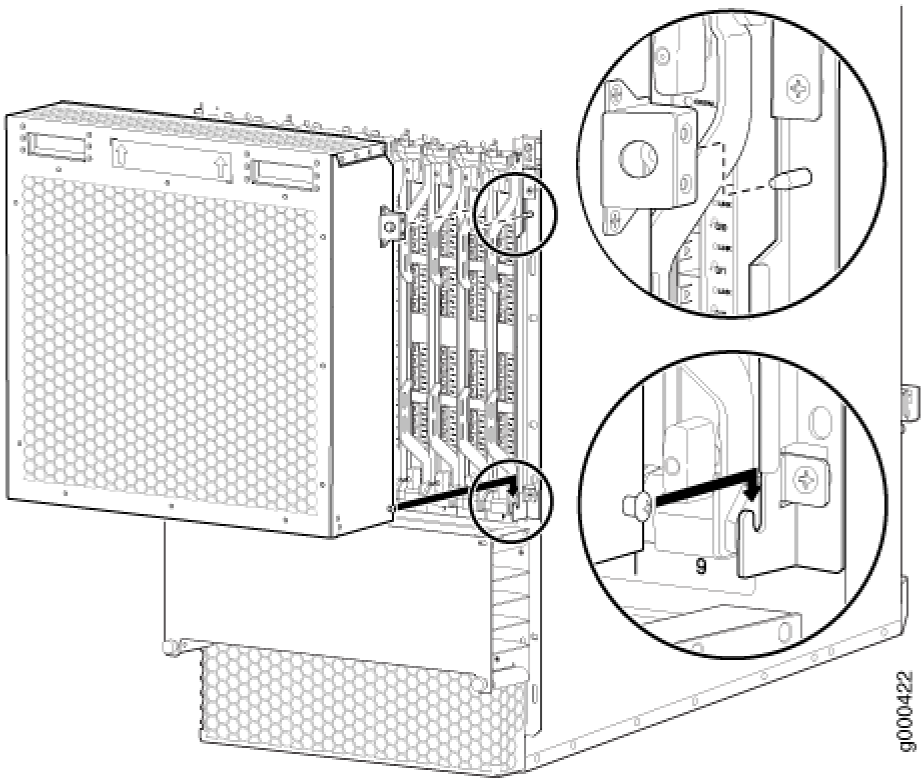


Figure 306: Removing the Extended EMI Card-Cage Cover

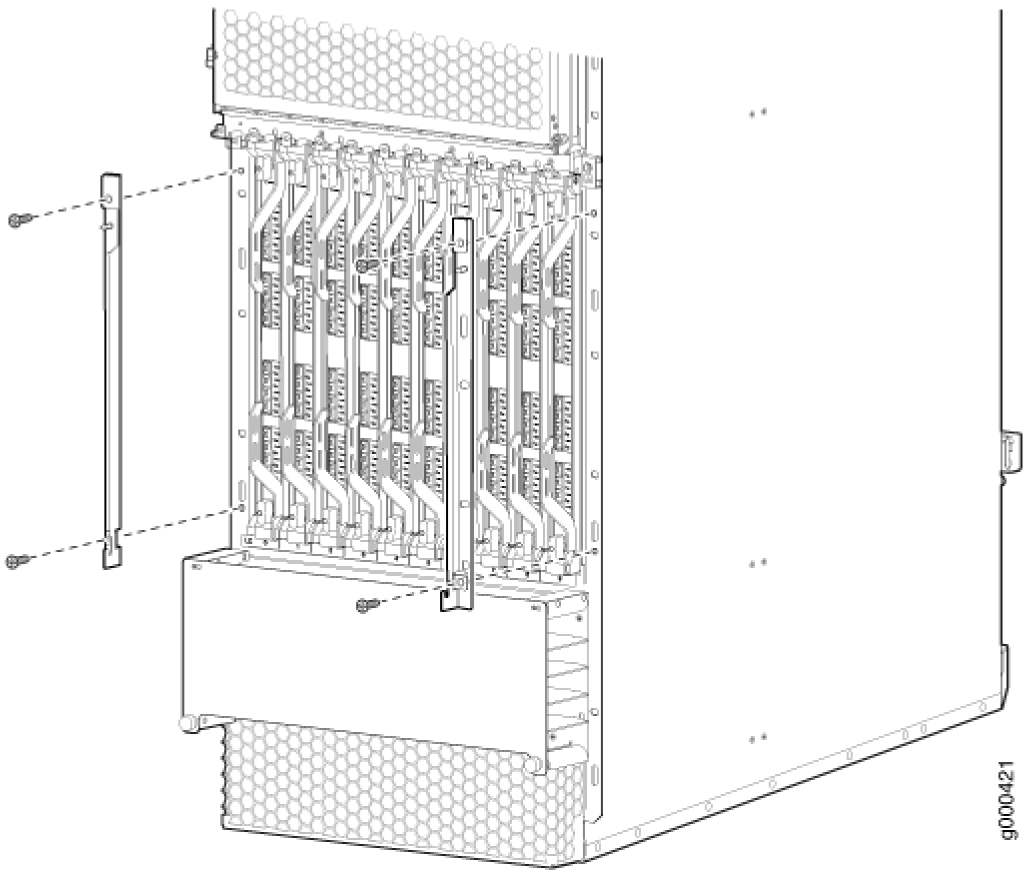


Installing the MX2010 Extended EMI Cover

The extended electromagnetic interference (EMI) covers attaches to the router over the card cage.

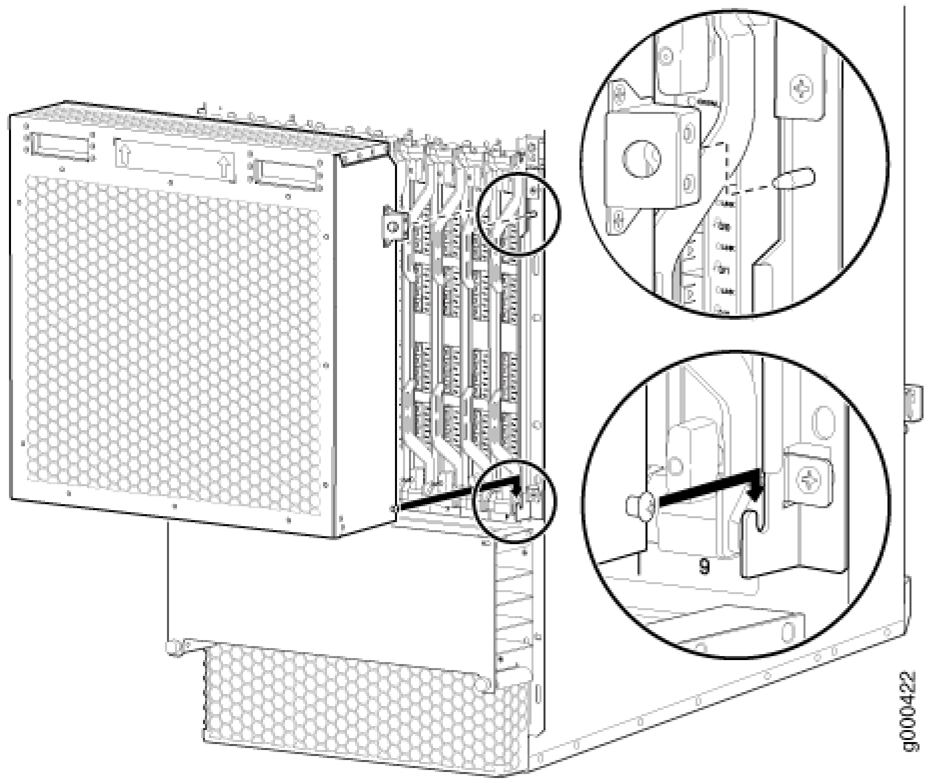
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. On each side of the card cage, orient the extended EMI cover's mounting brackets so that they line up with the mounting holes. The groove that holds the points on the cover should be at the top.
3. Using a number 2 Phillips (+) screwdriver, secure the extended EMI cover mounting brackets to the sides of the card cage by using the four screws provided (two on each side) (see Figure 307 on page 604).

Figure 307: Installing the Extended EMI Cover Mounting Brackets



4. Orient the cover so that the arrows point up in front of the card cage.
5. Angle the extended EMI cover so that the points at each side fit into the grooves on the EMI cover's mounting brackets.
6. Tilt the extended EMI cover into place and press firmly until the sides contact the mounting brackets of the EMI cover.

Figure 308: Installing the Extended EMI Card-Cage Cover



SEE ALSO

- Replacing the MX2010 Extended Cable Manager | 541
- Replacing the MX2010 Standard EMI Cover | 598
- Preventing Electrostatic Discharge Damage to an MX Series Router

RELATED DOCUMENTATION

- Replacing the MX2010 Standard EMI Cover | 598
- Preventing Electrostatic Discharge Damage to an MX Series Router

Replacing an MX2010 Fan Tray

IN THIS SECTION

- Removing an MX2010 Fan Tray | 606
- Installing an MX2010 Fan Tray | 608

Removing an MX2010 Fan Tray

> **CAUTION**: To prevent overheating, install the replacement fan tray immediately after removing the existing fan tray.

To remove the upper or lower fan trays (see Figure 309 on page 607 and Figure 310 on page 607):

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. Reposition the DC cable manager, if necessary, before removing the upper or lower fan tray:
   - Unwrap any cables on the DC cable manager, and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable manager and tray, and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
3. Loosen the two captive screws on each side of the fan tray access panel and open.
4. Loosen the two captive screws on the fan tray faceplate.
5. While grasping the handle, press and hold the latch until the status LED turns off. Pull the fan tray out approximately 1 to 3 inches until it stops.

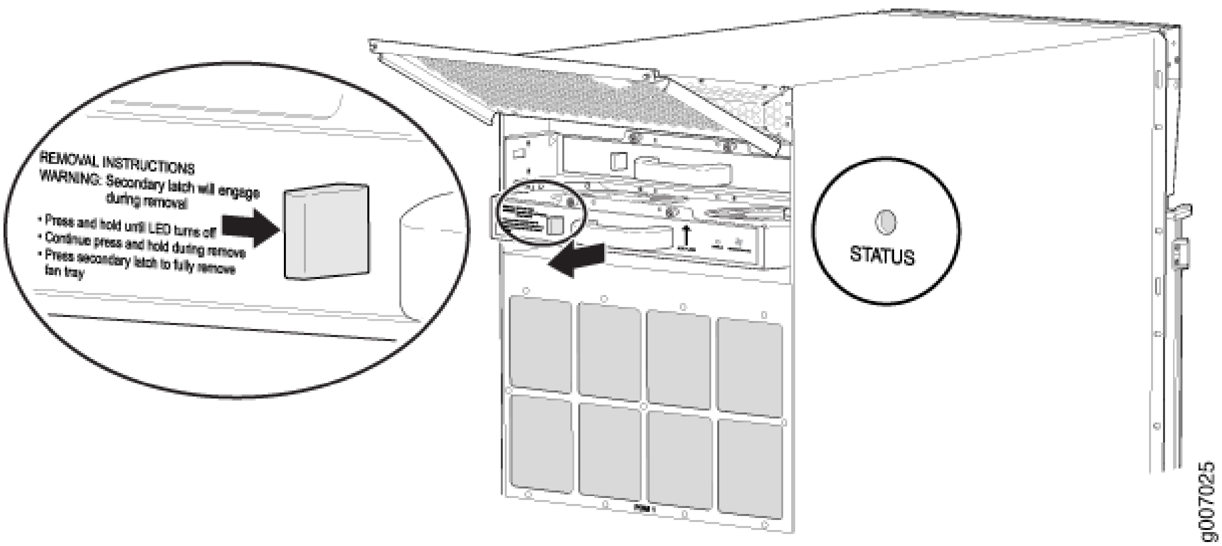
   > **NOTE**: The fan trays are interchangeable and are hot-insertable and hot-removable.

6. Press and hold the latch a second time to disengage fan operation. Place one hand under the fan tray for support while pulling the fan tray completely out of the router.

   > **WARNING**: The fan trays use a double latch safety mechanism. You must continually press and hold the latch while removing the fan trays.

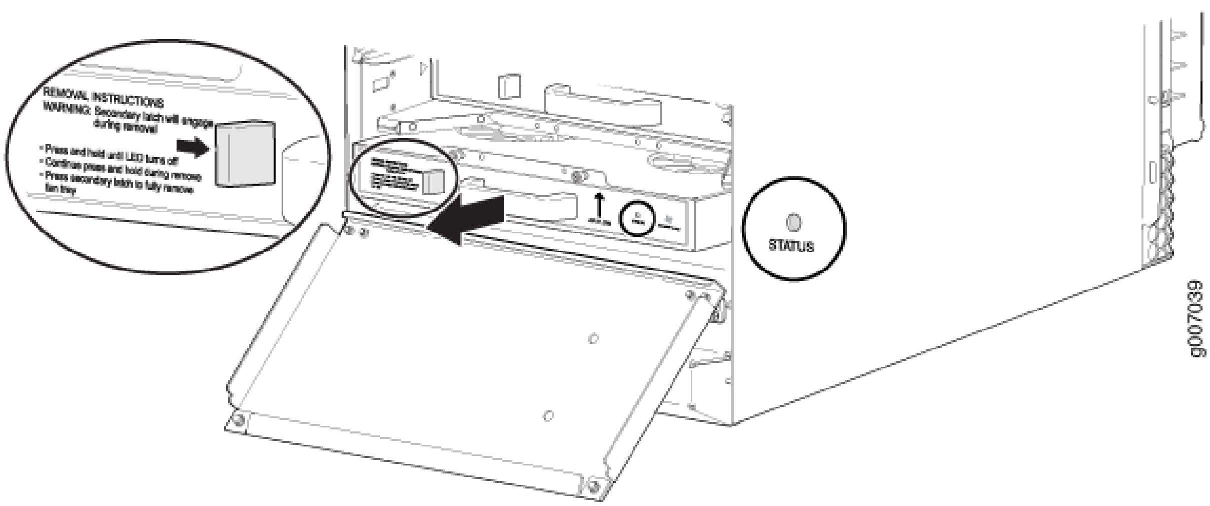
7. Place the fan tray on an antistatic mat or in an approved ESD bag.

Figure 309: Removing Upper Fan Trays



> **WARNING**: Before removing a fan tray, make sure the fan blades have stopped completely.

Figure 310: Removing Lower Fan Trays



SEE ALSO

Preventing Electrostatic Discharge Damage to an MX Series Router

Installing an MX2010 Fan Tray | 452

Maintaining the MX2010 Fan Trays | 743

Installing an MX2010 Fan Tray

This topic describes how to install the upper or lower fan trays in a MX2010. This procedure applies to both the standard fan tray and the optimized power fan tray. To install the upper or lower fan tray (see Figure 311 on page 609 and Figure 312 on page 609):

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. Reposition the DC cable manager, if necessary, before installing the upper or lower fan tray:
   - Unwrap any cables on the DC cable manager and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable manager, and tray and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
3. Loosen the two captive screws on the access panel and open.
4. Remove the fan tray from the antistatic mat or ESD bag.
5. Grasp the fan tray by the handle, and place one hand under the fan tray for support. Insert the fan tray partially into the chassis while pressing the latch.

   NOTE: When inserting the fan tray, observe the correct orientation by the "this side up" label on the fan tray.

6. Press and hold the latch again while carefully pushing the fan tray into the chassis.

   NOTE: The fan tray has a double-locking safety mechanism that allows you to safely install the fan tray in a two-stage process.

7. Tighten the two captive screws on the fan tray faceplate.
8. Close the access panel and secure the two captive screws on either side of the access panel.
9. Reinstall the DC cable manager back into position, if necessary.

Figure 311: Installing Upper Fan Trays

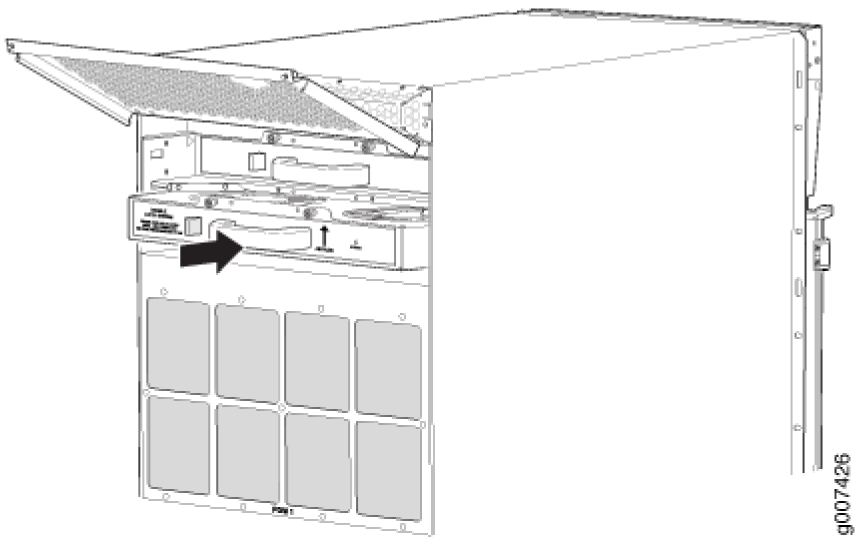
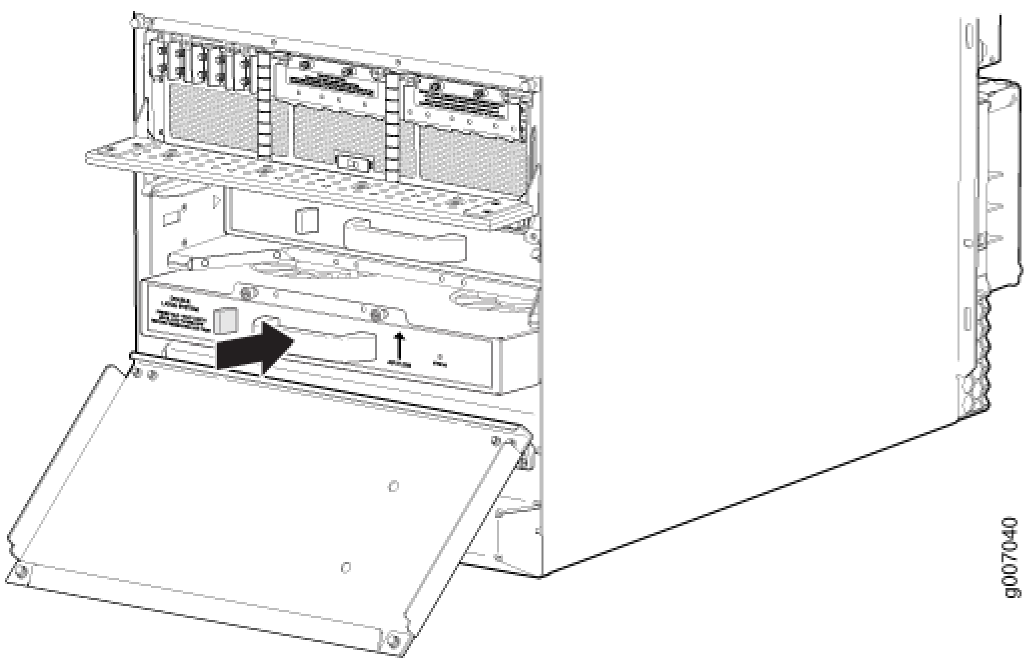


Figure 312: Installing Lower Fan Trays



SEE ALSO

Maintaining the MX2010 Fan Trays | 743

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
Maintaining the MX2010 Fan Trays | 743

Replacing the MX2010 Air Baffle

IN THIS SECTION

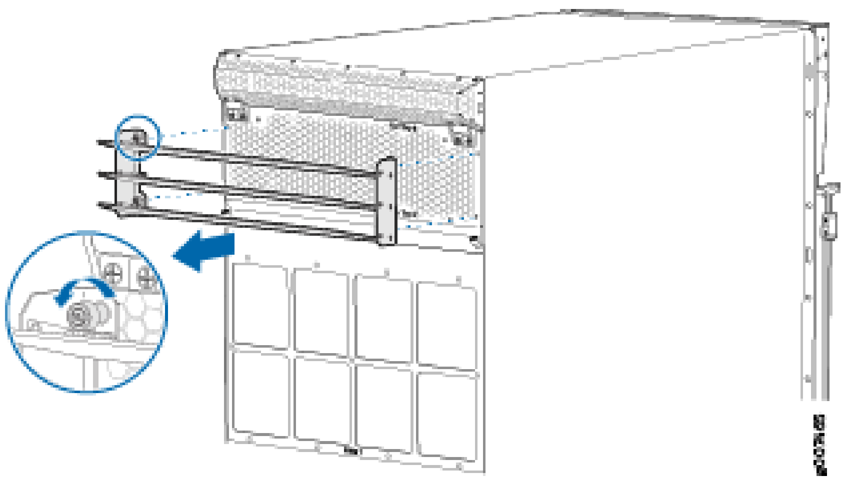
- Removing the MX2010 Air Baffle | 610
- Installing the MX2010 Air Baffle | 611

Removing the MX2010 Air Baffle

To remove the upper air baffle—MX2000-UPR-BAFFLE-A:

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 four captive screws located on either side of the air baffle that is attached to the upper fan tray access door.
3. Grasp the air baffle, and pull straight out from the upper fan tray access door as shown in Figure 313 on page 611.

Figure 313: Removing the Air Baffle



SEE ALSO

Maintaining the MX2010 Air Baffle | 754

Installing the MX2010 Air Baffle | 454

Installing the MX2010 Air Baffle

To install the upper air baffle—MX2000-UPR-BAFFLE-A:

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. Close the upper fan tray access door.
3. Align the holes on the air baffle with the holes located on either side of the upper fan tray access door, (see Figure 314 on page 612).
4. Tighten the four captive screws to secure the air baffle to the upper fan tray access door. Use #2 Phillips screwdriver. Do not overtighten. Do not apply more than 8.0 lb-in (0.90 Nm) of torque to the captive screws.
5. An air baffle can have fixed or adjustable louvers. Fixed louvers are set at an angle of 10-degrees. You must set adjustable louvers at a 10-degree upward tilt/angle to direct the exhaust air away from the router, (see Figure 315 on page 612).

Figure 314: Installing the Air Baffle

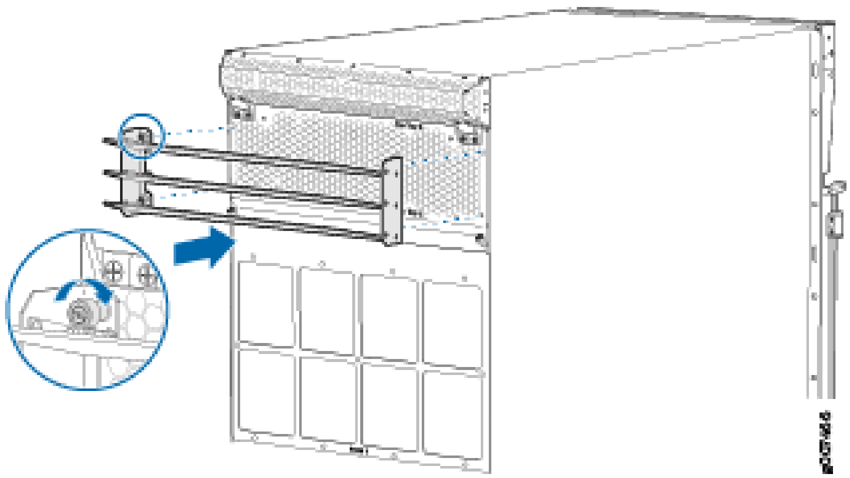
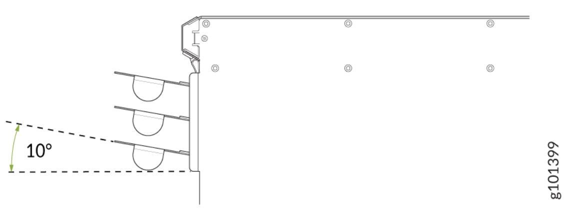


Figure 315: Air Baffle Louvers Adjusted at 10 Degrees Angle



SEE ALSO

Maintaining the MX2010 Air Baffle | 754
Replacing the MX2010 Air Baffle | 610

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
MX2010 Cooling System Description | 51
Maintaining the MX2010 Air Baffle | 754

Replacing an MX2010 MIC

IN THIS SECTION

- Removing an MX2010 MIC | **613**
- Installing an MX2010 MIC | **615**
- Installing an MX2010 Dual-Wide MIC | **619**
- Replacing a MIC Installed on an MPC6E | **623**

Removing an MX2010 MIC

MICs are hot-insertable and hot-removable. When you remove a MIC, the router continues to function, although the MIC interfaces being removed no longer function.

The MICs are located in the MPCs installed in the front of the router. A MIC weighs less than 2 lb (0.9 kg).

To remove a MIC (see Figure 316 on page 615):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the MIC. If the MIC 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 MIC offline:

   - Press its online/offline button. Use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the MIC **OK/FAIL** LED goes off (about 5 seconds).
   - Issue the following CLI command:

   ```
   user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot offline
   ```

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.
4. Label the cables connected to the MIC so that you can later reconnect each cable to the correct MIC.
5. Disconnect the cables from the MIC. If the MIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

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

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

6. Arrange the cable to prevent it from 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.

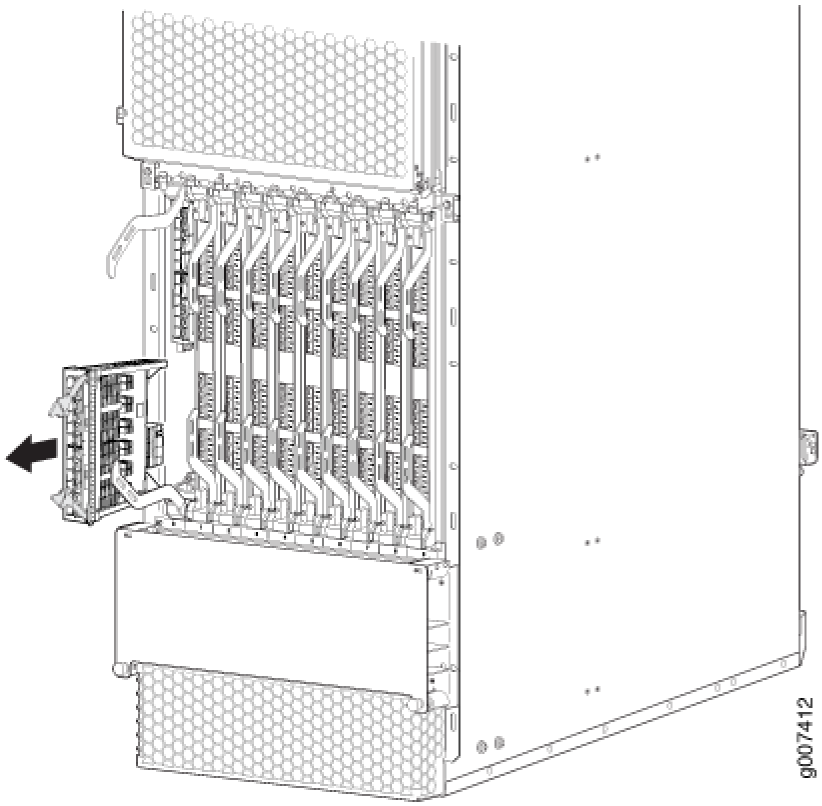
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

7. On the MPC, pull the ejector lever that is adjacent to the MIC you are removing away from the MPC faceplate. This disconnects the MIC from the MPC.

NOTE: To remove a dual-wide MIC that takes up both MIC slots, you must pull both ejector levers away from the MPC faceplate.

8. Grasp the handles on the MIC faceplate, and slide the MIC out of the MPC card carrier. Place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a MIC into the emptied MIC slot within a short time, install a blank MIC panel over the slot to maintain proper airflow in the MPC card cage.

Figure 316: Removing a Single-Wide MIC



SEE ALSO

Maintaining MX2010 MICs | 760
Installing an MX2010 MIC | 459
Installing an MX2010 Dual-Wide MIC | 446

Installing an MX2010 MIC

To install a MIC (see Figure 318 on page 619):

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 you have used a dual-wide MIC and are now replacing it with two single-wide MICs, install the septum (see Figure 317 on page 617):
   a. Place the MPC on a flat surface (if necessary, remove the MPC from the adapter card as described in "Removing an MX2010 MPC from the Adapter Card" on page 628.

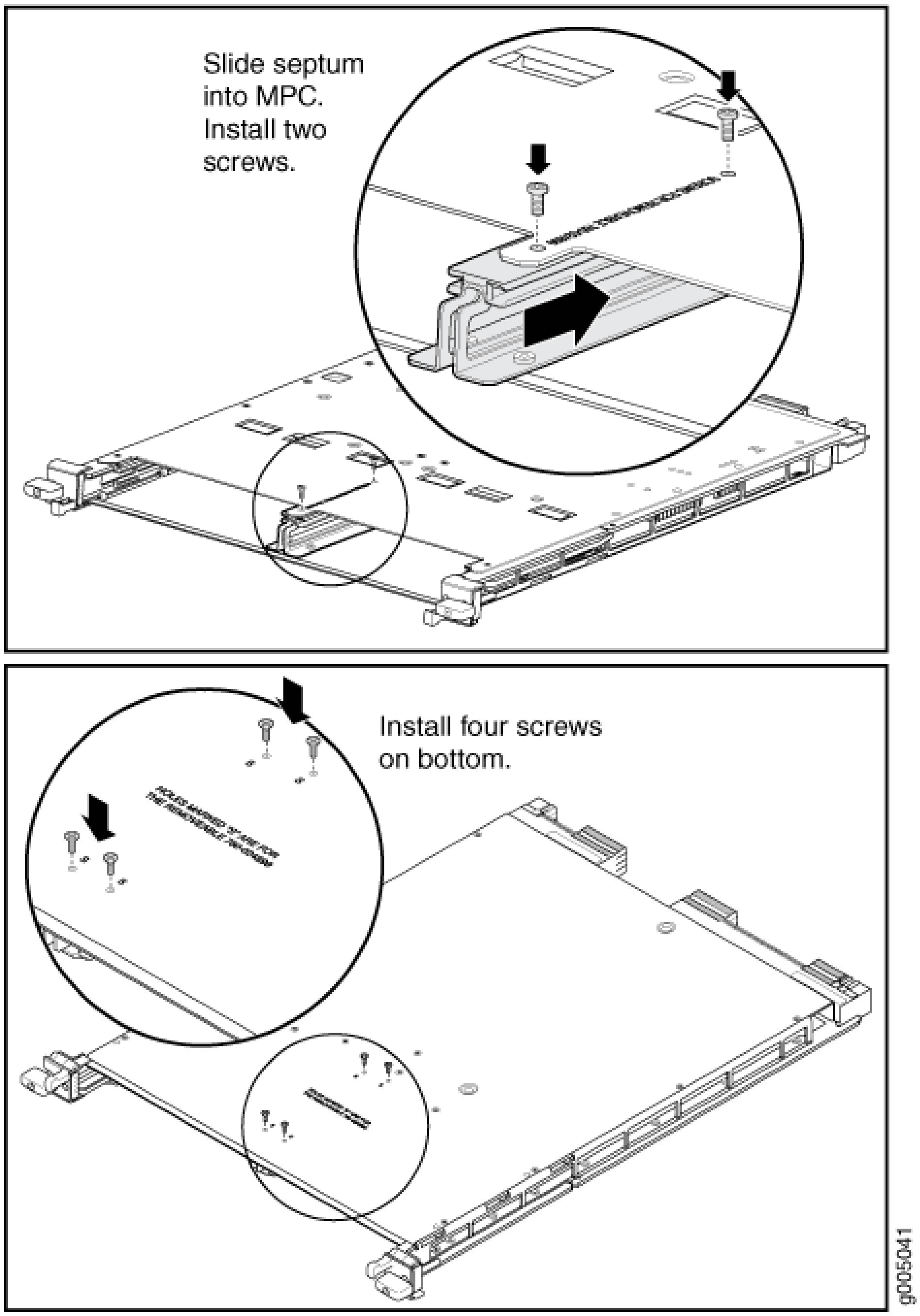
b. Position the septum in the center of the MPC so that it lines up with holes labeled **S** on the top of the MPC.

c. Insert a screw into each of the two holes labeled **S**, and then tighten them completely.

d. On the bottom of the MPC, insert a screw into each of the four holes labeled **S**, and then tighten them completely.

e. Install the MPC as described in "Installing an MX2010 MPC into an Adapter Card" on page 633.

Figure 317: Installing the Septum



3. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
4. On the MPC, pull the ejector lever that is adjacent to the MIC you are installing away from the MPC faceplate.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MPC until it is firmly seated in the MPC.

CAUTION: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector lever is engaged by pushing it toward the MPC faceplate.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

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

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

9. Insert the appropriate cables into the cable connectors on the MIC.
10. Arrange each cable 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.

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.

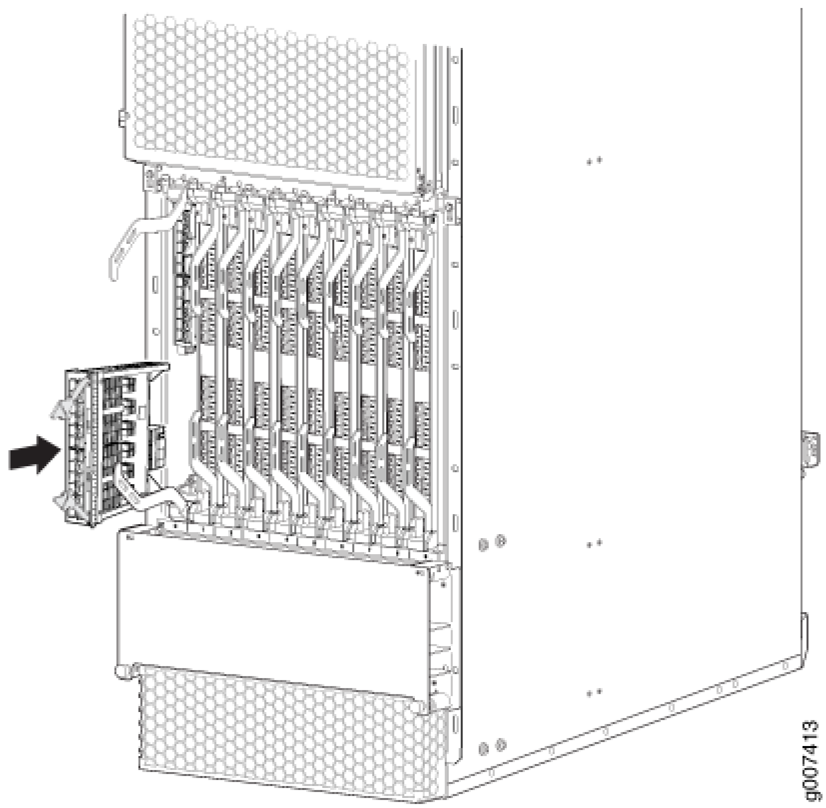
11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

```
user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot online
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the `show chassis fpc pic-status` command described in "Maintaining MX2010 MICs" on page 760.

Figure 318: Installing a MIC



SEE ALSO

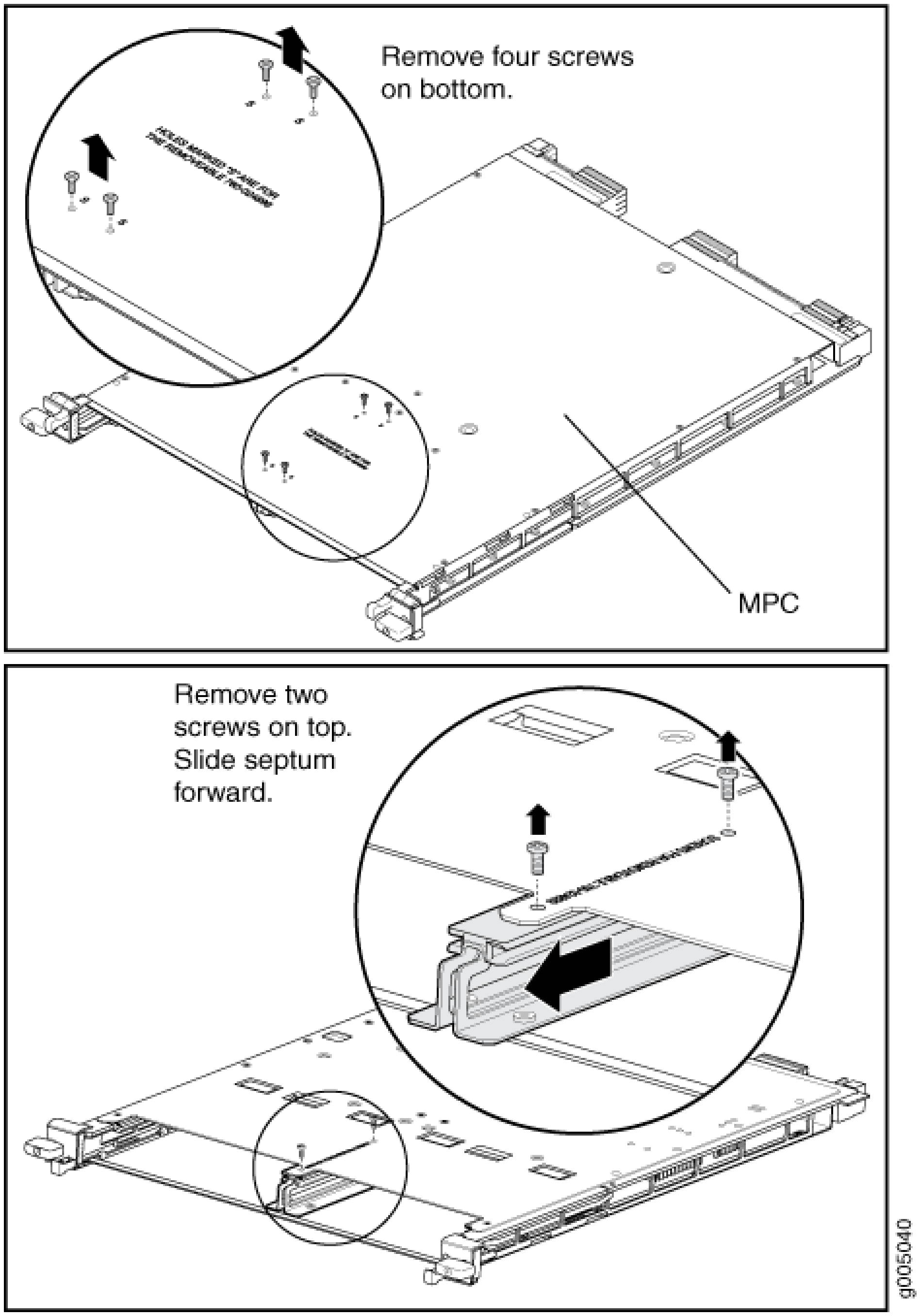
Maintaining MX2010 MICs | 760
Replacing an MX2010 MIC | 613
Installing an MX2010 Dual-Wide MIC | 446

Installing an MX2010 Dual-Wide MIC

To install a dual-wide MIC:

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 septum, if necessary (see Figure 319 on page 621):
   a. Place the MPC on a flat surface. If necessary, remove the MPC from the adapter card as described in "Removing an MX2010 MPC from the Adapter Card " on page 628.
   b. Remove the four screws labeled **S** on the bottom of the MPC.
   c. Remove the two screws labeled **S** on the top of the MPC.
   d. Slide the septum toward you and out of the MPC.
   e. Store the septum and screws for later use.
   f. Install the MPC as described in "Installing an MX2010 MPC into an Adapter Card" on page 633.

Figure 319: Removing the Septum



3. If the MIC uses fiber-optic cable, verify that a rubber safety cap is over each transceiver on the faceplate. Install a cap if necessary.
4. Pull the ejector lever above both MIC slots outward away from the router.
5. Align the rear of the MIC with the guides located at the corners of the MIC slot.
6. Slide the MIC into the MIC slot until it is firmly seated in the chassis.

CAUTION: Slide the MIC straight into the slot to avoid damaging the components on the MIC.

7. Verify that the ejector levers are engaged by pushing them inward toward the router.
8. If the MIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

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

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

9. Insert the appropriate cables into the cable connectors on the MIC.
10. Arrange each cable 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.

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.

11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

```
user@host> request chassis mic fpc-slot fpc-slot mic-slot mic-slot online
```

The normal functioning status LED confirms that the MIC is online. You can also verify correct MIC functioning by issuing the `show chassis fpc pic-status` command described in "Maintaining MX2010 MICs" on page 760.

SEE ALSO

Maintaining MX2010 MICs | 760
Replacing an MX2010 MIC | 613

Replacing a MIC Installed on an MPC6E

IN THIS SECTION

- Removing a MIC from an MPC6E | 623
- Installing a MIC on an MPC6E | 624

The MPC6E line cards are supported on the MX2008, MX2010 and MX2020 routers. You can install the MPC6E directly into the MX2008, MX2010 and MX2020 line-card slots without using adapter cards.

The MPC6E has two slots for installing MICs. For information about which MICs are supported on this MPC, see *MICs Supported by MX Series Routers*.

You use the two ejector levers on an MPC6E to insert the MPC into the line-card slot and to remove it from the slot. Similarly, the two ejector levers on a MIC enable you to insert the MIC into the MPC and to remove the MIC from the MPC. The ejector levers on the MICs are very close to an ejector lever of the MPC6E that houses the MICs. This proximity makes the MIC ejector levers difficult to access. The MPC6E has a unique mechanism by which you can shift the MPC6E ejector levers temporarily, enabling easy access to the MIC.

Video: https://www.youtube.com/watch?v=uo5kISOIdS8

Removing a MIC from an MPC6E

To remove a MIC installed on an MPC6E:

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. Identify the MIC that you want to remove from the MPC6E.

3. On the MPC6E that houses the MIC, hold the ejector lever at the base and move it gently toward the direction indicated by the arrow. You might need to apply firm pressure to move the ejector lever.

   The MPC6E lever moves about an inch from its original position, leaving enough space for you to easily access the MIC ejector levers.

   NOTE:

   - The arrow on top and bottom of the MPC6E indicates that the ejector lever of the MPC6E can be moved perpendicular to its actuation direction.
   - Moving the ejector lever of the MPC6E blocks access to the adjacent MPC. Remember to move the lever back to its original position after removing the MIC.

4. Pull the MIC ejector levers to slide the MIC out of the MIC slot on the MPC6E.
5. Push the MPC6E ejector lever in the direction opposite to the arrow, to return the ejector lever to its original position. The ejector lever no longer blocks access to the adjacent MPC.

Installing a MIC on an MPC6E

To install a MIC on an MPC6E:

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. Identify the slot in the MPC6E where you want to install the MIC.
3. On the MPC6E, hold the ejector lever at the base and move it gently toward the direction indicated by the arrow. You might need to apply firm pressure to move the ejector lever.

   The MPC6E ejector lever moves about an inch from its original position, leaving enough space for you to easily access the MIC slot.

   NOTE:

   - The arrow present on top and bottom of the MPC6E indicates that the ejector lever of the MPC6E can be moved perpendicular to its actuation direction.
   - Moving the ejector lever of the MPC6E blocks access to the adjacent MPC. Remember to move the lever back to its original position after inserting the MIC.

4. Slide the MIC into the MIC slot until it is firmly seated in the MPC.

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

5. Push the MPC6E ejector lever in the direction opposite to the arrow, to return the ejector lever to its original position. The ejector lever no longer blocks access to the adjacent MPC.

RELATED DOCUMENTATION

MPC6E

Maintaining MX2008 Interface Modules

Replacing an MX2010 MIC | 613

Replacing an MX2020 MIC

MIC/MPC Compatibility

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

MX2010 Modular Interface Card Description | 102

Maintaining MX2010 MICs | 760

Troubleshooting the MX2010 MICs | 832

Replacing an MX2010 MPC and Adapter Card

IN THIS SECTION

- Removing an MX2010 MPC with Adapter Card | 626
- Removing an MX2010 MPC from the Adapter Card | 628
- Removing an MX2010 Adapter Card | 630
- Installing an MX2010 Adapter Card | 632
- Installing an MX2010 MPC into an Adapter Card | 633

Removing an MX2010 MPC with Adapter Card

An MPC with an adapter card weighs up to 25 lb (11.34 kg). Be prepared to accept its full weight.

To remove an MPC with an adapter card:

1. Have ready a replacement MPC or blank panel and an antistatic mat. Also have ready rubber safety caps for each MPC you are removing that uses an optical interface.
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 cables connected to each port on the MPC so that you can later reconnect the cables to the correct ports.
4. Use one of the following methods to take the MPC offline:

   - Press and hold the corresponding **LC** online button on the craft interface. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off.

   - Issue the following CLI command:

   ```
   user@host>request chassis fpc slot slot-number offline
   ```

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

   NOTE: When you issue the `request chassis fpc slot slot-number offline` command, the FRU loses power, and the system's total power increases.

5. Disconnect the cables from the MPC.

   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.

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. Immediately cover each optical transceiver and the end of each fiber-optic cable with a rubber safety cap.
7. Arrange the disconnected cables in the standard upper and lower cable managers to prevent the cables from developing stress points.
8. Simultaneously turn both of the ejector handles outward to unseat the MPC along with the adapter card.
9. Grasp the handles, and slide the combined cards straight out of the card cage halfway.
10. Place one hand around the front of the combined cards and the other hand under it to support it. Slide the combined cards completely out of the chassis.

CAUTION: The weight of the MPC with the adapter card is concentrated in the back end. Be prepared to accept the full weight—up to 25 lb (11.34 kg)—as you slide the cards out of the chassis.

When the combined cards are out of the chassis, do not hold the cards by the ejector handles, bus bars, or edge connectors. They cannot support the card's weight.

Do not stack the combined cards on top of one another after removal.

11. Place each card (MCP and adapter card) individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.
12. If you are not reinstalling both MPC and adapter card into the emptied slot within a short time, install a blank adapter card panel over the slot to maintain proper airflow in the card cage.

CAUTION: After removing both cards from the chassis, wait at least 30 seconds before reinserting it, removing an MPC and adapter card from a different slot, or inserting an MPC and adapter card into a different slot.

SEE ALSO

Installing an MX2010 MPC into an Adapter Card | 633

Removing an MX2010 MPC from the Adapter Card

An MPC without the adapter card weighs up to 18.35 lb (8.32 kg). Be prepared to accept its full weight.

To remove an MPC from the adapter card (see Figure 320 on page 630):

1. Have ready a replacement MPC and an antistatic mat for the MPC. Also have ready rubber safety caps for each MPC you are removing that uses an optical interface.
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 cables connected to each port on the MPC so that you can later reconnect the cables to the correct ports.
4. Use one of the following methods to take the MPC offline:

   - Press and hold the corresponding MPC **LC** online button on the craft interface. The green **OK** LED next to the button begins to blink. Hold the button down until the LED goes off.

   - Issue the following CLI command:

   ```
   user@host>request chassis fpc slot slot-number offline
   ```

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

   NOTE: When you issue the `request chassis fpc slot slot-number offline` command, the FRU loses power, and the system's total power increases.

5. Disconnect the cables from the MPC.

   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.

> **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.

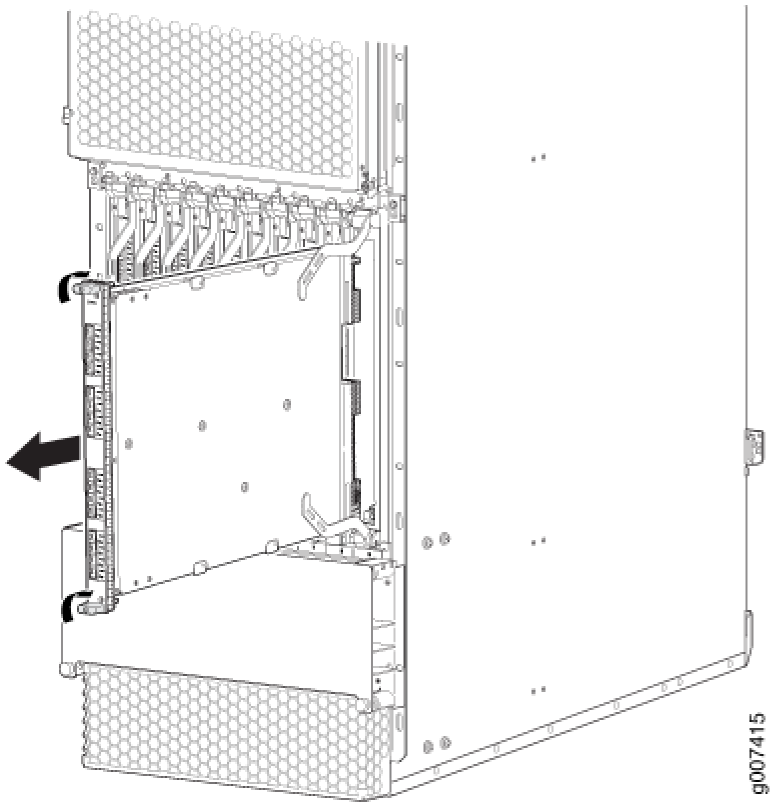
6. Immediately cover each optical transceiver and the end of each fiber-optic cable with a rubber safety cap.
7. Arrange the disconnected cables in the upper and lower cable managers to prevent the cables from developing stress points.
8. Simultaneously turn both of the knobs counterclockwise to unseat the MPC from the adapter card.
9. Grasp both the knobs, and slide the MPC straight out of the adapter card.
10. Place one hand around the front of the MPC and the other hand under it to support it. Slide the MPC completely out of the adapter card.

> **CAUTION**: The weight of the MPC without the adapter card is concentrated in the back end. Be prepared to accept the full weight—up to 18.35 lb (8.32 kg)—as you slide the MPC out of the adapter card.
>
> When the MPC is out of the adapter card, do not hold it by the knobs, bus bars, or edge connectors. They cannot support its weight.
>
> Do not stack MPCs on top of one another after removal.

11. Place each adapter card individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.
12. If you are not reinstalling an MPC into the emptied MPC slot within a short time, install a blank MPC panel over the slot to maintain proper airflow in the MPC card cage.

> **CAUTION**: After removing an MPC from the adapter card, wait at least 30 seconds before reinserting it, removing an MPC from a different slot, or inserting an MPC into a different slot.

Figure 320: Removing an MPC from the Adapter Card



SEE ALSO

Maintaining MX2010 MPCs | 763
Installing an MX2010 MPC into an Adapter Card | 633

Removing an MX2010 Adapter Card

An adapter card weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To remove an adapter card:

1. Have ready a replacement adapter card and an antistatic mat for the adapter card.
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.
    - To take the MPC offline, see "Removing an MX2010 MPC with Adapter Card" on page 626.

3. Issue the following CLI command to take the adapter card offline:

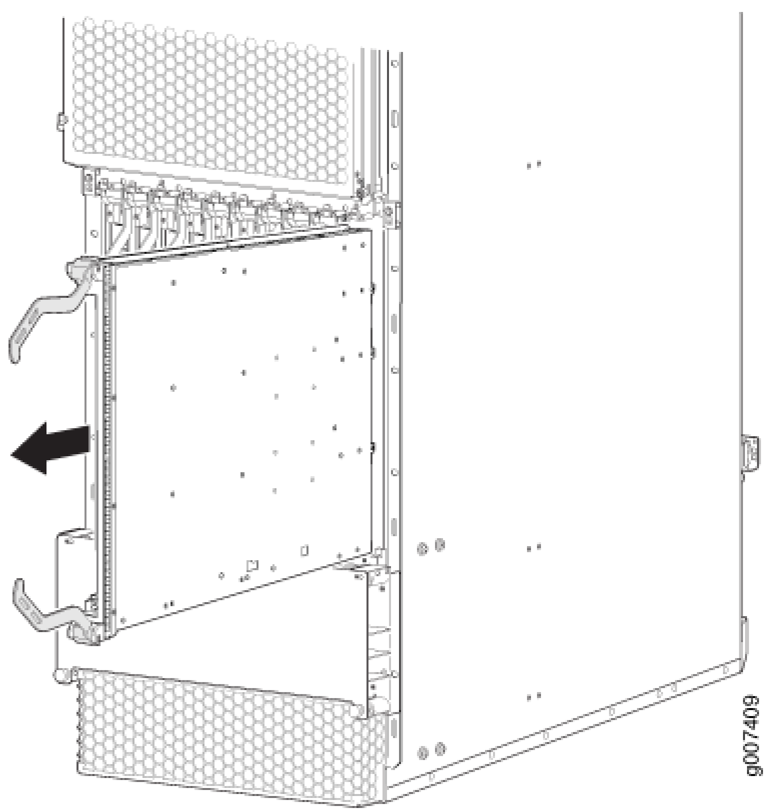
```
user@host>request chassis adc slot slot-number offline
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

> **NOTE**: When you issue the `request chassis adc slot slot-number offline` command, the FRU loses power, and the system's total power increases.

4. Open the ejector handles outward simultaneously to unseat the adapter card.
5. Grasp the ejector handles, and slide the adapter card about halfway out of the chassis.
6. Place one hand underneath the adapter card to support it, and slide it completely out of the chassis.
7. Place the adapter card on the antistatic mat or into an antistatic bag.
8. If you are not replacing the adapter card immediately, install a blank panel over the empty slot.

Figure 321: Removing an Adapter Card



Installing an MX2010 Adapter Card

An adapter card weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To install an adapter card (see Figure 322 on page 633):

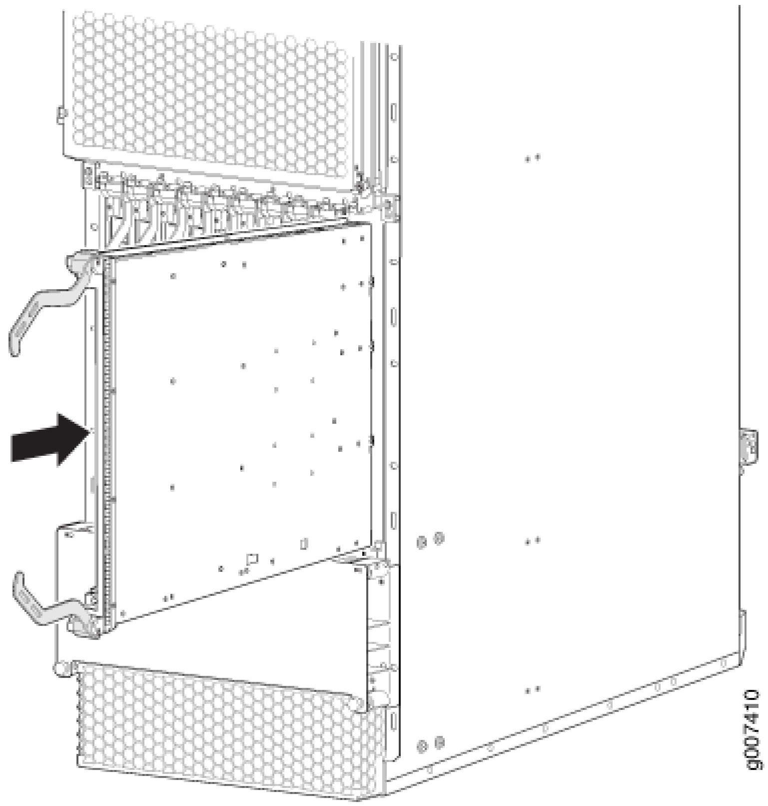
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the adapter card from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Orient the adapter card so that the faceplate faces you vertically.
5. Lift the adapter card into place, and carefully align the sides of the adapter card with the guides inside the card cage.
6. Slide the adapter card all the way into the card cage until you feel resistance.
7. Grasp both ejector handles, and gently close them inward simultaneously until the adapter card is fully seated.
8. Issue the following CLI command to bring the adapter card online:

```
user@host>request chassis adc slot slot-number online
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

NOTE: When you issue the `request chassis adc slot slot-number online` command, the FRU gains power, and the system's total power decreases.

Figure 322: Installing an Adapter Card



SEE ALSO

MX2000 Adapter Card (ADC) Description | 90

Maintaining the MX2010 Adapter Cards | 712

Installing an MX2010 MPC into an Adapter Card

An MPC weighs up to 25 lb (11.34 kg). Be prepared to accept its full weight.

To install an MPC (see Figure 323 on page 635):

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 MPC from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Verify that each fiber-optic transceiver is covered with a rubber safety cap.
5. Orient the MPC so that the faceplate faces you vertically.

6. Lift the MPC into place, and carefully align the sides of the MPC with the guides inside the adapter card.
7. Slide the MPC all the way into the adapter card until you feel resistance.
8. Grasp both knobs, and rotate them clockwise simultaneously until the MPC is fully seated into the adapter card.
9. Remove the rubber safety cap from each fiber-optic transceiver and 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.

10. Insert the cables into the cable connector ports on each MPC (see Figure 324 on page 636).
11. Arrange the cable in the cable manager to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

> **CAUTION**: Do not let fiber-optic 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.

12. Use one of the following methods to bring the MPC online:
    - Press and hold the corresponding MPC **LC** online button on the craft interface until the green **OK** LED next to the button lights steadily, in about 5 seconds.
    - Issue the following CLI command:

    ```
    user@host>request chassis adc slot slot-number online
    ```

    For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

NOTE: When you issue the `request chassis adc slot` *`slot-number`* `online` command, the FRU gets power, and the system's total power decreases.

CAUTION: After the **OK** LED turns green, wait at least 30 seconds before removing the MPC again, removing an MPC from a different slot, or inserting a MPC in a different slot.

You can also verify that the MPC is functioning correctly by issuing the **show chassis fpc** and `show chassis fpc pic-status` commands.

Figure 323: Installing an MPC into an Adapter Card

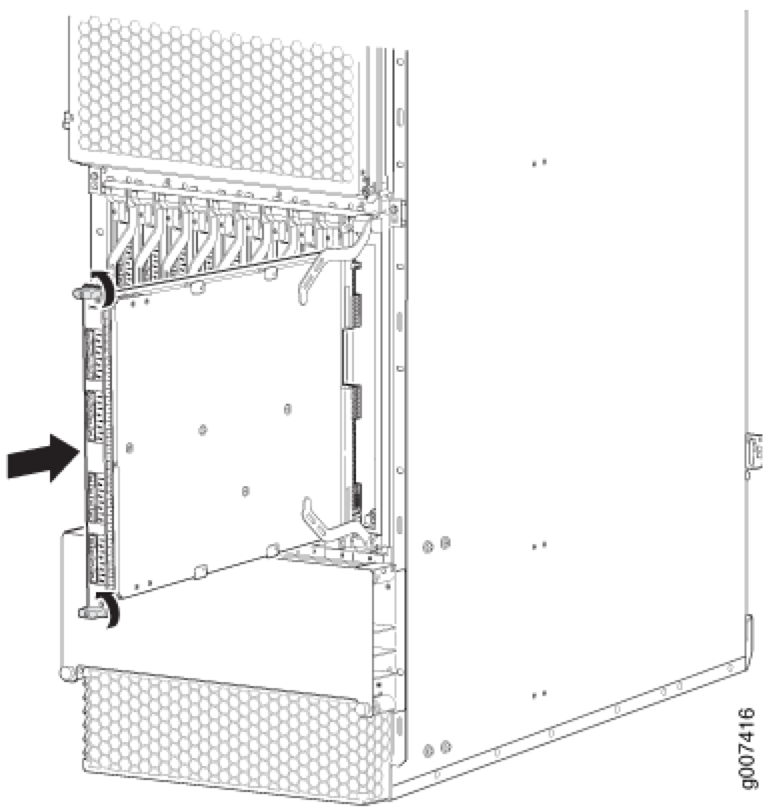
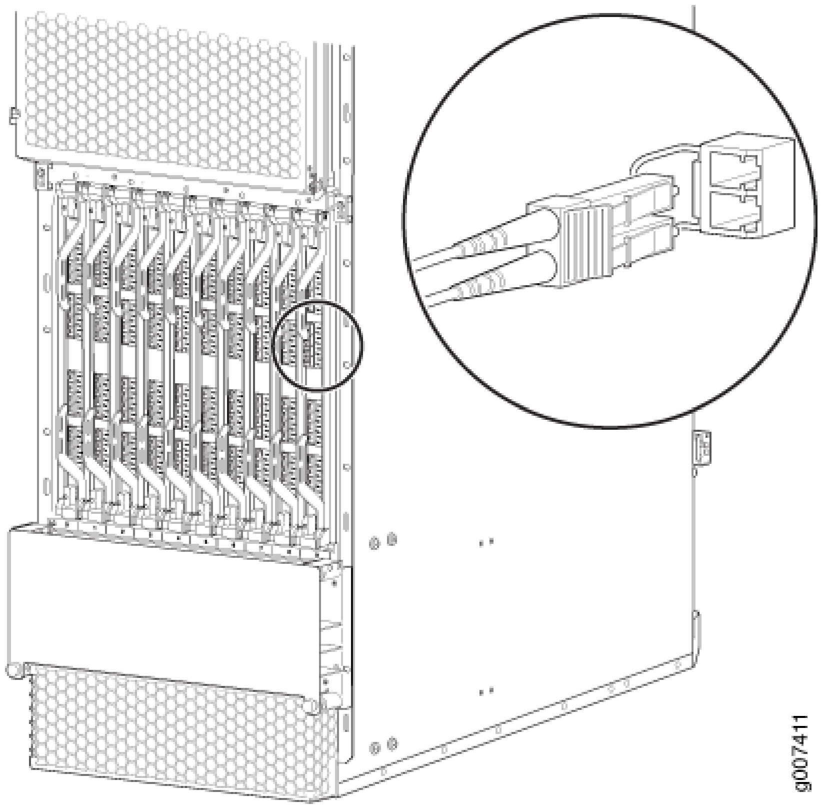


Figure 324: Attaching a Cable to an MPC



SEE ALSO

[Maintaining MX2010 MPCs | 763]

[Removing an MX2010 MPC from the Adapter Card | 628]

[Removing an MX2010 MPC with Adapter Card | 626]

RELATED DOCUMENTATION

[Preventing Electrostatic Discharge Damage to an MX Series Router]

[MX2010 MPC Terminology | 101]

[Maintaining MX2010 MICs | 760]

[Troubleshooting the MX2010 MPCs | 833]

Replacing an MX2000 SFB

IN THIS SECTION

- Removing an MX2000 SFB | 637
- Installing an MX2000 SFB | 639

Removing an MX2000 SFB

To remove an SFB (see Figure 325 on page 638 and Figure 326 on page 639):

NOTE: You can remove the SFB as a unit.

CAUTION: Before removing an SFB, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

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 grounding points on the chassis.
3. Open the ejector handles outward simultaneously to unseat the SFB.
4. Grasp the ejector handles, and slide the SFB about halfway out of the chassis.

   CAUTION: The weight of the SFB is concentrated in the back end. Be prepared to accept the full weight—up to 12 lb (5.45 kg)—as you slide the SFB out of the chassis.

5. Place one hand underneath the SFB to support it, and slide it completely out of the chassis.
6. Place the SFB on the antistatic mat or into an antistatic bag.

   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.

7. If you are not replacing the SFB immediately, install a blank panel over the empty slot.

Figure 325: Removing an SFB (MX2010)

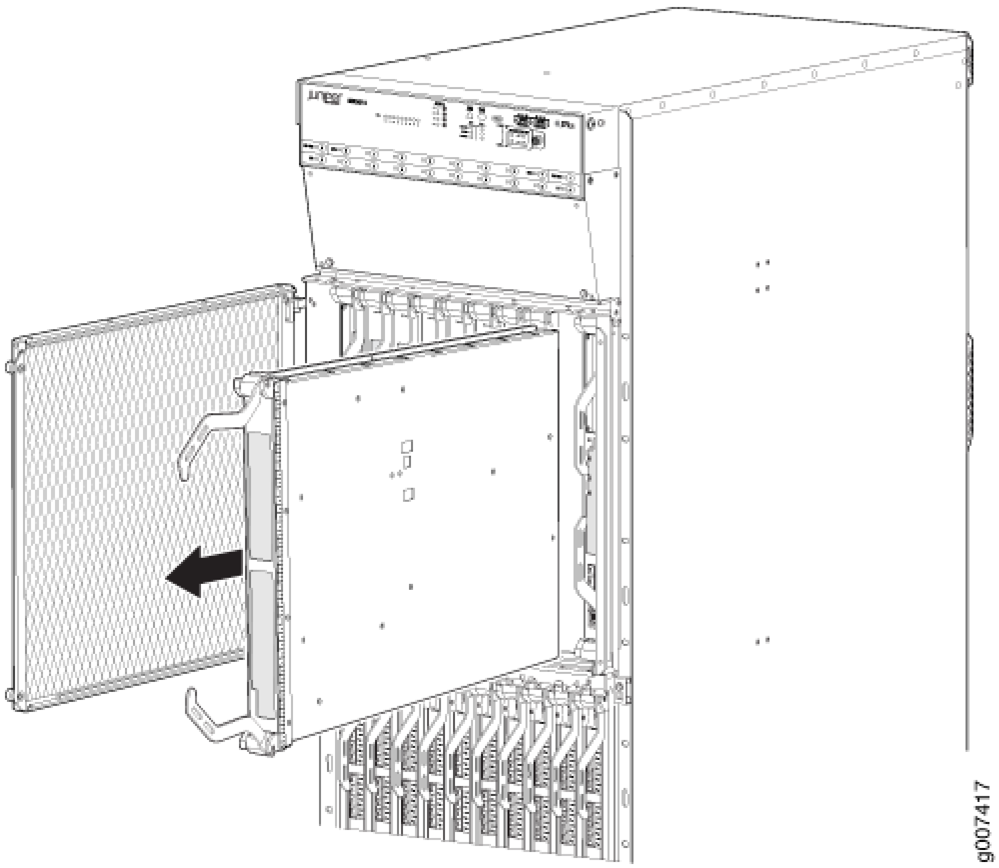
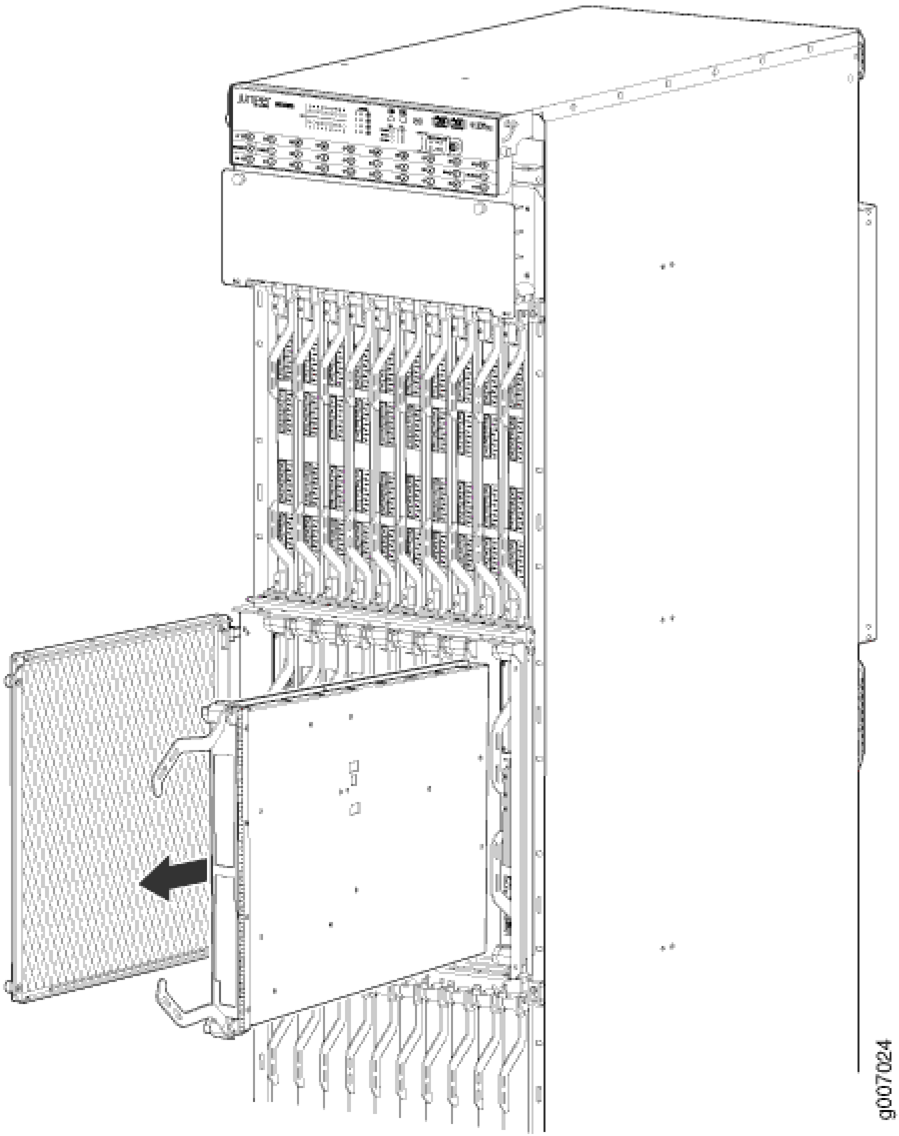


Figure 326: Removing an SFB (MX2020)



SEE ALSO

Maintaining the MX2010 SFB | 794
Installing an MX2000 SFB | 463

Installing an MX2000 SFB

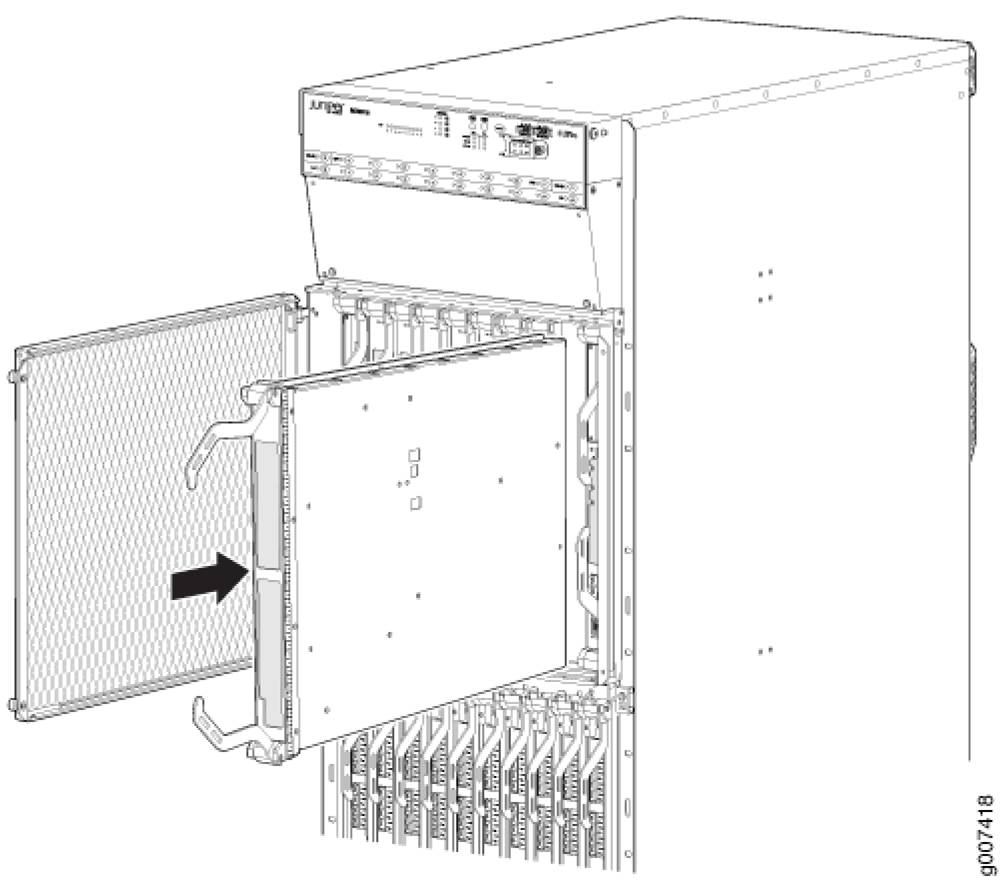
To install an SFB (see Figure 327 on page 640):

> ⚠ **CAUTION**: Before removing or replacing an SFB, ensure that the ejector handles are stored horizontally and pressed toward the center of the SFB.

> ⚠ **CAUTION**: If one of the SFBs fails, do not remove the failed SFB until you have a replacement or blank panel to install.

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. Take each SFB to be installed out of its electrostatic bag, and identify the slot on the SFB where it will be connected.
3. Carefully align the sides of the SFB with the guides inside the chassis.
4. Slide the SFB into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Place the ejector handles in their proper position, vertically and toward the center of the board.

Figure 327: Installing an SFB



6. Check the LEDs on the SFB faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the SFB is installed.
   - If the **OK/FAIL** LED is red, remove and install the SFB again. If the **OK/FAIL** LED still lights steadily, the SFB is not functioning properly. Contact your customer support representative. See "Contact Customer Support" on page 838.
7. Check the status of the SFB by using the `show chassis environment sfb` command:

```
user@host> show chassis environment sfb
SFB 0 status:
  State                       Online
  Intake-Zone0 Temperature    32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature   38 degrees C / 100 degrees F
  IntakeA-Zone0 Temperature   28 degrees C / 82 degrees F
  IntakeB-Zone1 Temperature   29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature   31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature   55 degrees C / 131 degrees F
  SFB-XF1-Zone0 Temperature   48 degrees C / 118 degrees F
  SFB-XF0-Zone0 Temperature   47 degrees C / 116 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL      1500 mV
    LTC3880-XF2-1.5v-CH0       1500 mV
    LTC3880-XF2-1.5v-CH1       1500 mV
    LTC3880-XF2-1.0v-RAIL      1029 mV
    LTC3880-XF2-1.0v-CH0       1029 mV
    LTC3880-XF2-1.0v-CH1       1032 mV
    LTC3880-XF1-1.5v-RAIL      1499 mV
    LTC3880-XF1-1.5v-CH0       1499 mV
    LTC3880-XF1-1.5v-CH1       1500 mV
    LTC3880-XF1-1.0v-RAIL      1029 mV
    LTC3880-XF1-1.0v-CH0       1029 mV
    LTC3880-XF1-1.0v-CH1       1032 mV
    LTC3880-XF0-1.5v-RAIL      1499 mV
    LTC3880-XF0-1.5v-CH0       1499 mV
    LTC3880-XF0-1.5v-CH1       1501 mV
    LTC3880-XF0-1.0v-RAIL      1029 mV
    LTC3880-XF0-1.0v-CH0       1029 mV
    LTC3880-XF0-1.0v-CH1       1032 mV
    LTC3880-3.3v-RAIL          3299 mV
    LTC3880-3.3v-CH0           3299 mV
    LTC3880-3.3v-CH1           3299 mV
SFB 1 status:
```

```
  State                      Online
  Intake-Zone0 Temperature   32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  27 degrees C / 80 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature  56 degrees C / 132 degrees F
  SFB-XF1-Zone0 Temperature  47 degrees C / 116 degrees F
  SFB-XF0-Zone0 Temperature  47 degrees C / 116 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1499 mV
    LTC3880-XF2-1.5v-CH0      1499 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1030 mV
    LTC3880-XF1-1.0v-CH0      1030 mV
    LTC3880-XF1-1.0v-CH1      1033 mV
    LTC3880-XF0-1.5v-RAIL     1500 mV
    LTC3880-XF0-1.5v-CH0      1500 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 2 status:
  State                      Online
  Intake-Zone0 Temperature   33 degrees C / 91 degrees F
  Exhaust-Zone1 Temperature  38 degrees C / 100 degrees F
  IntakeA-Zone0 Temperature  29 degrees C / 84 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  33 degrees C / 91 degrees F
  SFB-XF2-Zone1 Temperature  58 degrees C / 136 degrees F
  SFB-XF1-Zone0 Temperature  49 degrees C / 120 degrees F
  SFB-XF0-Zone0 Temperature  49 degrees C / 120 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
```

```
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1500 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3299 mV
    LTC3880-3.3v-CH0          3299 mV
    LTC3880-3.3v-CH1          3299 mV
SFB 3 status:
  State                      Online
  Intake-Zone0 Temperature   44 degrees C / 111 degrees F
  Exhaust-Zone1 Temperature  40 degrees C / 104 degrees F
  IntakeA-Zone0 Temperature  36 degrees C / 96 degrees F
  IntakeB-Zone1 Temperature  31 degrees C / 87 degrees F
  Exhaust-Zone0 Temperature  38 degrees C / 100 degrees F
  SFB-XF2-Zone1 Temperature  59 degrees C / 138 degrees F
  SFB-XF1-Zone0 Temperature  52 degrees C / 125 degrees F
  SFB-XF0-Zone0 Temperature  59 degrees C / 138 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1501 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
```

```
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 4 status:
  State                      Online
  Intake-Zone0 Temperature   32 degrees C / 89 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  27 degrees C / 80 degrees F
  IntakeB-Zone1 Temperature  28 degrees C / 82 degrees F
  Exhaust-Zone0 Temperature  31 degrees C / 87 degrees F
  SFB-XF2-Zone1 Temperature  54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature  46 degrees C / 114 degrees F
  SFB-XF0-Zone0 Temperature  45 degrees C / 113 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1499 mV
    LTC3880-XF2-1.5v-CH0      1499 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1500 mV
    LTC3880-XF1-1.5v-CH0      1500 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1500 mV
    LTC3880-XF0-1.0v-RAIL      949 mV
    LTC3880-XF0-1.0v-CH0       949 mV
    LTC3880-XF0-1.0v-CH1       952 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 5 status:
  State                      Online
```

```
  Intake-Zone0 Temperature   33 degrees C / 91 degrees F
  Exhaust-Zone1 Temperature  36 degrees C / 96 degrees F
  IntakeA-Zone0 Temperature  28 degrees C / 82 degrees F
  IntakeB-Zone1 Temperature  28 degrees C / 82 degrees F
  Exhaust-Zone0 Temperature  32 degrees C / 89 degrees F
  SFB-XF2-Zone1 Temperature  54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature  50 degrees C / 122 degrees F
  SFB-XF0-Zone0 Temperature  50 degrees C / 122 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
    LTC3880-XF0-1.5v-CH0      1499 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1033 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3300 mV
SFB 6 status:
  State                      Online
  Intake-Zone0 Temperature   41 degrees C / 105 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  32 degrees C / 89 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  37 degrees C / 98 degrees F
  SFB-XF2-Zone1 Temperature  54 degrees C / 129 degrees F
  SFB-XF1-Zone0 Temperature  60 degrees C / 140 degrees F
  SFB-XF0-Zone0 Temperature  60 degrees C / 140 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
```

```
    LTC3880-XF2-1.5v-CH1      1500 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1033 mV
    LTC3880-XF0-1.5v-RAIL     1500 mV
    LTC3880-XF0-1.5v-CH0      1500 mV
    LTC3880-XF0-1.5v-CH1      1501 mV
    LTC3880-XF0-1.0v-RAIL     1029 mV
    LTC3880-XF0-1.0v-CH0      1029 mV
    LTC3880-XF0-1.0v-CH1      1033 mV
    LTC3880-3.3v-RAIL         3300 mV
    LTC3880-3.3v-CH0          3300 mV
    LTC3880-3.3v-CH1          3299 mV
SFB 7 status:
  State                      Online
  Intake-Zone0 Temperature   41 degrees C / 105 degrees F
  Exhaust-Zone1 Temperature  37 degrees C / 98 degrees F
  IntakeA-Zone0 Temperature  33 degrees C / 91 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  Exhaust-Zone0 Temperature  37 degrees C / 98 degrees F
  SFB-XF2-Zone1 Temperature  55 degrees C / 131 degrees F
  SFB-XF1-Zone0 Temperature  50 degrees C / 122 degrees F
  SFB-XF0-Zone0 Temperature  57 degrees C / 134 degrees F
  Power
    LTC3880-XF2-1.5v-RAIL     1500 mV
    LTC3880-XF2-1.5v-CH0      1500 mV
    LTC3880-XF2-1.5v-CH1      1501 mV
    LTC3880-XF2-1.0v-RAIL     1029 mV
    LTC3880-XF2-1.0v-CH0      1029 mV
    LTC3880-XF2-1.0v-CH1      1032 mV
    LTC3880-XF1-1.5v-RAIL     1499 mV
    LTC3880-XF1-1.5v-CH0      1499 mV
    LTC3880-XF1-1.5v-CH1      1500 mV
    LTC3880-XF1-1.0v-RAIL     1029 mV
    LTC3880-XF1-1.0v-CH0      1029 mV
    LTC3880-XF1-1.0v-CH1      1032 mV
    LTC3880-XF0-1.5v-RAIL     1499 mV
```

```
LTC3880-XF0-1.5v-CH0      1499 mV
LTC3880-XF0-1.5v-CH1      1501 mV
LTC3880-XF0-1.0v-RAIL     1029 mV
LTC3880-XF0-1.0v-CH0      1029 mV
LTC3880-XF0-1.0v-CH1      1033 mV
LTC3880-3.3v-RAIL         3300 mV
LTC3880-3.3v-CH0          3300 mV
LTC3880-3.3v-CH1          3300 mV
```

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

Removing the SFBs Before Installing an MX2020 Router with a Pallet Jack

MX2000 Switch Fabric Board (SFB) Overview | 72

MX2000-SFB2-S Enhanced Switch Fabric Board Description

MX2000-SFB3 Switch Fabric Board Description

Replacing an MX2000 CB-RE

IN THIS SECTION

- Removing a CB-RE from an MX2000 Router | 647
- Installing an MX2020 CB-RE | 650
- Installing an MX2010 CB-RE | 653

Removing a CB-RE from an MX2000 Router

To remove a CB-RE:

NOTE: You can remove the CB-RE as a unit.

CAUTION: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

CAUTION: Before you replace a CB-RE, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router.

1. Take the host subsystem offline.
2. Place an electrostatic bag or antistatic mat on a flat, stable surface.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Open the ejector handles outward simultaneously to unseat the CB-RE.
5. Grasp the ejector handles, and slide the CB-RE about halfway out of the chassis.
6. Place one hand underneath the CB-RE to support it, and slide it completely out of the chassis.
7. Place the CB-RE on the antistatic mat or into an antistatic bag.
8. If you are not replacing the CB-RE immediately, install a blank panel over the empty slot.

Figure 328: Removing a CB-RE (MX2010)

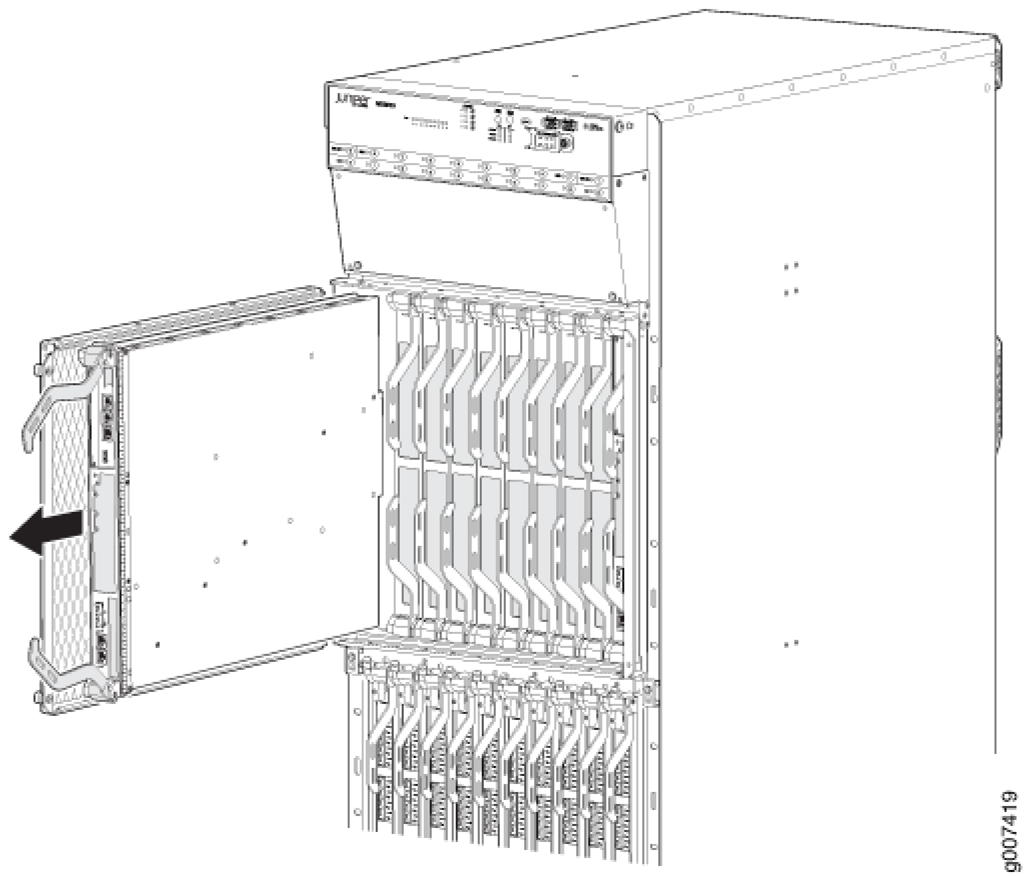
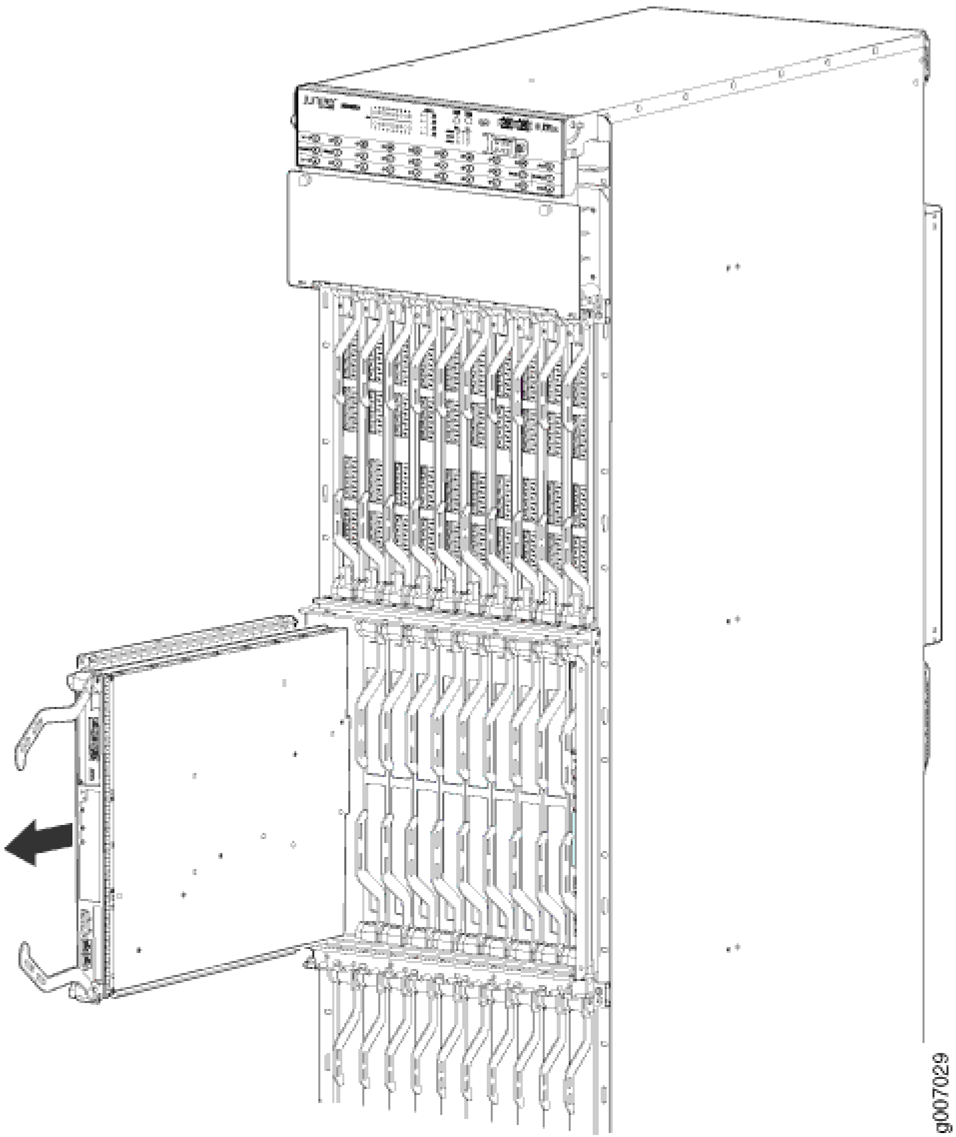


Figure 329: Removing a CB-RE (MX2020)



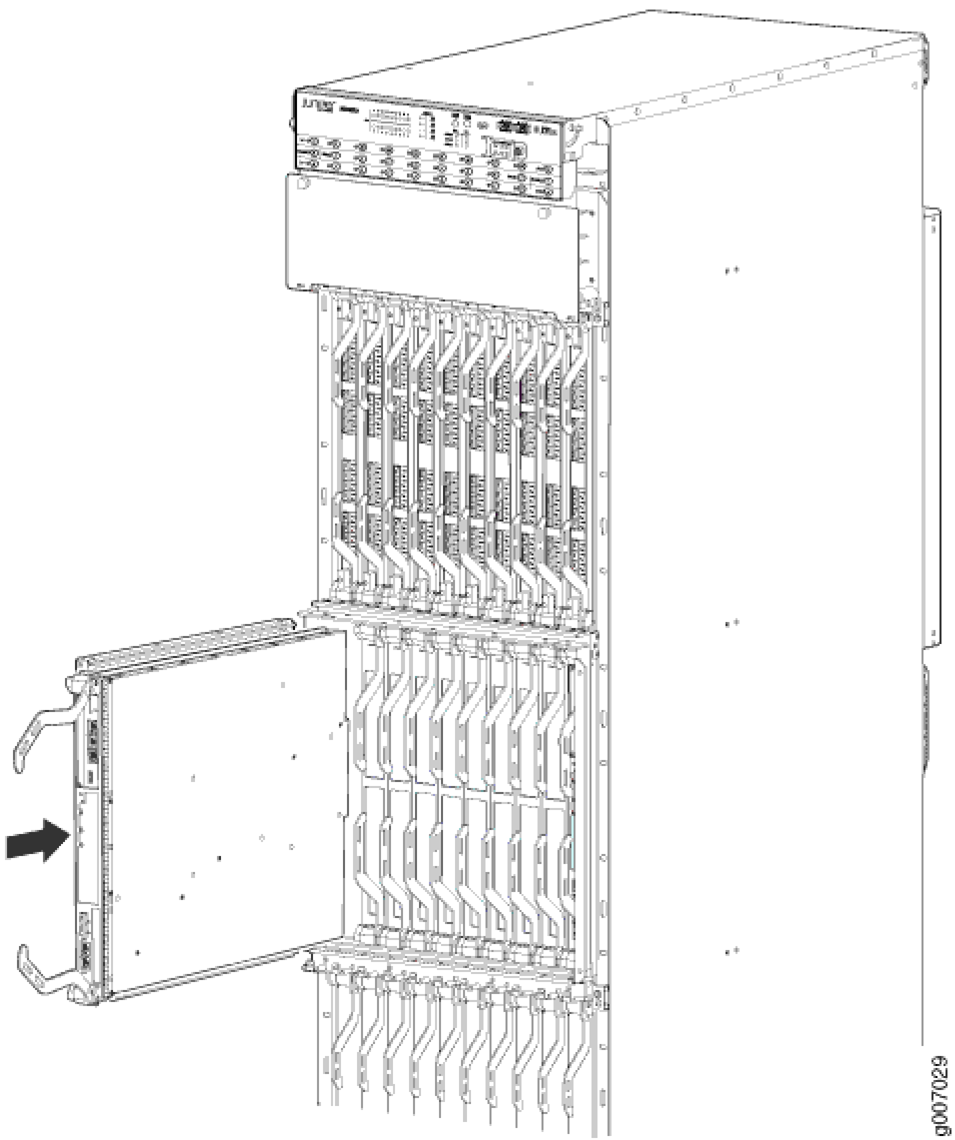
Installing an MX2020 CB-RE

To install a CB-RE (see Figure 330 on page 651):

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. Take each CB-RE to be installed out of its electrostatic bag, and identify the slot on the CB-RE where it will be connected.
3. Verify that each fiber-optic CB-RE has a rubber safety cap covering the transceiver. If it does not, cover the transceiver with a safety cap.
4. Locate the slot in the CB-RE card cage in which you plan to install the CB-RE.

5. Ensure that the CB-RE is right-side up, with the text on the faceplate of the CB-RE facing upward.
6. Lift the CB-RE into place, and carefully align first the bottom, then the top of the CB-RE with the guides inside the card cage.
7. Slide the CB-RE all the way into the card cage until you feel resistance.
8. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.

Figure 330: Installing an MX2020 CB-RE



9. Check the LEDs on the CB-RE faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the CB-RE is installed.

- If the **OK/FAIL** LED is red, remove and install the CB-RE again. If the **OK/FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative. See *Contact Customer Support*.

10. Check the status of the CB-RE using the `show chassis environment cb` command:

```
user@host> show chassis environment cb
CB 0 status:
 State                          Online Master
  IntakeA-Zone0 Temperature  25 degrees C / 77 degrees F
  IntakeB-Zone1 Temperature  29 degrees C / 84 degrees F
  IntakeC-Zone0 Temperature  28 degrees C / 82 degrees F
  ExhaustA-Zone0 Temperature 26 degrees C / 78 degrees F
  ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
  TCBC-Zone0 Temperature     32 degrees C / 89 degrees F
  Power 1
    1.0 V                     1008 mV
    1.2 V                     1208 mV
    1.8 V                     1801 mV
    2.5 V                     2526 mV
    3.3 V                     3312 mV
    5.0 V                     5020 mV
    5.0 V RE                  4995 mV
    12.0 V                   12123 mV
    12.0 V RE                12007 mV
  Bus Revision               100
  FPGA Revision              271
CB 1 status:
  State                      Online Standby
  IntakeA-Zone0 Temperature  30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature  25 degrees C / 77 degrees F
  IntakeC-Zone0 Temperature  39 degrees C / 102 degrees F
  ExhaustA-Zone0 Temperature 33 degrees C / 91 degrees F
  ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
  TCBC-Zone0 Temperature     31 degrees C / 87 degrees F
  Power 1
    1.0 V                     1015 mV
    1.2 V                     1211 mV
    1.8 V                     1814 mV
    2.5 V                     2545 mV
    3.3 V                     3345 mV
    5.0 V                     5066 mV
    5.0 V RE                  5020 mV
```

```
    12.0 V                    12104 mV
    12.0 V RE                 12046 mV
  Bus Revision                100
  FPGA Revision               0
```

Installing an MX2010 CB-RE

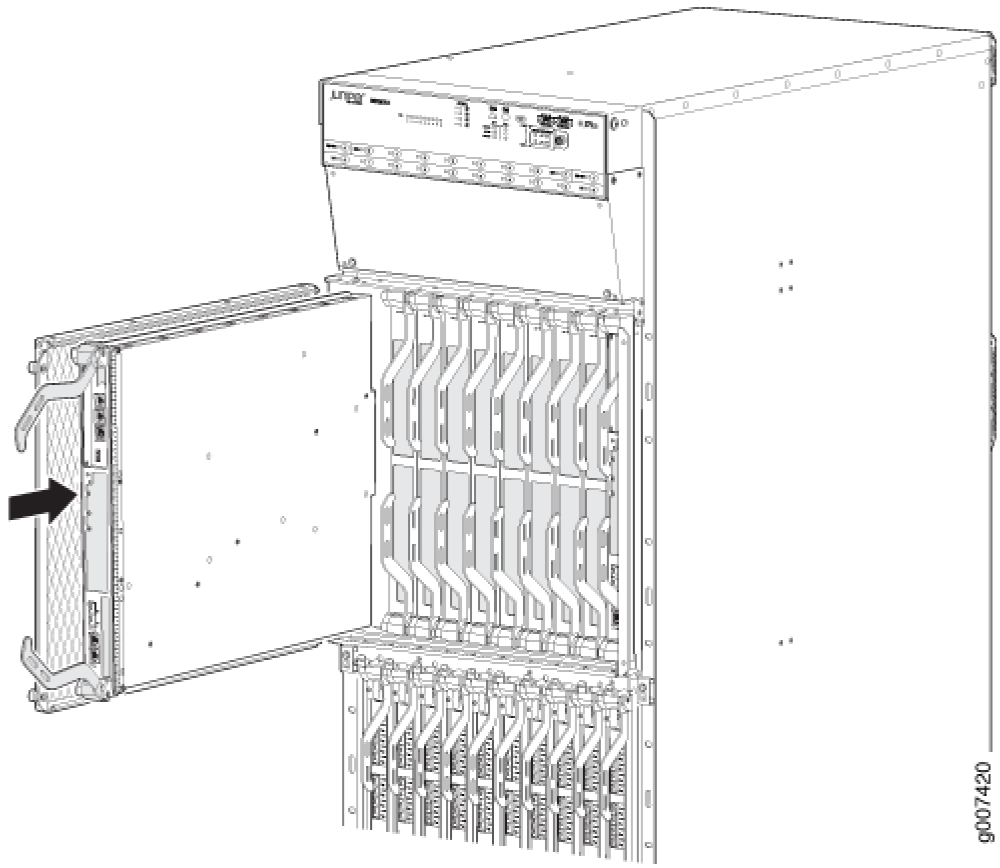
To install a CB-RE (seeFigure 331 on page 655):

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 CB-RE from the electrostatic bag.
3. Carefully align the sides of the CB-RE with the guides inside the chassis.
4. Slide the CB-RE into the chassis until you feel resistance, carefully ensuring that it is correctly aligned.
5. Grasp both ejector handles, and gently close them inward simultaneously until the CB-RE is fully seated.
6. Check the LEDs on the CB-RE faceplate to verify that it is functioning normally.
   - The green **OK/FAIL** LED should light steadily a few minutes after the CB-RE is installed.
   - If the **OK/FAIL** LED is red, remove and install the CB-RE again. If the **OK/FAIL** LED still lights steadily, the CB-RE is not functioning properly. Contact your customer support representative. See *Contact Customer Support*.
7. Check the status of the CB-RE by using the `show chassis environment cb` command:

```
user@host> show chassis environment cb
CB 0 status:
 State                         Online Master
  IntakeA-Zone0 Temperature   25 degrees C / 77 degrees F
  IntakeB-Zone1 Temperature   29 degrees C / 84 degrees F
  IntakeC-Zone0 Temperature   28 degrees C / 82 degrees F
  ExhaustA-Zone0 Temperature 26 degrees C / 78 degrees F
  ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
  TCBC-Zone0 Temperature     32 degrees C / 89 degrees F
  Power 1
    1.0 V                     1008 mV
    1.2 V                     1208 mV
    1.8 V                     1801 mV
    2.5 V                     2526 mV
    3.3 V                     3312 mV
    5.0 V                     5020 mV
```

```
    5.0 V RE                 4995 mV
    12.0 V                  12123 mV
    12.0 V RE               12007 mV
  Bus Revision              100
  FPGA Revision             271
CB 1 status:
  State                     Online Standby
  IntakeA-Zone0 Temperature  30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature  25 degrees C / 77 degrees F
  IntakeC-Zone0 Temperature  39 degrees C / 102 degrees F
  ExhaustA-Zone0 Temperature 33 degrees C / 91 degrees F
  ExhaustB-Zone1 Temperature 28 degrees C / 82 degrees F
  TCBC-Zone0 Temperature     31 degrees C / 87 degrees F
  Power 1
    1.0 V                    1015 mV
    1.2 V                    1211 mV
    1.8 V                    1814 mV
    2.5 V                    2545 mV
    3.3 V                    3345 mV
    5.0 V                    5066 mV
    5.0 V RE                 5020 mV
    12.0 V                  12104 mV
    12.0 V RE               12046 mV
  Bus Revision              100
  FPGA Revision             0
```

Figure 331: Installing an MX2010 CB-RE



RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

CB-RE LEDs | 69

Taking an MX2000 Host Subsystem Offline | 800

RE-MX2000-1800x4 CB-RE Description | 58

REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description | 62

Prevention of Electrostatic Discharge Damage

Replacing an SFP or XFP Transceiver on an MX2010 MPC or MIC

IN THIS SECTION

- Removing an SFP or XFP from an MX2010 MPC or MIC | 656
- Installing an SFP or XFP into an MX2000 MPC or MIC | 657

Small form-factor pluggables transceivers such as SFPs and XFPs are optical transceivers that are installed in an MPC or a MIC. SFPs and XFPs are hot-insertable and hot-removable.

Removing an SFP or XFP from an MX2010 MPC or MIC

Removing an SFP or XFP does not interrupt MPC or MIC functioning, but the removed transceiver no longer receives or transmits data.

To remove an SFP or XFP (see Figure 332 on page 657):

1. Have ready a replacement transceiver or a transceiver slot plug, an antistatic mat, and a rubber safety cap for the transceiver.
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 cables connected to the transceiver so that you can reconnect them correctly later.

> **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.

4. Remove the cable connector from the transceiver.
5. Carefully arrange the disconnected cable in the cable manager to prevent the cable from developing stress points.

> **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.

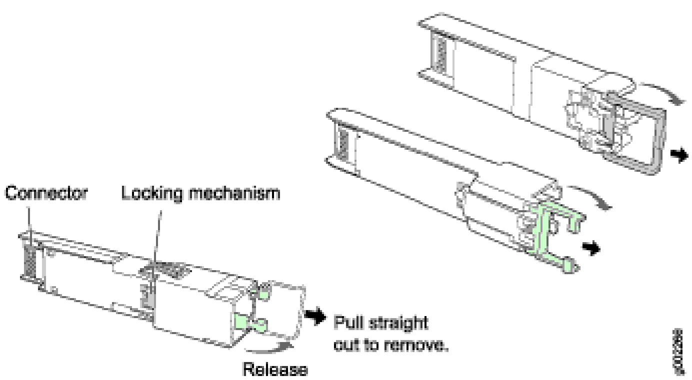
6. Pull the ejector handle out from the transceiver to unlock the transceiver.

CAUTION: Make sure that you open the ejector handle completely until you hear it click. This prevents damage to the transceiver.

Use needle nose pliers to pull the ejector handle out from the transceiver.

7. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the MPC or MIC.
8. Using your fingers, grasp the body of the transceiver, and pull it the rest of the way out of the MPC or MIC.

Figure 332: Removing SFPs or XFPs



9. Place a rubber safety cap over the transceiver.
10. Place the removed transceiver on an antistatic mat or in an electrostatic bag.

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

SEE ALSO

Installing an SFP or XFP into an MX2000 MPC or MIC | 499
Preventing Electrostatic Discharge Damage to an MX Series Router

Installing an SFP or XFP into an MX2000 MPC or MIC

To install an SFP or XFP:

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. Take each transceiver to be installed out of its electrostatic bag, and identify the slot on the component where it will be installed.
3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.
4. Carefully align the transceiver with the slots in the component. The connectors should face the component.
5. Slide the transceiver until the connector is seated in the component slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.
6. Close the ejector handle of the transceiver.
7. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

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

8. Verify that the status LEDs on the component faceplate indicate that the SFP or XFP is functioning correctly. For more information about the component LEDs, see the *MX Series Interface Module Reference*.

SEE ALSO

Removing an SFP or XFP from an MX2010 MPC or MIC | 656

Removing an SFP or XFP Transceiver from an MX2020 MPC or MIC

Prevention of Electrostatic Discharge Damage

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

Replacing an MX2010 MIC | 613

Replacing an MX2010 MPC and Adapter Card | 625

Replacing an MX2000 AC Power Supply Module

IN THIS SECTION

- Removing an MX2000 AC Power Supply Module | 659
- Installing MX2000 Router AC Power Supply Modules | 663

Removing an MX2000 AC Power Supply Module

Before you remove a PSM, be aware of the following:

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PdSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To remove an AC PSM (see Figure 333 on page 661 and Figure 334 on page 662, and Figure 335 on page 663):

NOTE: The minimum number of AC PSMs changes based on the configuration.

1. With one PSM installed and operational, remove any additional PSMs by turning the power switch to the off (**O**) position.
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. Loosen the two captive screws on the PSM faceplate.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull the PSM straight out of the chassis.

CAUTION: Do not touch the power connectors on back of the PSM. They can get damaged.

6. Place the PSM module into an antistatic bag.

NOTE: Each PSM slot not occupied by a AC PSM must be covered by a PSM blank panel.

Figure 333: Removing an MX2020 Router AC Power Supply Module

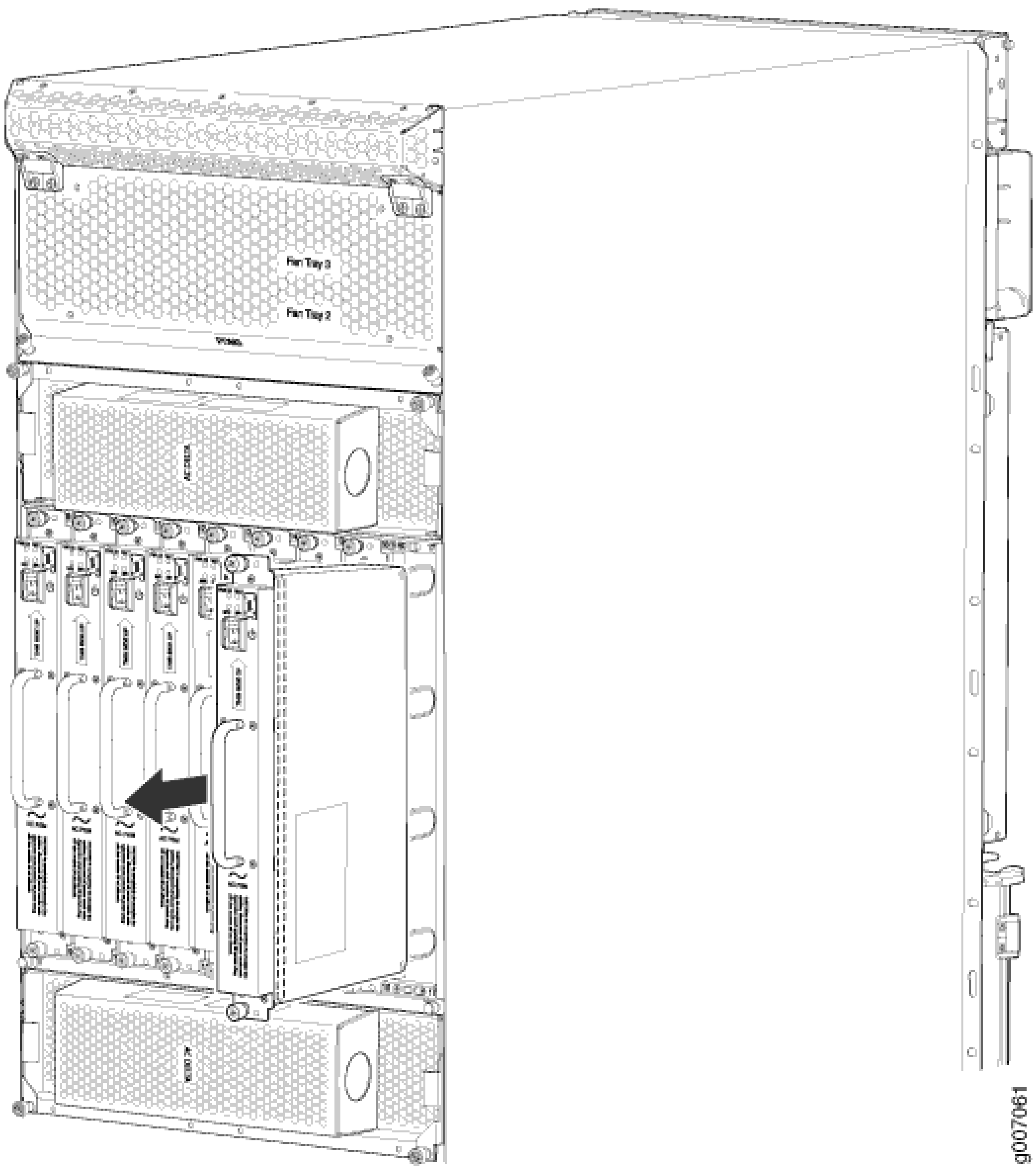


Figure 334: Removing an MX2010 Router AC Power Supply Module

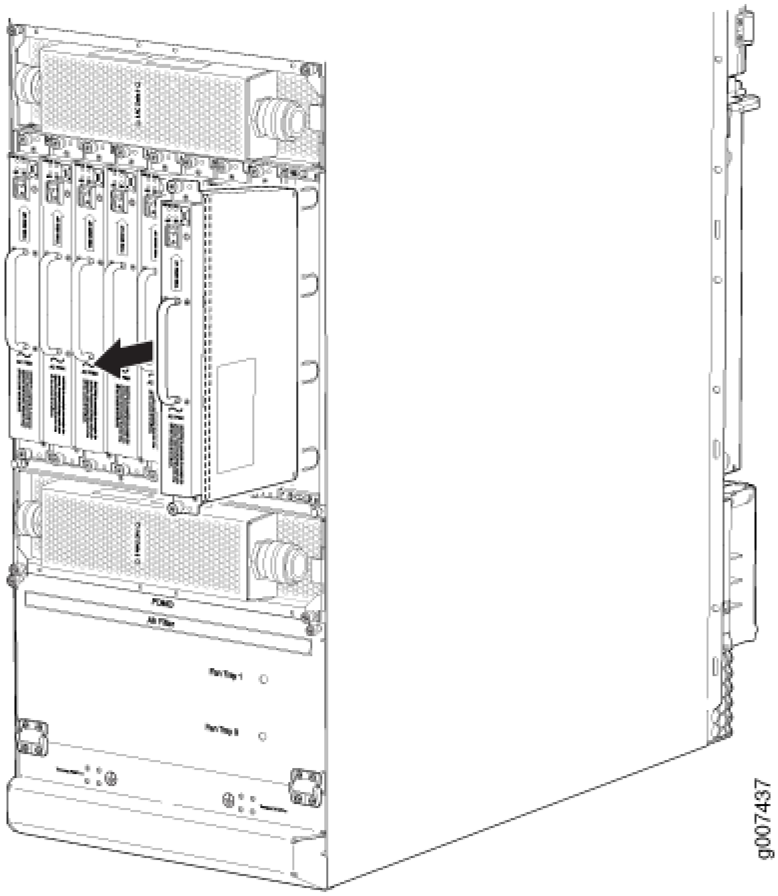
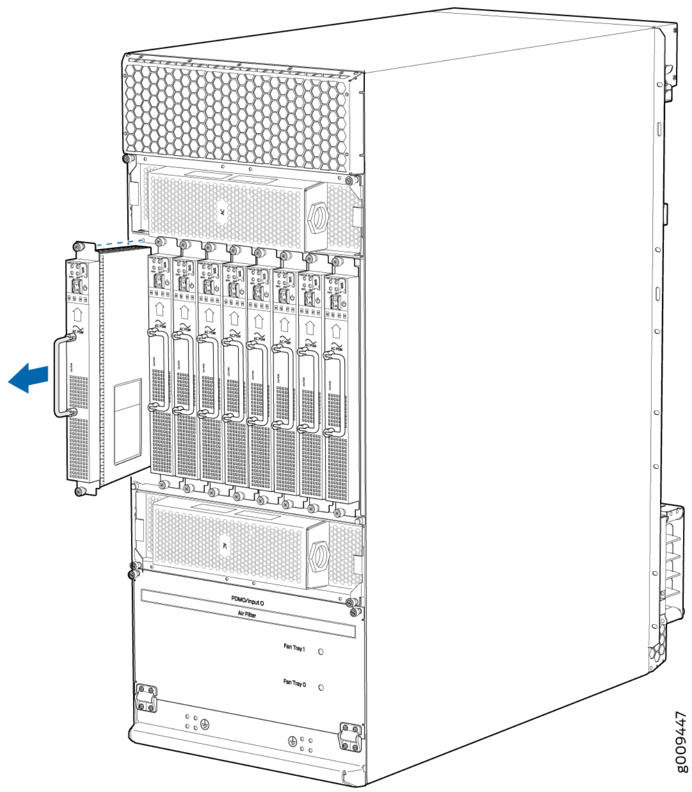


Figure 335: Removing an MX2008 AC Power Supply Module



Installing MX2000 Router AC Power Supply Modules

Before you install a PSM, be aware of the following:

NOTE: The AC PSM is hot-swappable when a minimum number of PSMs installed and operational.

WARNING: The AC PSMs have no circuit breakers that can physically disconnect AC current from the router. After AC feeds have been connected to the PDM, the AC voltage is always present on the power midplane and is distributed to the PSM connectors on the power midplane.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating PSM, each PSM slot must contain either a PSM or a blank panel. If you remove a PSM, you must install a replacement PSM or a blank panel shortly after the removal.

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

To install an AC PSM (see Figure 336 on page 665,Figure 337 on page 666, or Figure 338 on page 667:

1. With one PSM installed and operational, install an additional PSM with the power supply switch in the off (**O**), or in the on (|) position.

   WARNING: If there is only one PSM installed and operational, the power supply switch must be placed in the off (**O**) position.

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. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the power supply module into the chassis.
4. Tighten the captive screws on the PSM faceplate.
5. Turn on the power switch to the on (|) position.
6. Verify that the **PWR OK** LED is lit steadily green.

Figure 336: Installing an MX2020 Router AC Power Supply Module

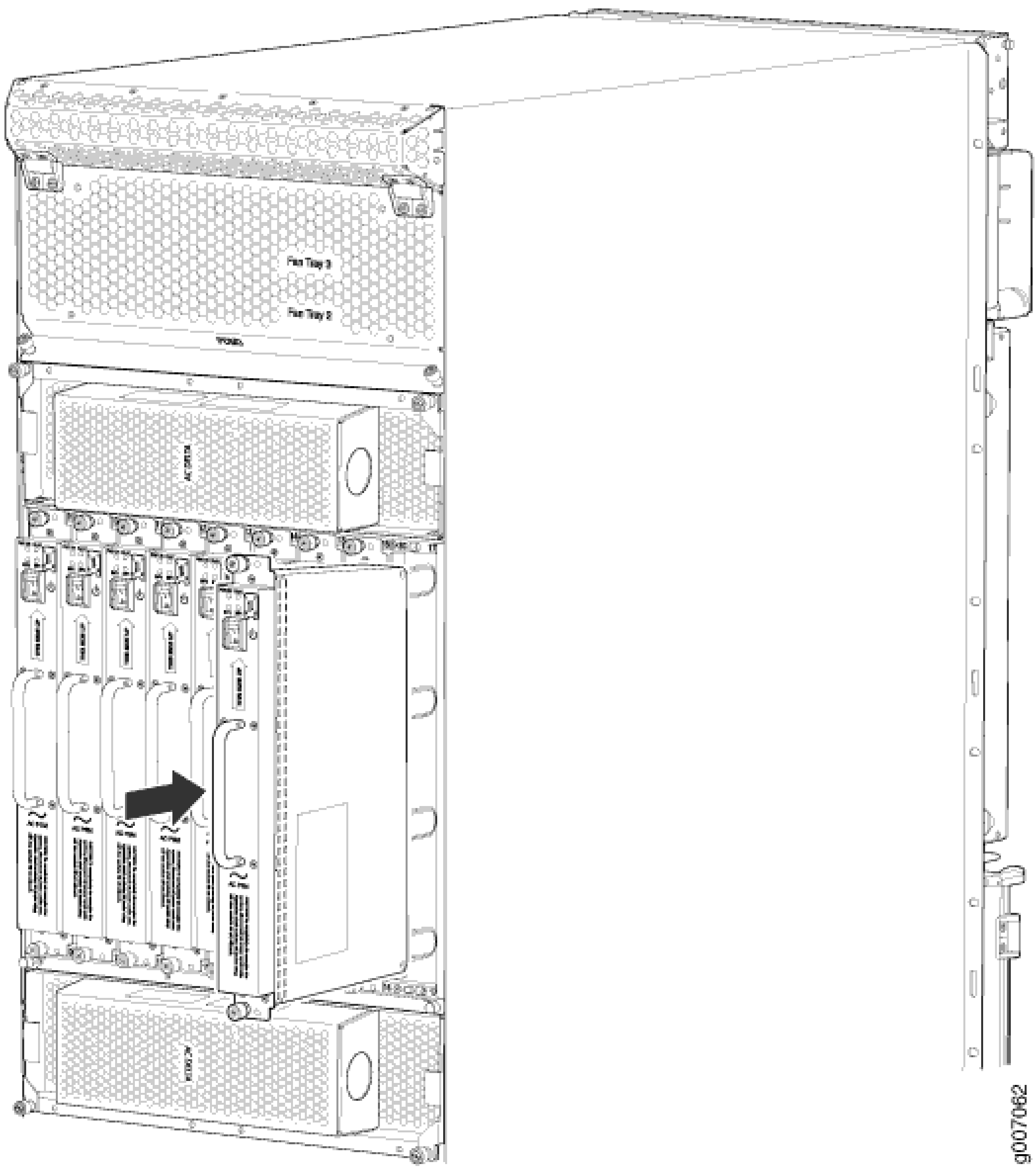


Figure 337: Installing an MX2010 Router AC Power Supply Module

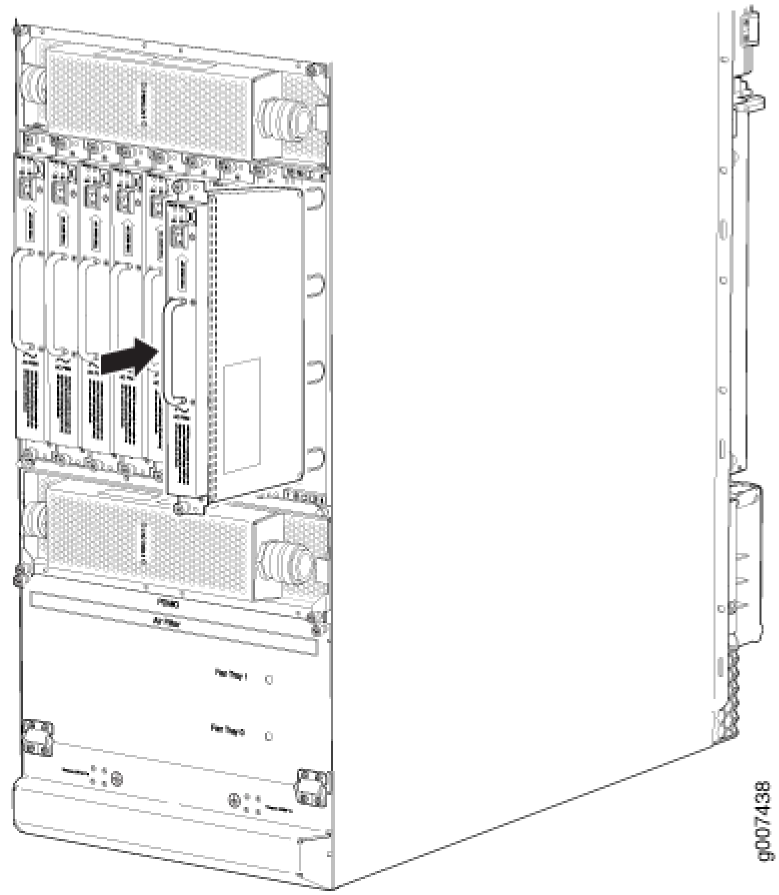
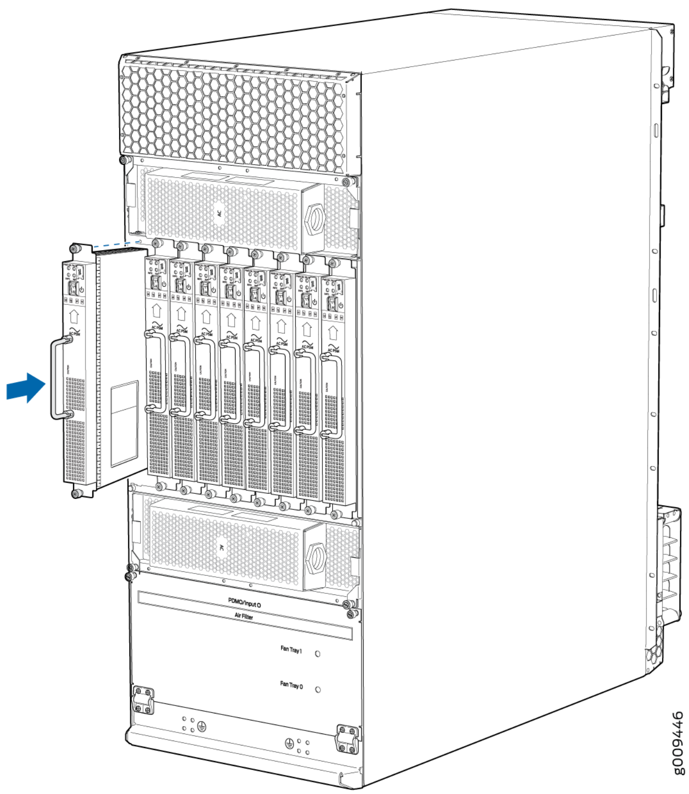


Figure 338: Installing an MX2008 Router AC Power Supply Module



RELATED DOCUMENTATION

MX2000 AC Power System Electrical Specifications | 218
Maintaining the Power Supply Modules on the MX2000 Line of Routers | 779
Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router | 812

Replacing an MX2010 Three-Phase Delta AC Power Cord

IN THIS SECTION

- Removing an MX2000 Three-Phase Delta AC Power Cord | 668

- Installing an MX2010 Three-Phase Delta AC Power Cord | **671**

The MX2010 router has either one redundant PDM or two redundant PDMs. An AC power cord on a redundant PDM is hot-insertable and hot-removable. When a redundant PDM is powered down, the other PDM automatically assumes the entire electrical load for the router. If you have only one PDM, you must power off the system before removing the AC power cord.

Removing an MX2000 Three-Phase Delta AC Power Cord

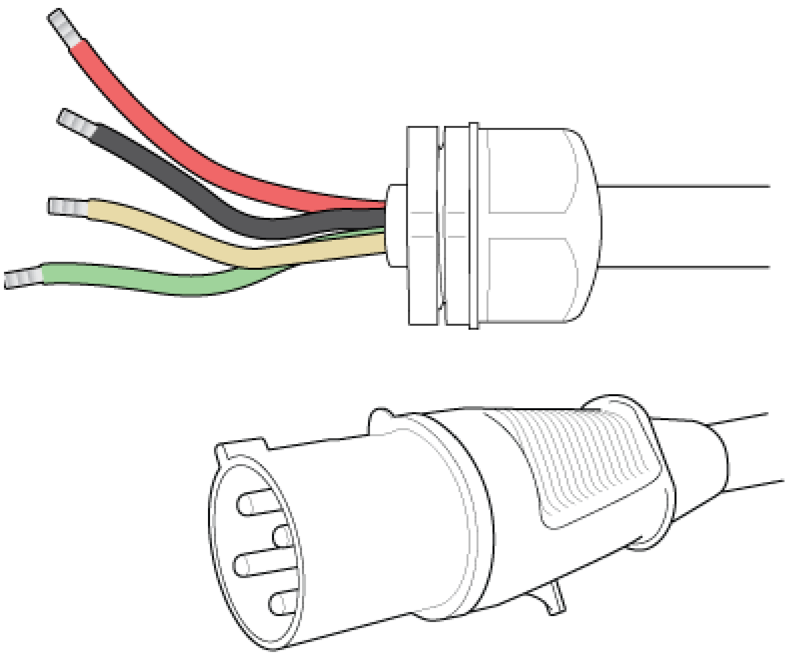
To remove a three-phase delta AC power cord:

1. Switch off the customer-site circuit breakers to the PDM being removed. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. Switch the power switch on the PSM faceplate to the off (**O**) position.

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

4. Remove the ESD grounding strap from the ESD point on the chassis, and attach it to an approved site ESD grounding point. See the instructions for your site.
5. Disconnect the AC power cord (see Figure 339 on page 669) from the power source.

Figure 339: Three-Phase Delta AC Power Cord



6. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
7. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
8. Remove the cover of the metal wiring compartment.
9. Disconnect the wires from the AC terminal block on the three-phase delta AC PDM (see Figure 340 on page 670). Loosen each of the input terminals or grounding point screws, and remove each wire from the grounding point or input terminal.

> **NOTE**: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

To remove wires from the terminal block that serves six PSMs:

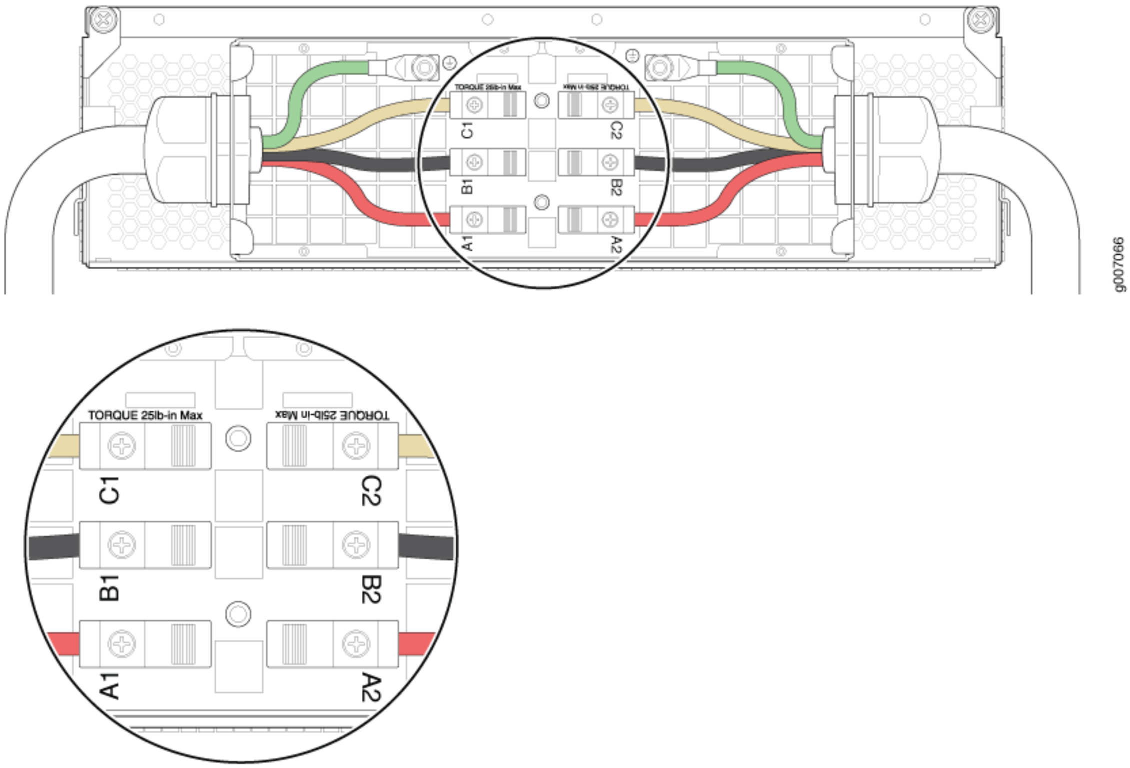
a. Remove the wire labeled **L3** from the input terminal labeled **C1**.

b. Remove the wire labeled **L2** from the input terminal labeled **B1**.

c. Remove the wire labeled **L1** from the input terminal labeled **A1**.

d. Remove the grounding wire from the grounding point labeled **GND**.

Figure 340: Disconnecting the Power Cord from a Three-Phase Delta AC Power Distribution Module



To remove wires from the terminal block that serves three PSMs:

a. Remove the wire labeled **L3** from the input terminal labeled **C2**.

b. Remove the wire labeled **L2** from the input terminal labeled **B2**.

c. Remove the wire labeled **L1** from the input terminal labeled **A2**.

d. Remove the grounding wire from the grounding point labeled **GND**.

> **NOTE**: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

10. Loosen the plastic cable tie fastening the AC power cord to the PDM.
11. Loosen and remove the retaining nut from the AC power cord.
12. Pull the AC power cord out of the metal wiring compartment.
13. Carefully move the AC power cable out of the way.
14. Disconnect the AC power cord from the AC PDM.

SEE ALSO

Installing an MX2010 Three-Phase Delta AC Power Cord | 671

Installing an MX2010 Three-Phase Delta AC Power Cord

To install a three-phase delta AC power cord:

1. Switch off the customer-site circuit breakers to the PDM being removed. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. Switch the power switches on all the PSM faceplates to the off (**O**) position for any PSMs that are powered only from this PDM.

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

4. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
5. Remove the cover of the metal AC wiring compartment.
6. Unscrew the retaining nut from the AC power cord.
7. Place the retaining nut inside the metal wiring compartment.
8. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
9. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
10. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 341 on page 672). Loosen each of the input terminal or grounding point screws, and insert the wire into the grounding point or input terminal, and tighten the screw (see Table 112 on page 673 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

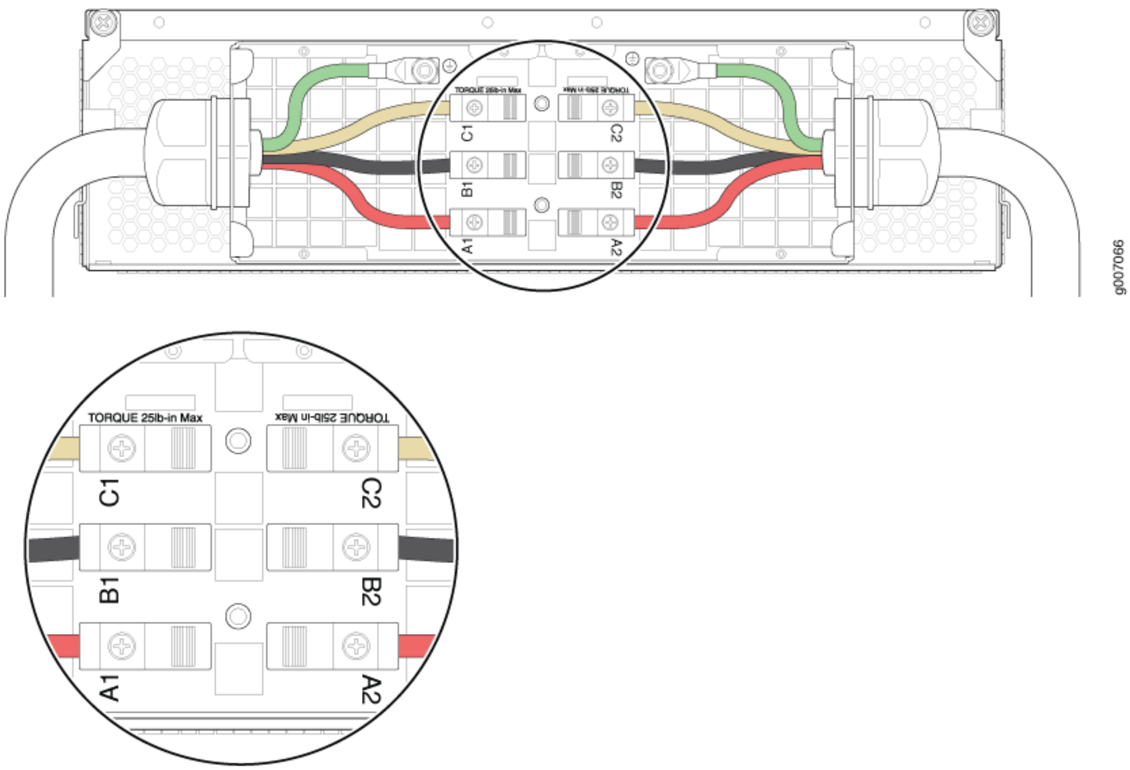
    a. Insert the grounding wire into the grounding point labeled **GND**.

    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

Figure 341: Connecting Power to a Three-Phase Delta AC Power Distribution Module



NOTE: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2010 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with disengaged PSM) to make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-B1, B1-C1, C1-A1, A2-B2, B2-C2, and C2-A2 for three-phase delta PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker, de-energizing the PDM, and install the metal cover and engage all AC PSMs.

NOTE: Three-phase delta AC wire assembly kits can be purchased from Juniper Networks.

Table 112: Supported Three-Phase Delta AC Wire Gauge

Wire Gauge	Description
4 x 6-AWG or equivalent	4 conductor wires, each wire is 6-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

WARNING: Power connections must be performed by a licensed electrician only.

11. Verify that the power cord wire connections are correct.
12. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.

13. Using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
14. 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.
15. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD ground point. See the instructions for your site.
16. Connect the AC power cord plug to the power source.
17. Switch on the customer-site circuit breakers to provide voltage to the AC power cord.
18. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
19. Verify the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.
20. Switch the power switch on the PSM to the on (|) position to provide power to the router components.

> **NOTE**: After a PDM is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDM, the command output displays, and messages on the LED display on the craft interface—to indicate that the PDM is functioning normally. Ignore error indicators that appear during the first 60 seconds.

SEE ALSO

Removing an MX2000 Three-Phase Delta AC Power Cord | 668

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
MX2000 Three-Phase Delta AC Power Distribution Module Description | 129
MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | 136
Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | 364
Troubleshooting the MX2000 Router Power System | 823
MX2000 AC Power Cord Specifications | 214
MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications | 223

Replacing an MX2000 Three-Phase Delta AC Power Distribution Module

IN THIS SECTION

- Removing an MX2000 Three-Phase Delta AC Power Distribution Module | 675
- Installing an MX2000 Router Three-Phase Delta AC Power Distribution Module | 681

Removing an MX2000 Three-Phase Delta AC Power Distribution Module

Before you remove a three-phase delta AC PDM, be aware of the following:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

WARNING: Do not touch the power connectors on the PDM. They can contain dangerous voltages.

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

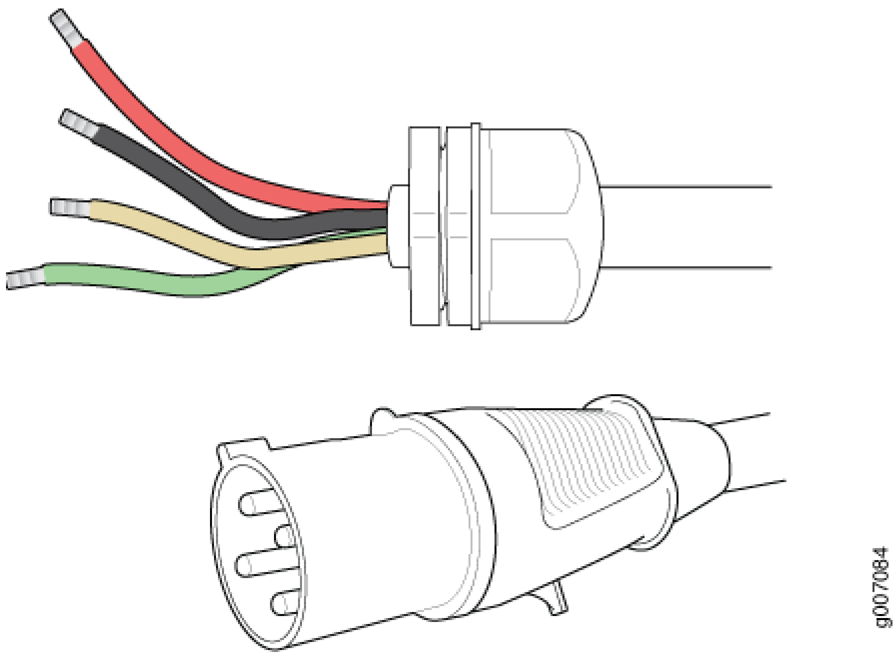
NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker to the **ON** position.

NOTE: The MX2008, MX2010, and MX2020 routers support the same power modules (AC/DC PSMs and AC/DC PDMs).

To remove a three-phase delta AC PDM:

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the removal process.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See instructions for your site.
3. Disconnect the AC power cord (see Figure 342 on page 676) from the power source.

Figure 342: Three-Phase Delta AC Power Cord



4. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
5. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
6. Remove the cover of the metal AC wiring compartment.
7. Disconnect the wires from the AC terminal block on the three-phase delta AC PDM (see Figure 343 on page 677), loosen each of the input terminals or grounding point screws, and remove each wire form the grounding point or input terminal.

   To remove wires from the terminal block that serves six PSMs:

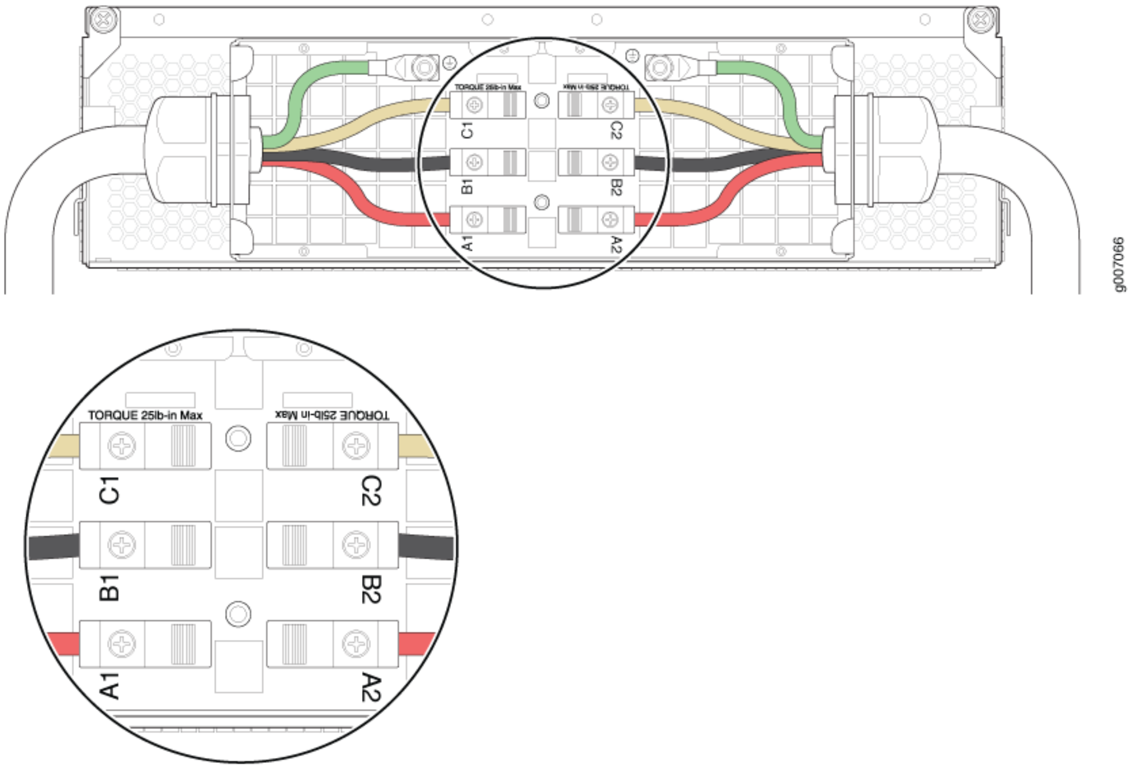
   a. Remove the wire labeled **L3** from the input terminal labeled **C1**.

   b. Remove the wire labeled **L2** from the input terminal labeled **B1**.

   c. Remove the wire labeled **L1** from the input terminal labeled **A1**.

   d. Remove the grounding wire from the grounding point labeled **GND**.

Figure 343: Disconnecting the Power Cord from a Three-Phase Delta AC Power Distribution Module



To remove wires from the terminal block that serves three PSMs:

a. Remove the wire labeled **L3** from the input terminal labeled **C2**.

b. Remove the wire labeled **L2** from the input terminal labeled **B2**.

c. Remove the wire labeled **L1** from the input terminal labeled **A2**.

d. Remove the grounding wire from the grounding point labeled **GND**.

> **NOTE**: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

> **NOTE**: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either clockwise or counterclockwise will operate correctly.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

8. Loosen the plastic cable tie fastening the AC power cord to the PDM.
9. Loosen and remove the retaining nut from the AC power cord.
10. Pull the AC power cord out of the metal wiring compartment.
11. Carefully move the AC power cable out of the way.
12. Disconnect both of the AC power cords from the AC PDM.
13. Loosen the two captive screws on the locking levers of the PDM faceplate completely.
14. Pull the locking levers on either side of the faceplate up to unseat the PDM.
15. Grasp the levers on the PDM faceplate and pull firmly. Slide it halfway out of the chassis (see Figure 344 on page 679, Figure 345 on page 680 (MX2010), and Figure 346 on page 681 (MX2008).

CAUTION: Each three-phase delta AC PDM weighs approximately 12 lb (5.44 kg). Be prepared to support the full weight of the PDM as you remove it from the router.

16. Place one hand underneath the PDM to support it, and slide it completely out of the chassis.

Figure 344: Removing a Three-Phase Delta AC Power Distribution Module (MX2020 Router)

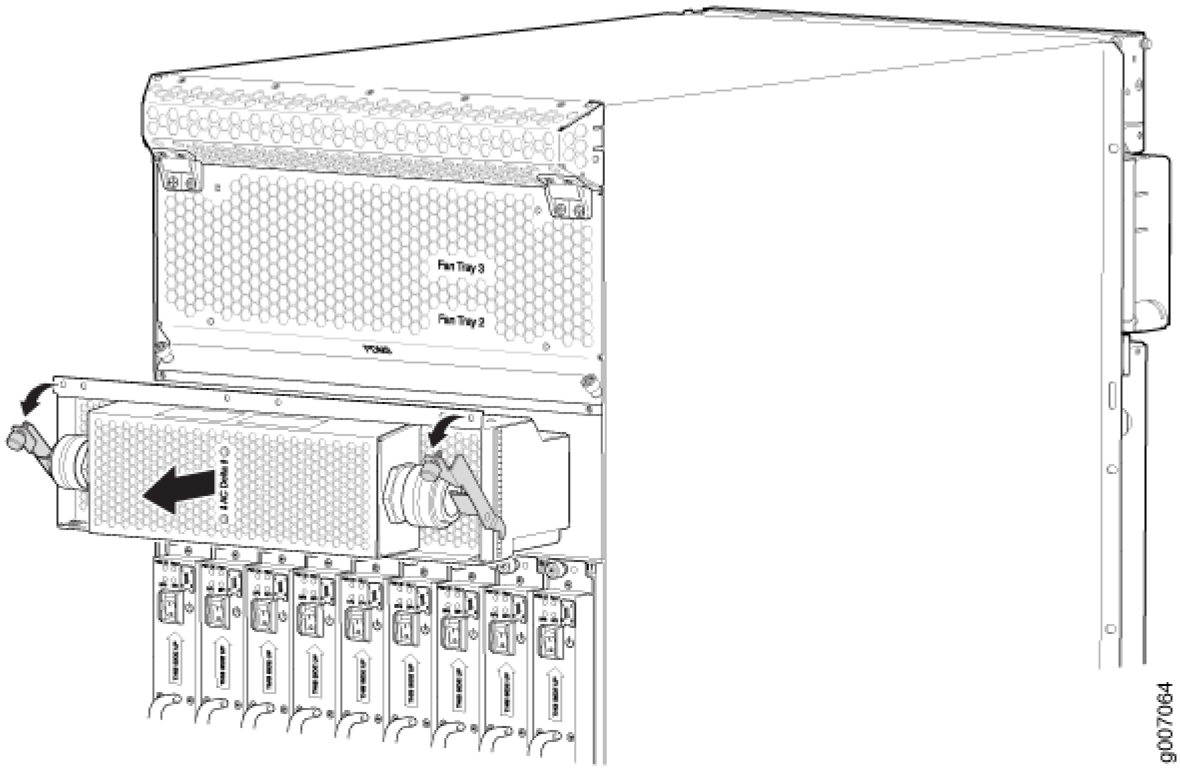


Figure 345: Removing a Three-Phase Delta AC Power Distribution Module (MX2010 Router)

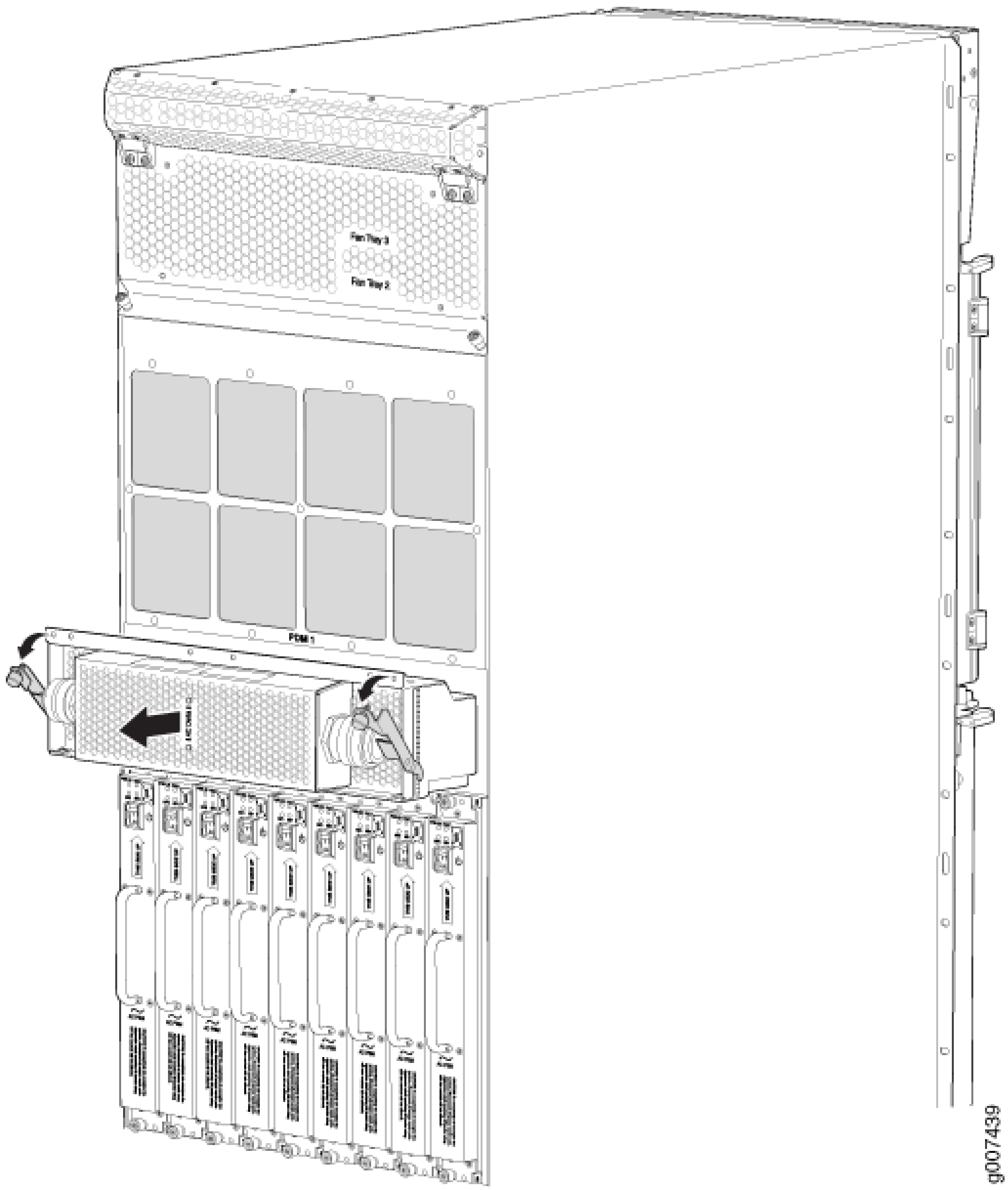
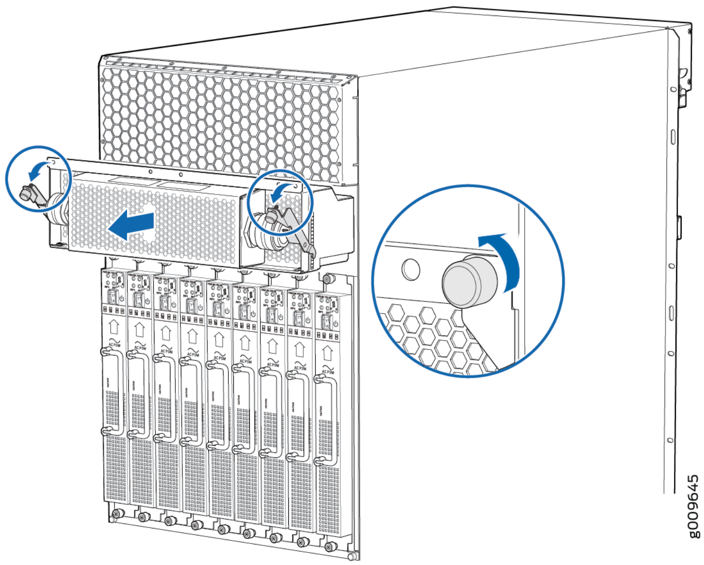


Figure 346: Removing a Three-Phase Delta AC Power Distribution Module (MX2008 Router)



NOTE: Each PDM slot not occupied by a AC PDM must be covered by a PDM blank panel.

SEE ALSO

MX2000 Three-Phase Delta AC Power Distribution Module Description | 129

MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications | 223

Installing an MX2000 Router Three-Phase Delta AC Power Distribution Module

Before you install a three-phase delta AC power distribution module (PDM), be aware of the following:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

NOTE: The PDMs are hot swappable in a redundant configuration. However, you cannot switch from one type of PDM (AC or DC) to another while the system is on.

Each three-phase delta AC PDM weighs approximately 12 lb (5.44 kg). To install a three-phase delta AC PDM:

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. [Optional]—If you are switching from a DC PDM to an AC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to AC.
4. Pull the locking levers on either side of the faceplate away until they stop.
5. Using both hands, slide the PDM into the chassis until you feel resistance (see Figure 347 on page 683Figure 348 on page 684, and Figure 349 on page 685).
6. Push the lock levers until they make contact with the PDM faceplate.
7. Tighten the two captive screws on the locking levers of the PDM faceplate to secure the PDM in the chassis. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
8. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.

Figure 347: Installing a Three-Phase Delta AC Power Distribution Module (MX2020)

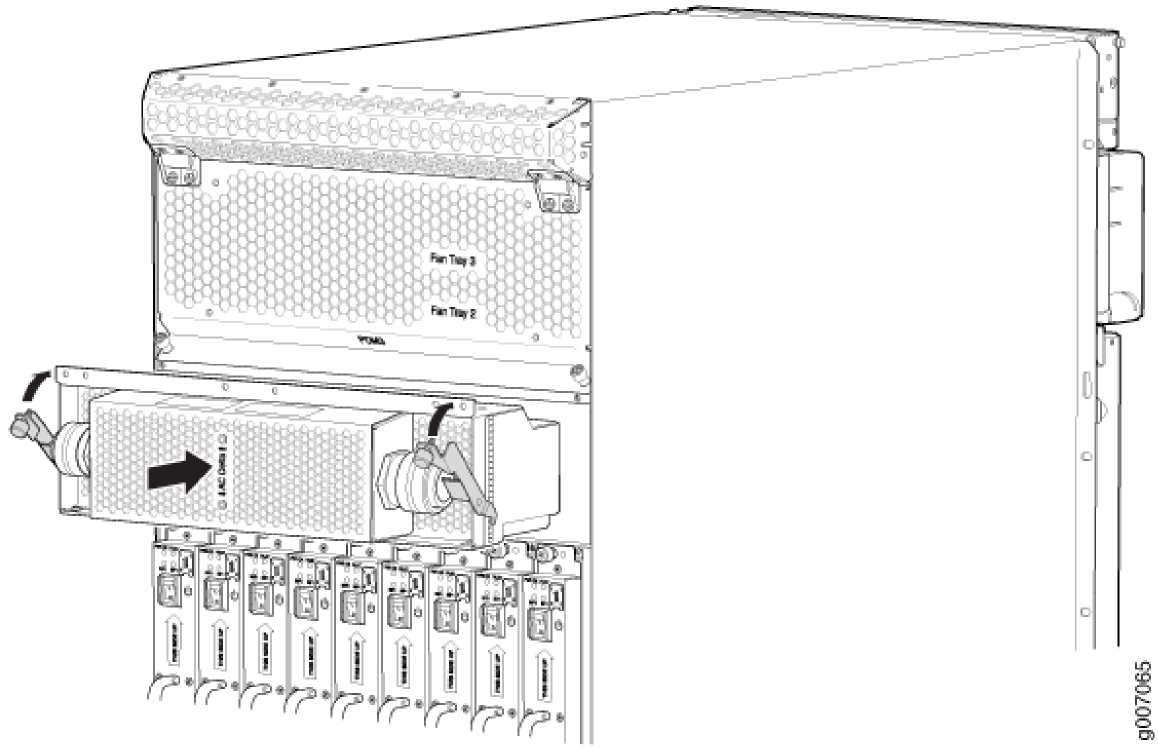


Figure 348: Installing a Three-Phase Delta AC Power Distribution Module (MX2010)

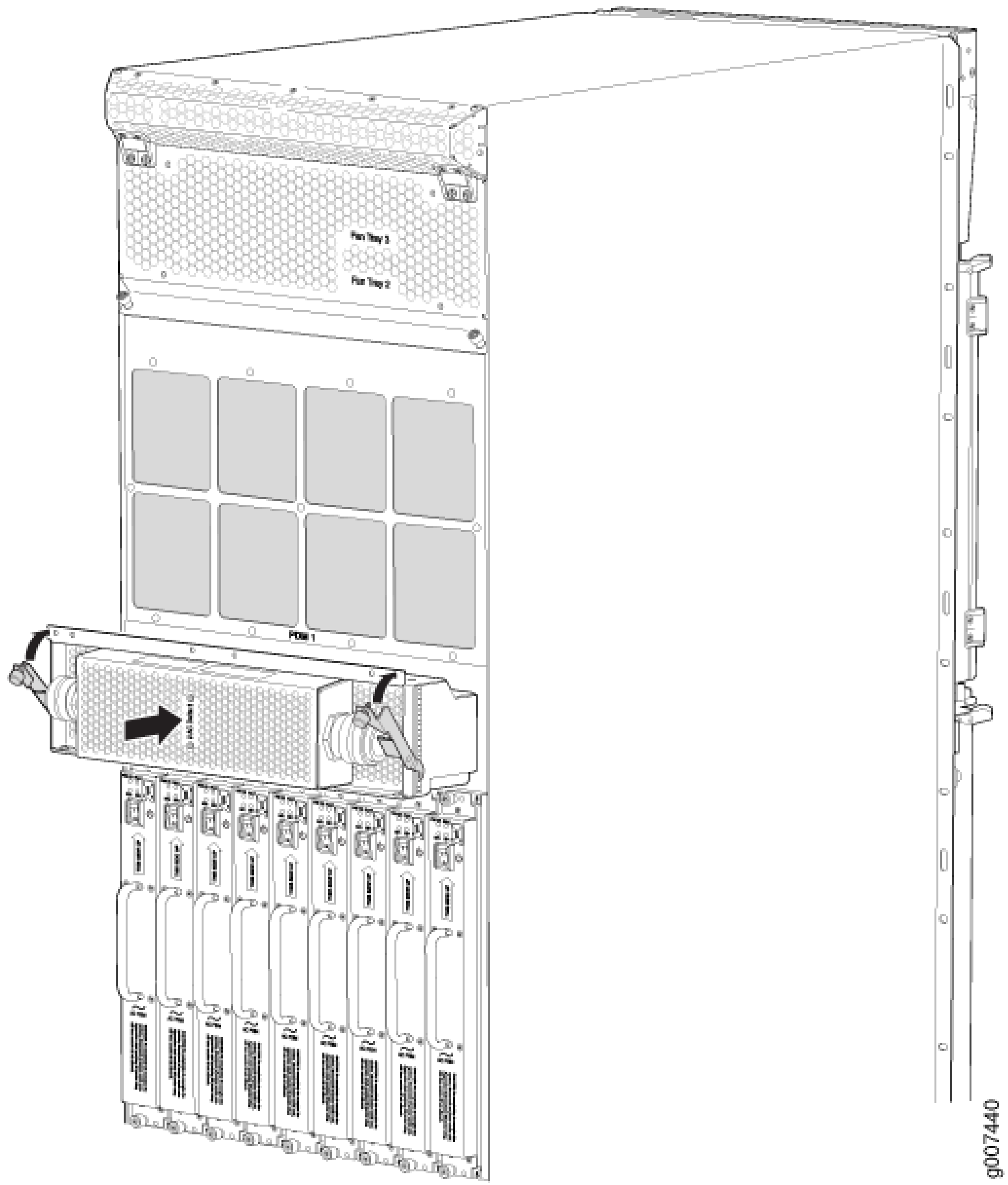
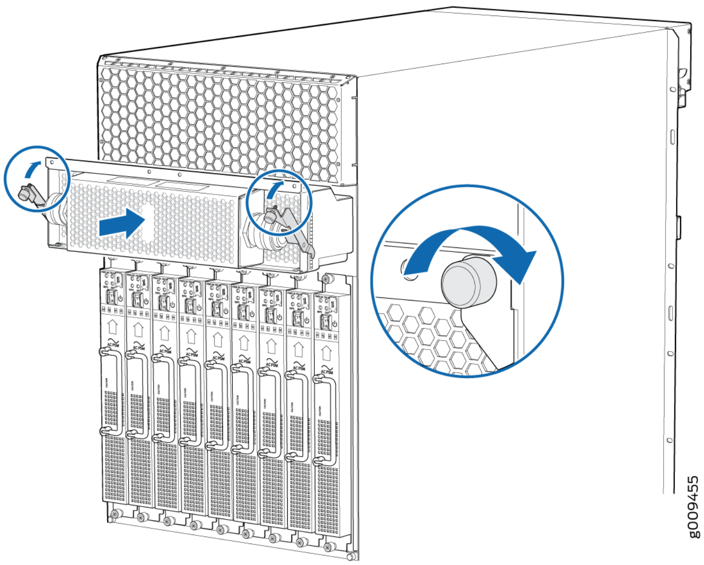


Figure 349: Installing a Three-Phase Delta AC Power Distribution Module (MX2008)



9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
14. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 350 on page 686). Loosen each of the input terminals or grounding point screws, and insert the wire into the grounding point or input terminal, and tighten the screw (see Table 113 on page 687 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

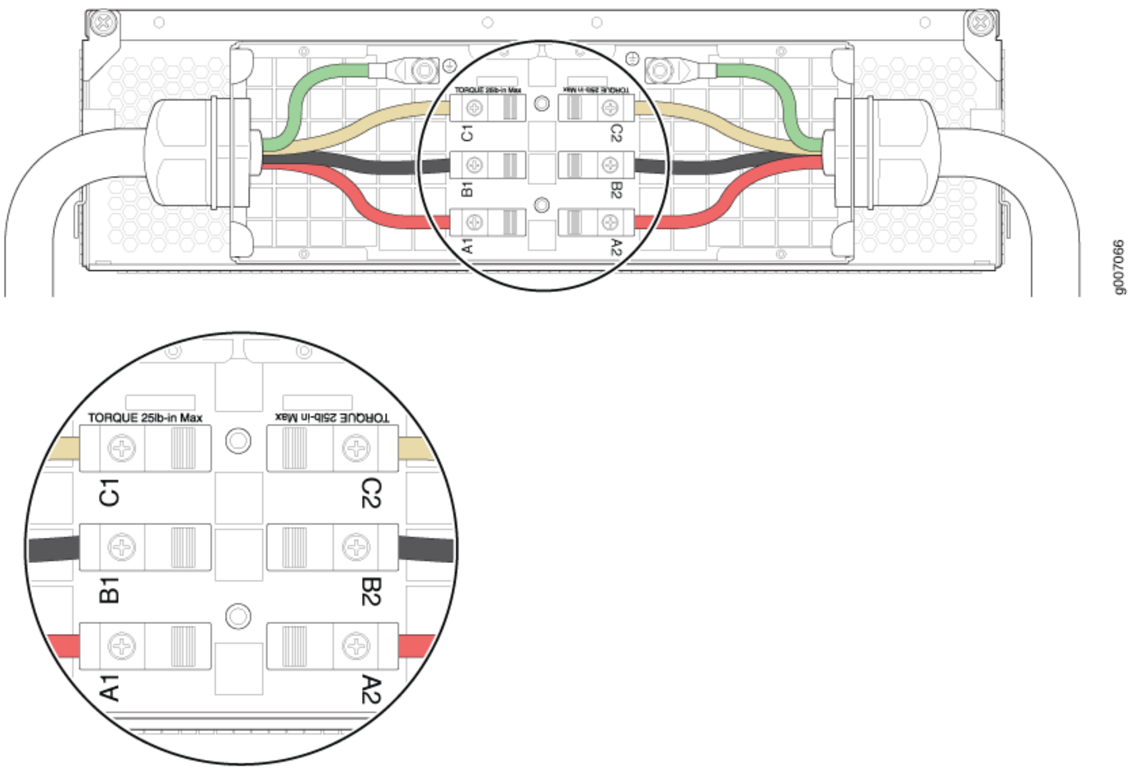
    a. Insert the grounding wire into the grounding point labeled **GND**.

    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

Figure 350: Connecting Power to a Three-Phase Delta AC Power Distribution Module



NOTE: The three-phase delta AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either clockwise or counterclockwise will operate correctly.

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with the PSM power switch turned off). Verify that the two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-B1, B1-C1, C1-A1, A2-B2, B2-C2, and C2-A2 for three-phase delta PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker to remove power from the PDM and install the metal cover.

NOTE: Three-phase delta AC wire assembly kits can be purchased from Juniper Networks.

Table 113: Supported Three-Phase Delta AC Wire Gauge

Wire Gauge	Description
4 x 6-AWG or equivalent	4 conductor wires, each wire is 6-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

WARNING: Power connections must be performed by a licensed electrician only.

15. Verify that the power cord wire connections are correct.
16. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.

17. Using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
18. 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.
19. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.
20. Connect the AC power cord plug to the power source.
21. Switch on the customer-site circuit breakers to provide voltage on the AC power cord.
22. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
23. Verify that the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.

RELATED DOCUMENTATION

MX2000 Three-Phase Delta AC Power Distribution Module Description | **129**

MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | **136**

Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules | **364**

Powering On a Three-Phase AC-Powered MX2000 Router

Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router | **812**

Troubleshooting the MX2000 Router Power System

MX2000 AC Power Cord Specifications | **214**

MX2000 AC Power System Electrical Specifications | **218**

MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications | **223**

Replacing an MX2010 Three-Phase Wye AC Power Cord

IN THIS SECTION

- Removing an MX2000 Three-Phase Wye AC Power Cord | **689**
- Installing an MX2010 Three-Phase Wye AC Power Cord | **692**

The MX2010 router has either one redundant PDM or two redundant PDMs. An AC power supply cord on a redundant PDM is hot-insertable and hot-removable. When a redundant PDM is powered down, the other PDM automatically assumes the entire electrical load for the router. If you have only one PDM, you must power off the system before removing the AC power supply cord.

Removing an MX2000 Three-Phase Wye AC Power Cord

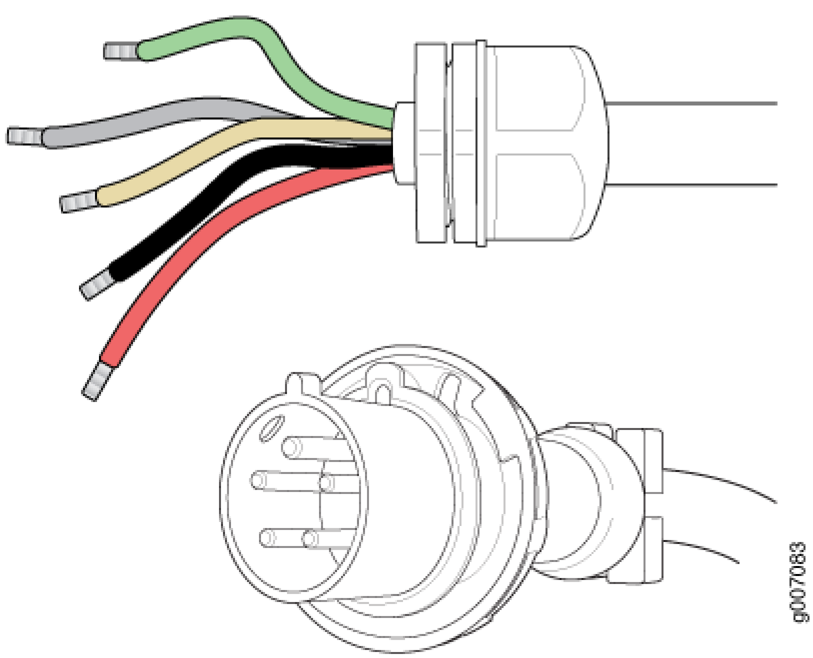
To remove a three-phase wye AC power cord:

1. Switch off the customer-site circuit breakers to the PDM being removed. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. Switch the power switch on the PSM faceplate to the off (**O**) position.

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

4. Remove the ESD grounding strap from the ESD point on the chassis, and attach it to an approved site ESD grounding point. See the instructions for your site.
5. Disconnect the AC power cord (see Figure 351 on page 689) from the power source.

Figure 351: Three-Phase Wye AC Power Supply Cord



6. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
7. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
8. Remove the cover of the metal AC wiring compartment.
9. Disconnect the wires from the AC terminal block on the three-phase wye AC PDM (see Figure 352 on page 691). Loosen each of the input terminals or grounding point screws, and remove each wire from the grounding point or input terminal.

> **NOTE**: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

To remove wires from the terminal block that serves six PSMs:

a. Remove the wire labeled **N** from the input terminal labeled **N1**.

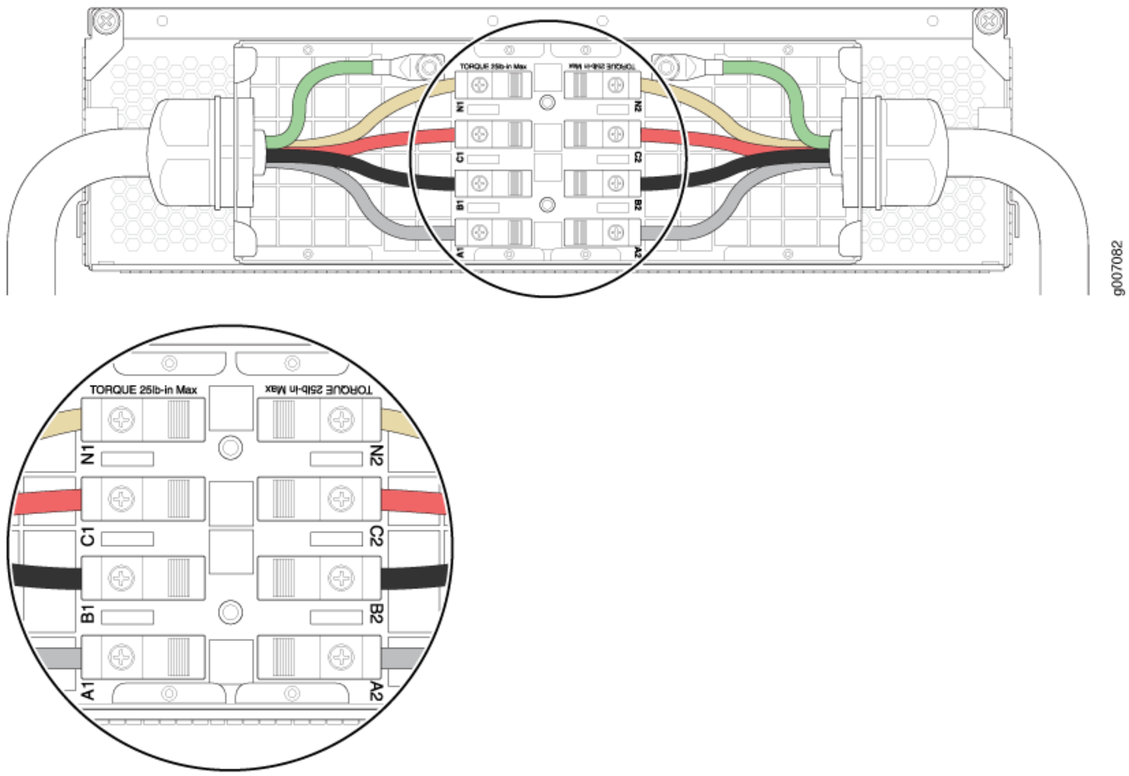
b. Remove the wire labeled **L3** from the input terminal labeled **C1**.

c. Remove the wire labeled **L2** from the input terminal labeled **B1**.

d. Remove the wire labeled **L1** from the input terminal labeled **A1**.

e. Remove the grounding wire from the grounding point labeled **GND**.

Figure 352: Disconnecting the Power Cord from a Three-Phase Wye AC Power Distribution Module



To remove wires from the terminal block that serves three PSMs:

a. Remove the wire labeled **N** from the input terminal labeled **N2**.

b. Remove the wire labeled **L3** from the input terminal labeled **C2**.

c. Remove the wire labeled **L2** from the input terminal labeled **B2**.

d. Remove the wire labeled **L1** from the input terminal labeled **A2**.

e. Remove the grounding wire from the grounding point labeled **GND**.

> **NOTE**: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

10. Loosen the plastic cable tie fastening the AC power cord to the PDM.
11. Loosen and remove the retaining nut from the AC power cord.
12. Pull the AC power cord out of the metal wiring compartment.
13. Carefully move the AC power cable out of the way.

14. Disconnect the AC power cord from the AC PDM.

SEE ALSO

Installing an MX2010 Three-Phase Wye AC Power Cord | 692

Preventing Electrostatic Discharge Damage to an MX Series Router

MX2000 Three-Phase Wye AC Power Distribution Module Description | 131

Installing an MX2010 Three-Phase Wye AC Power Cord

To install a three-phase wye AC power cord:

1. Switch off the customer-site circuit breakers to the PDM being removed. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. Switch all the power switches on the PSM faceplates to the off (**O**) position.

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

4. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
5. Remove the cover of the metal AC wiring compartment.
6. Unscrew the retaining nut from the AC power cord.
7. Place the retaining nut inside the metal wiring compartment.
8. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
9. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.
10. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 353 on page 693). Loosen each of the input terminal or grounding point screws, insert the wire into the grounding point or input terminal, and tighten the screw (see Table 114 on page 694 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

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

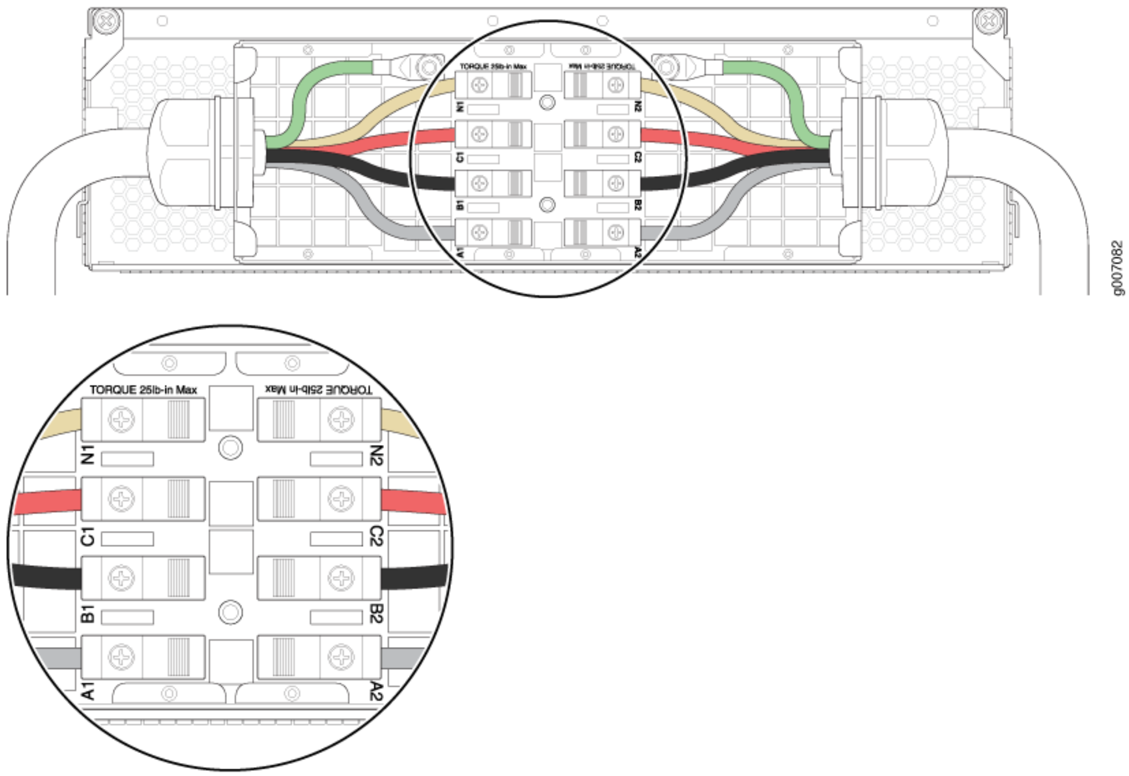
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

e. Insert the wire labeled **N** into the input terminal labeled **N1**.

Figure 353: Connecting Power to a Three-Phase Wye AC Power Distribution Module



NOTE: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

NOTE: The color of each AC power wire might vary. The MX2010 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

e. Insert the wire labeled **N** into the input terminal labeled **N2**.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with disengaged PSM) to make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker, de-energizing the PDM, and install the metal cover and engage all AC PSMs.

NOTE: Three-phase wye AC wire assembly kits can be purchased from Juniper Networks.

Table 114: Supported Three-Phase Wye AC Wire Gauge

Wire Gauge	Description
5 x 10-AWG or equivalent	5 conductor wires, each wire is 10-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

> **WARNING**: Power connections must be performed by a licensed electrician only.

11. Verify that the power cord wire connections are correct.
12. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
13. 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.
14. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD ground point. See the instructions for your site.
15. Connect the AC power cord plug to the power source.
16. Switch on the customer-site circuit breakers to provide voltage to the AC power cord.
17. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
18. Verify the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.
19. Switch the power switch on the PSM to the on (|) position to provide power to the router components.

> **NOTE**: After a PDM is powered on, it can take up to 60 seconds for status indicators—such as the LEDs on the PDM, the command output displays, and messages on the LED display on the craft interface—to indicate that the PDM is functioning normally. Ignore error indicators that appear during the first 60 seconds.

SEE ALSO

Removing an MX2000 Three-Phase Wye AC Power Cord | 689

Preventing Electrostatic Discharge Damage to an MX Series Router

MX2000 Three-Phase Wye AC Power Distribution Module Description | 131

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router

MX2000 Three-Phase Wye AC Power Distribution Module Description | 131

MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | 136

Replacing an MX2010 Three-Phase Wye AC Power Distribution Module

Troubleshooting the MX2000 Router Power System | 823

MX2000 AC Power Cord Specifications | 214

Replacing an MX2020 Three-Phase Wye AC Power Distribution Module

IN THIS SECTION

- Removing an MX2000 Three-Phase Wye AC Power Distribution Module | 696
- Installing an MX2000 Router Three-Phase Wye AC Power Distribution Module | 702

Removing an MX2000 Three-Phase Wye AC Power Distribution Module

Before you remove a three-phase wye AC Power Distribution Module (PDM), be aware of the following:

WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the AC circuit, move the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** position.

WARNING: Do not touch the power connectors on the PDM. They can contain dangerous voltages.

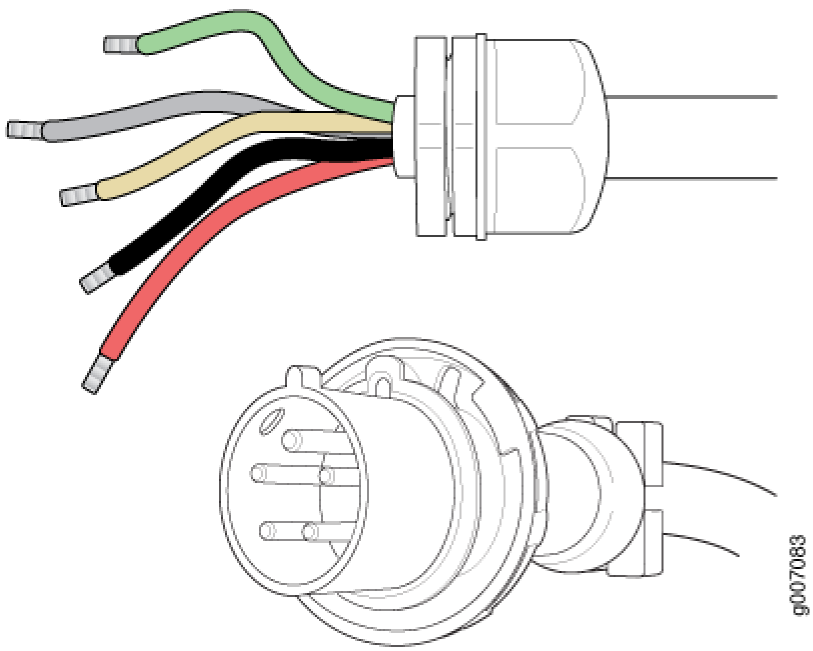
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each PDM slot must contain either a PDM or a blank panel. If you remove a PDM, you must install a replacement PDM or a blank panel shortly after the removal.

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

To remove a three-phase wye AC PDM:

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the removal process.
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. Remove the ESD grounding strap from the ESD point on the chassis, and attach it to an approved site ESD grounding point. See instructions for your site.
4. Disconnect the AC power cord (see Figure 354 on page 697) from the power source.

Figure 354: Three-Phase Wye AC Power Cord



5. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
6. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
7. Remove the cover of the metal AC wiring compartment.
8. Disconnect the wires from the AC terminal block on the three-phase wye AC PDM (see Figure 355 on page 698), loosen each of the input terminals or grounding point screws, and remove each wire from the grounding point or input terminal.

   To remove wires from the terminal block that serves six PSMs:

   a. Remove the wire labeled **N** from the input terminal labeled **N1**.

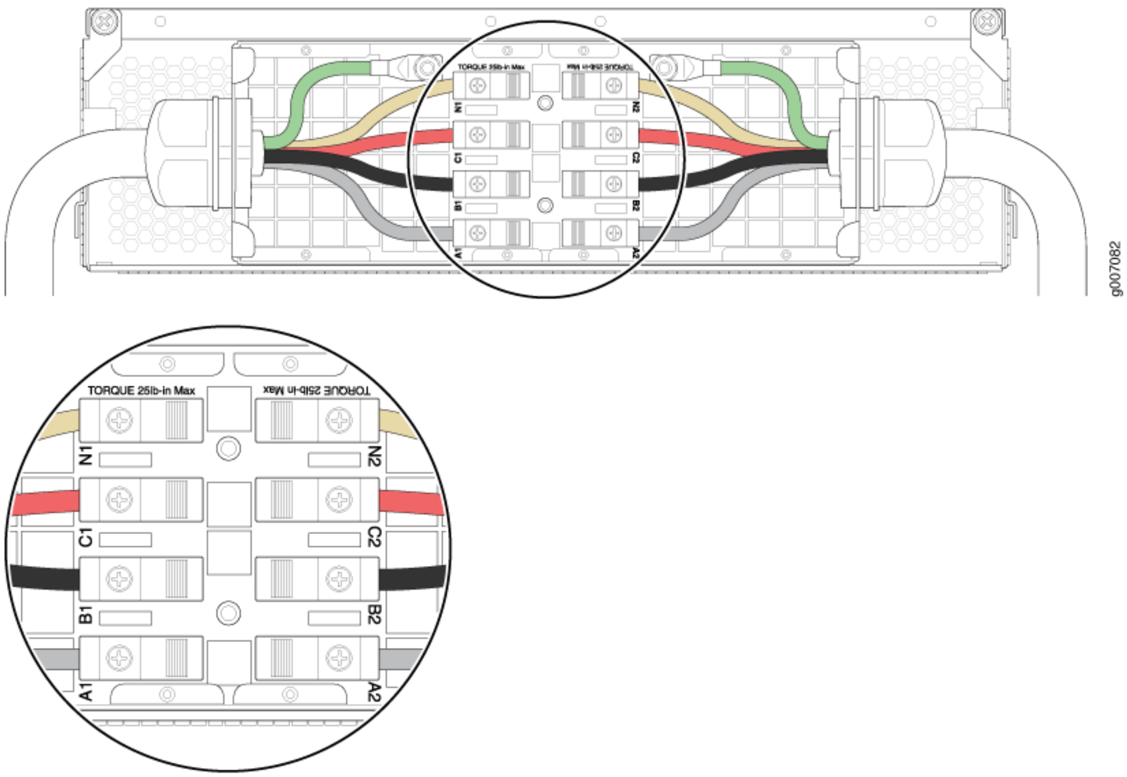
   b. Remove the wire labeled **L3** from the input terminal labeled **C1**.

c. Remove the wire labeled **L2** from the input terminal labeled **B1**.

d. Remove the wire labeled **L1** from the input terminal labeled **A1**.

e. Remove the grounding wire from the grounding point labeled **GND**.

Figure 355: Disconnecting the Power Cord from a Three-Phase Wye AC Power Distribution Module



To remove wires from the terminal block that serves three PSMs:

a. Remove the wire labeled **N** from the input terminal labeled **N2**.

b. Remove the wire labeled **L3** from the input terminal labeled **C2**.

c. Remove the wire labeled **L2** from the input terminal labeled **B2**.

d. Remove the wire labeled **L1** from the input terminal labeled **A2**.

e. Remove the grounding wire from the grounding point labeled **GND**.

NOTE: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged in to.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

9. Loosen the plastic cable tie fastening the AC power cord to the PDM.
10. Loosen and remove the retaining nut from the AC power cord.
11. Pull the AC power cord out of the metal wiring compartment.
12. Carefully move the AC power cable out of the way.
13. Disconnect the AC power cord from the AC PDM.
14. Loosen the two captive screws on the locking levers of the PDM faceplate completely.
15. Pull the locking levers on either side of the faceplate up to unseat the PDM.
16. Grasp the levers on the PDM faceplate and pull firmly. Slide it halfway out of the chassis (see Figure 356 on page 700, Figure 357 on page 701, and Figure 358 on page 702).

CAUTION: Each three-phase wye AC PDM weighs approximately 12 lb (5.44 kg). Be prepared to support the full weight of the PDM as you remove it from the router.

17. Place one hand underneath the PDM to support it, and slide it completely out of the chassis.

Figure 356: Removing an MX2020 Three-Phase Wye AC PDM

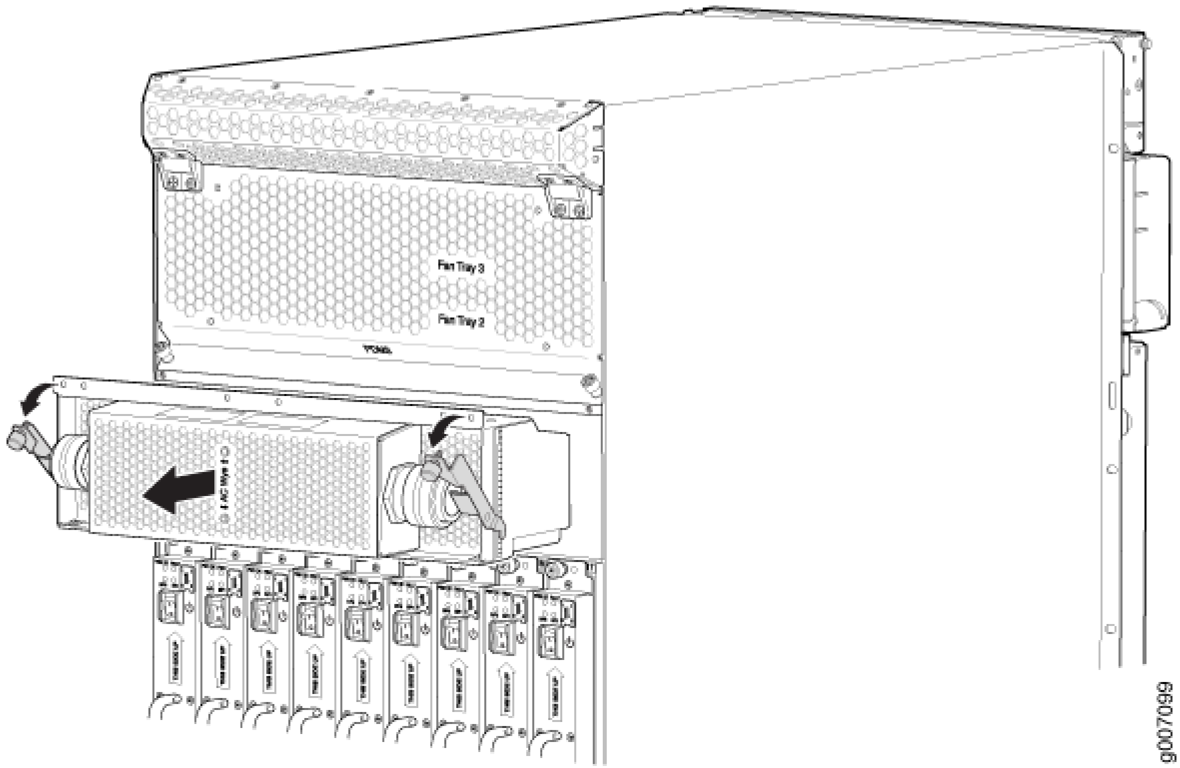


Figure 357: Removing an MX2010 Three-Phase Wye AC Power Distribution Module

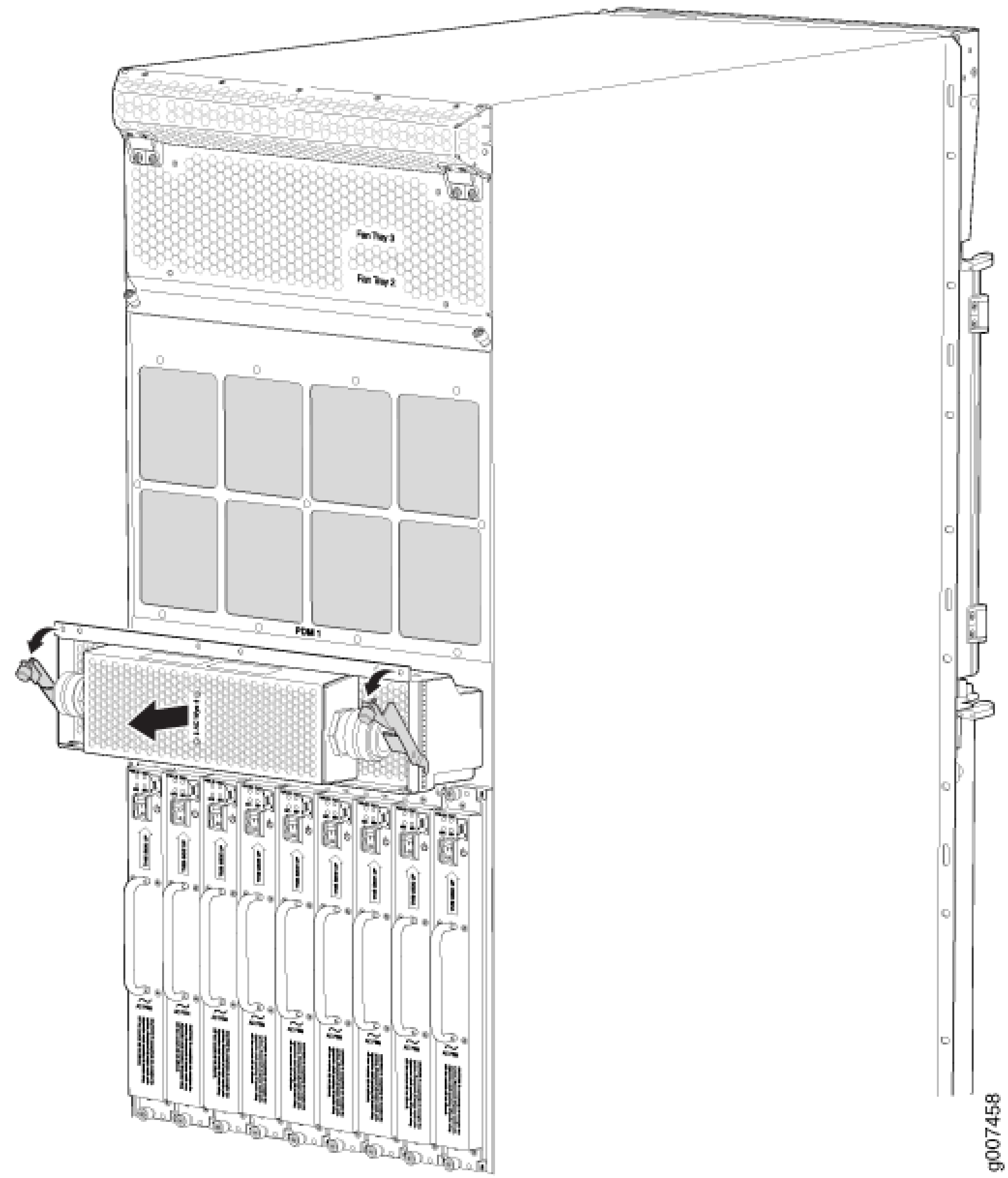
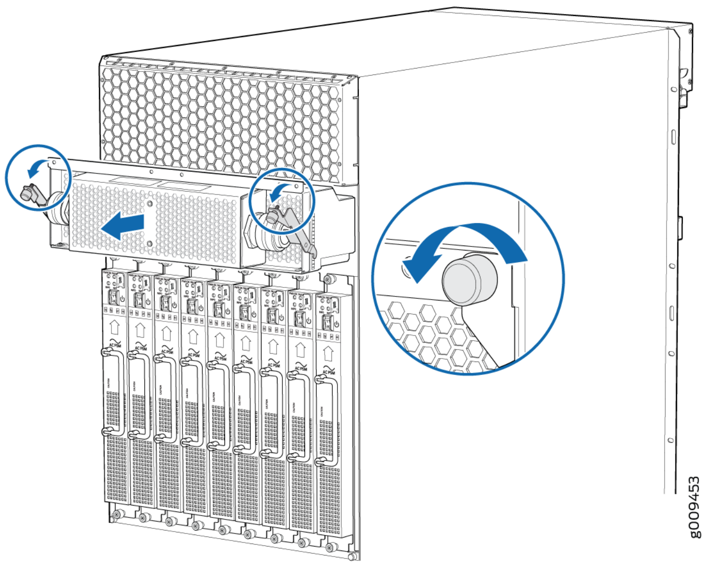


Figure 358: Removing an MX2008 Three-Phase Wye AC Power Distribution Module



NOTE: Each PDM slot not occupied by a AC PDM must be covered by a PDM blank panel.

Installing an MX2000 Router Three-Phase Wye AC Power Distribution Module

Each three-phase wye AC PDM weighs approximately 12 lb (5.44 kg). To install a three-phase wye AC PDM:

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

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

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

NOTE: The PDMs are hot swappable in a redundant configuration. However, you cannot convert to a DC configuration while the system is on.

1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
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. [Optional]—If you are switching from a DC PDM to an AC PDM, see "Converting an MX2000 Router Between AC and DC Power" on page 789 for instructions on how to change the setting on the internal bar of the power distribution unit (PDU) cage to AC.
4. Pull the locking levers on either side of the faceplate away until they stop.
5. Using both hands, slide the PDM into the chassis until you feel resistance (see Figure 359 on page 704, Figure 360 on page 705, or Figure 361 on page 706.

Figure 359: Installing a Three-Phase Wye AC PDM (MX2020)

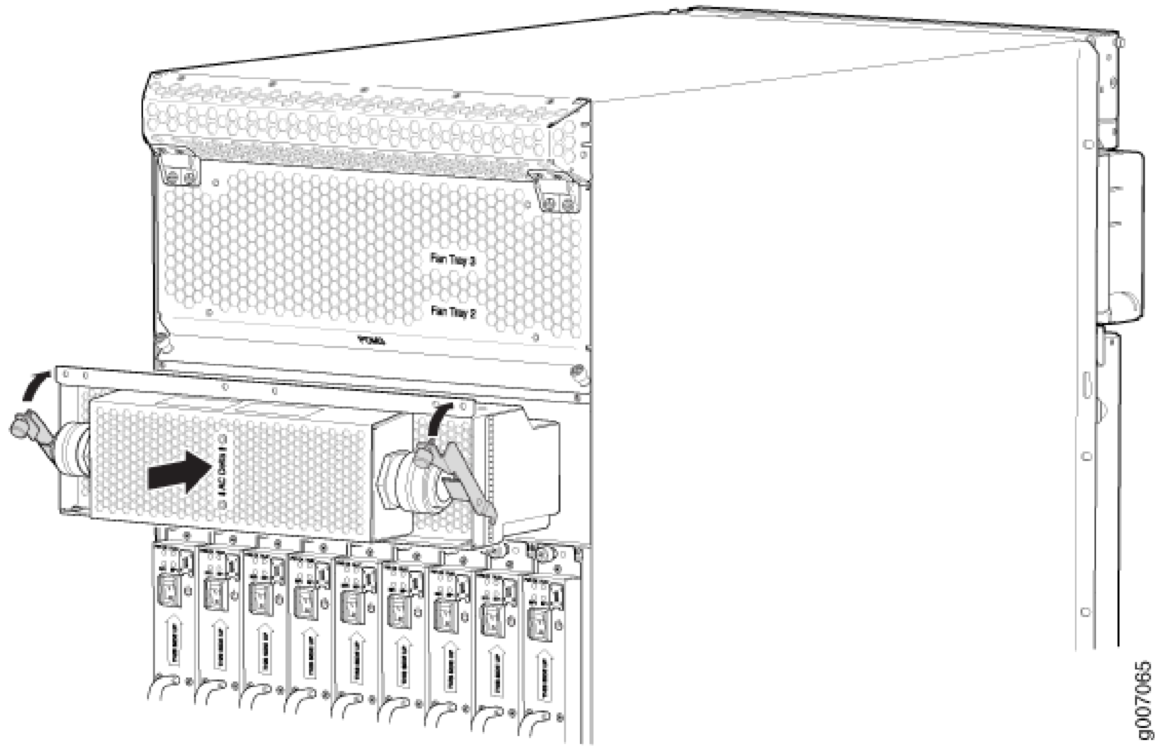


Figure 360: Installing a Three-Phase Wye AC PDM (MX2010)

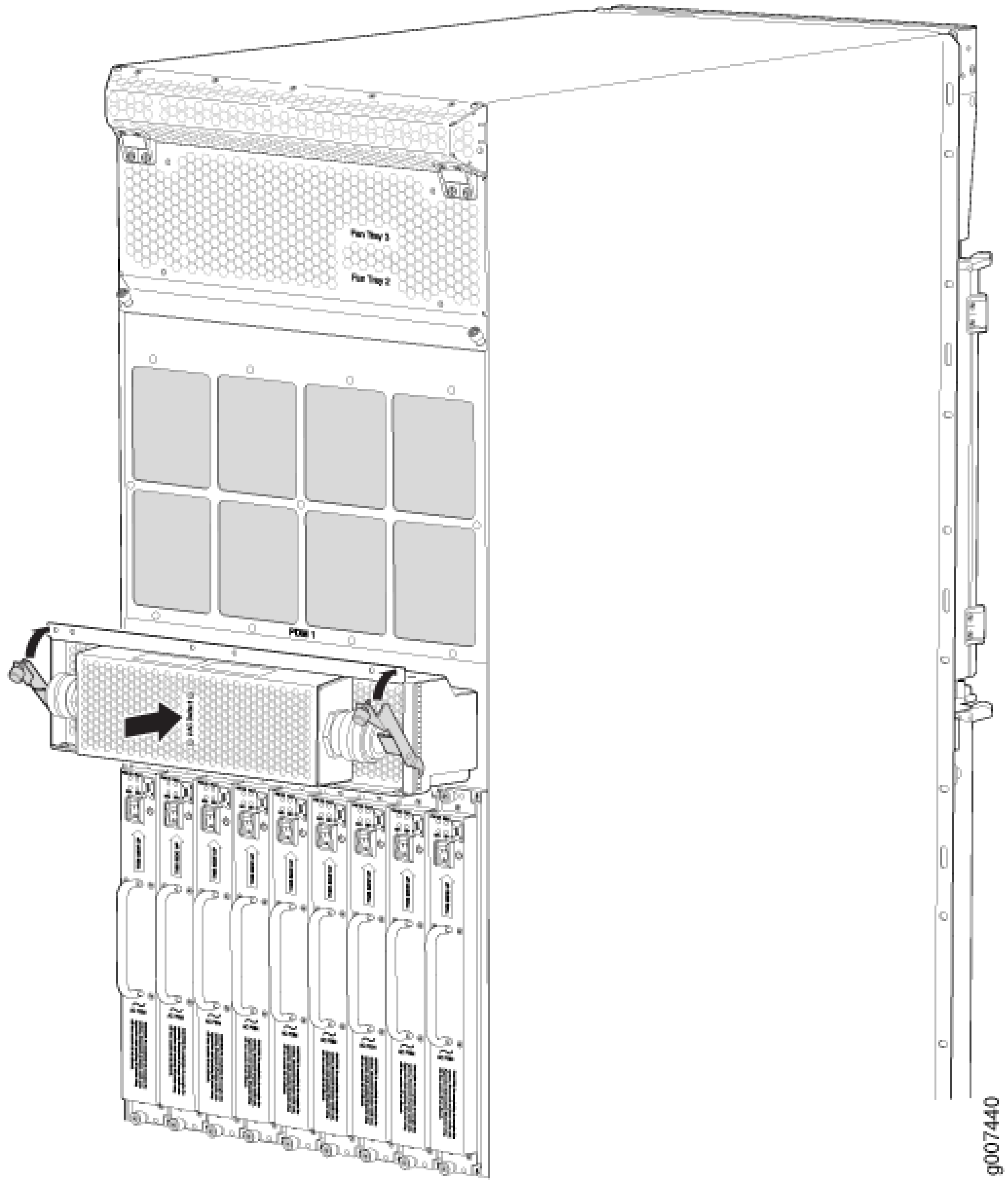
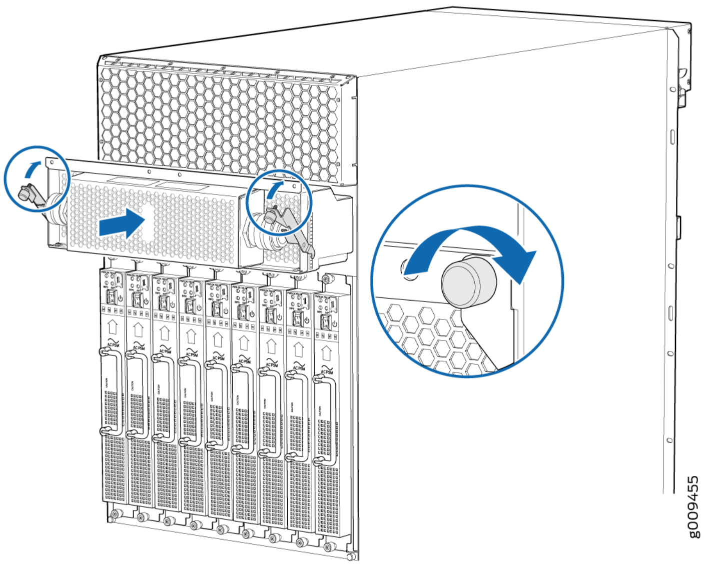


Figure 361: Installing an Three-Phase Wye AC PDM (MX2008)



6. Push the lock levers completely in until they make contact with the PDM faceplate.
7. Tighten the two captive screws on the locking levers of the PDM faceplate to secure the PDM in the chassis.
8. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects the AC terminal block.
9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Insert the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Insert the wires of the AC power cord through the hole of the metal wiring compartment.
14. Connect the wires to the AC terminal block on the three-phase wye AC PDM (see Figure 362 on page 707). Loosen each of the input terminals or grounding point screws, insert the wire into the grounding point or input terminal, and tighten the screw (see Table 115 on page 708 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

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

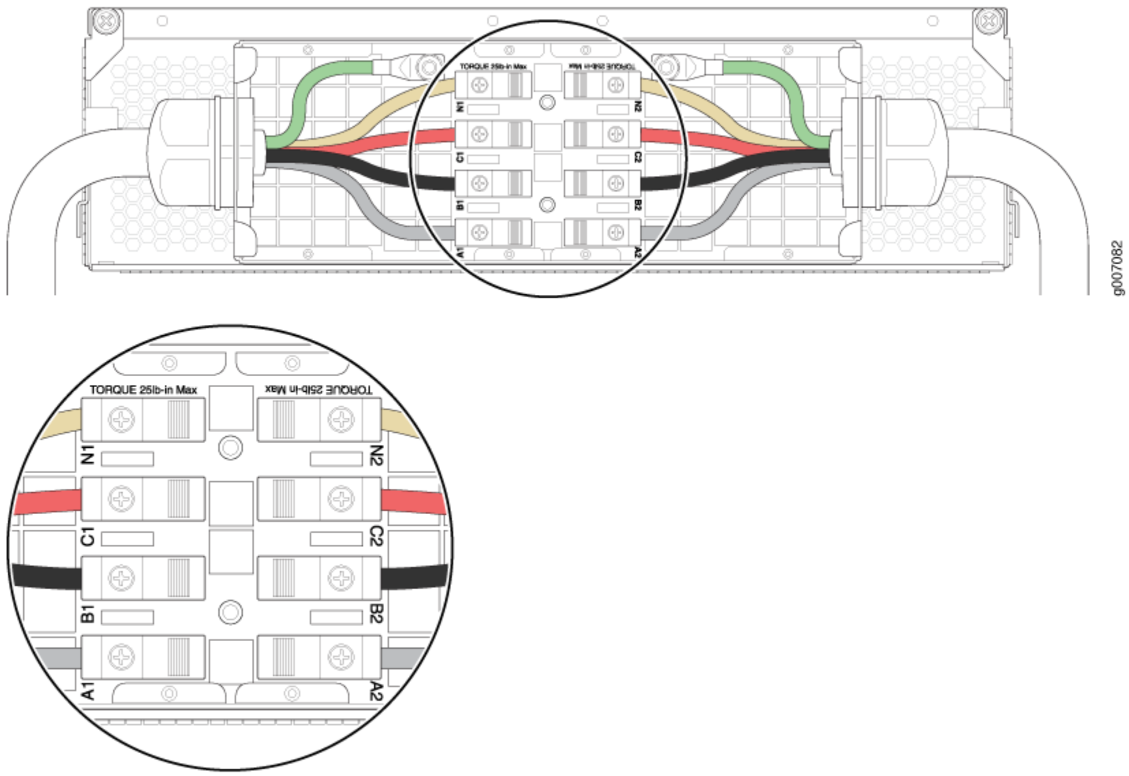
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    c. Insert the wire labeled **L2** into the input terminal labeled **B1**.

    d. Insert the wire labeled **L3** into the input terminal labeled **C1**.

    e. Insert the wire labeled **N** into the input terminal labeled **N1**.

Figure 362: Connecting Power to a Three-Phase Wye AC Power Distribution Module



> **NOTE**: The three-phase wye AC PDM terminal blocks will be flipped depending on which slot the PDM gets plugged into.

> **NOTE**: The color of each AC power wire might vary. The MX2000 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

> **CAUTION**: Wire label configuration is for Juniper Networks supplied cable only. If using your own cable, make sure you use the proper connections.

To insert wires into the terminal block that serves three PSMs:

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

b. Insert the wire labeled **L1** into the input terminal labeled **A2**.

c. Insert the wire labeled **L2** into the input terminal labeled **B2**.

d. Insert the wire labeled **L3** into the input terminal labeled **C2**.

e. Insert the wire labeled **N** into the input terminal labeled **N2**.

WARNING: To protect power supplies from input voltage that might be caused by mis-wired PDMs, before reinstalling the metal cover to the wiring compartment, apply AC voltage to the PDM (with disengaged PSM) to make sure that two LEDs on the PDM are lit green and that the AC voltage between AC terminal blocks A1-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye PDM is not more than 264 VAC when measured with a digital voltage meter (DVM). Then turn off the AC breaker de-energizing the PDM and install the metal cover and engage all AC PSMs.

NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

NOTE: Three-phase wye AC wire assembly kits can be purchased from Juniper Networks.

Table 115: Supported Three-Phase Wye AC Wire Gauge

Wire Gauge	Description
5 x 10-AWG or equivalent	5 conductor wires, each wire is 10-AWG

NOTE: We recommend that you use the proper gauge wire in order for the cable clamps to hold the AC cables. Using smaller gauge wiring will result in the cable clamps not tightening properly.

WARNING: Power connections must be performed by a licensed electrician only.

15. Verify that the power cord wire connections are correct.

16. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.
17. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
18. Verify that the AC power cord is not touching or blocking access to router components, and that it does not drape where people could trip on it.
19. Remove the ESD grounding strap from the ESD points on the chassis. Connect the strap to an approved site ESD grounding point. See the instructions for your site.
20. Connect the AC power cord plug to the power source.
21. Switch on the customer-site circuit breakers to provide voltage on the AC power cord.
22. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
23. Verify that the LED on the PDM faceplate is lit steadily, indicating that the AC terminal block is receiving power.

RELATED DOCUMENTATION

MX2000 Three-Phase AC Power Electrical Safety Guidelines

Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules | **368**

MX2000 Three-Phase Wye AC Power Distribution Module Description | **131**

MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs | **136**

Troubleshooting the MX2000 Router Power System

5

PART

Maintaining the Chassis and Components

Maintaining Components | 711

Packing and Returning Components | 808

Powering Off the Router | 812

CHAPTER 24

Maintaining Components

IN THIS CHAPTER

- Maintaining the MX2010 Adapter Cards | **712**
- Maintaining Cables That Connect to MX2010 MPCs or MICs | **713**
- Maintaining and Verifying the Status of the MX2010 Router Components | **715**
- Maintaining the MX2010 Air Filters | **716**
- Maintaining the MX2010 Air Vents | **717**
- Maintaining the MX2010 Chassis FRU Power-On Sequence | **718**
- Maintaining the MX2010 Control Boards | **719**
- Maintaining the MX2010 Cooling System Components | **721**
- Maintaining the MX2010 Cooling System Zones | **738**
- Maintaining the MX2010 Ethernet Switch | **739**
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- Maintaining the MX2010 Host Subsystem | **756**
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- Maintaining MX2010 Packet Forwarding Engine Components | **766**
- Maintaining the Power Supply Modules on the MX2000 Line of Routers | **779**
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- Converting an MX2000 Router Between AC and DC Power | **789**
- Maintaining the MX2010 Routing Engines | **792**
- Maintaining the MX2010 SFB | **794**
- Maintaining the MX2010 Switch Processor Mezzanine Board (SPMB) | **796**
- Maintaining and Verifying the MX2010 Router Version | **797**
- Maintaining and Verifying the Status of the MX2010 Craft Interface | **798**
- Taking an MX2000 Host Subsystem Offline | **800**
- Holding an MX2010 MPC | **803**

- Storing an MX2010 MPC | 806
- Routine Maintenance Procedures for the MX2010 Router | 806

Maintaining the MX2010 Adapter Cards

IN THIS SECTION

- Purpose | 712
- Action | 712

Purpose

For optimum router performance, verify the condition of the adapter cards. The router can have up to ten adapter cards mounted vertically in the line-card cage at the front of the chassis. The MPCs are installed vertically into the adapter cards.

Action

On a regular basis:

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

```
user@host> show chassis adc
Slot  State                            Uptime
 0    Online 4 hours, 7 minutes, 42 seconds
 1    Online 6 days, 22 hours, 33 minutes, 16 seconds
 2    Online 6 days, 18 hours, 49 minutes, 55 seconds
 3    Online 6 days, 18 hours, 49 minutes, 17 seconds
 4    Online 6 days, 22 hours, 32 minutes, 49 seconds
 5    Online 14 days, 2 hours, 18 minutes, 4 seconds
 6    Online 14 days, 2 hours, 17 minutes, 56 seconds
 7    Online 14 days, 2 hours, 17 minutes, 47 seconds
```

```
8    Online 14 days, 2 hours, 17 minutes, 39 seconds
9    Online 14 days, 2 hours, 17 minutes, 30 seconds
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2010 Chassis Description | 6
Replacing an MX2010 MPC and Adapter Card | 625
Connecting MPC or MIC Cables to the MX2010 Router | 409
Replacing a Cable on an MX2010 MPC or MIC | 516

Maintaining Cables That Connect to MX2010 MPCs or MICs

IN THIS SECTION

- Purpose | 713
- Action | 713

Purpose

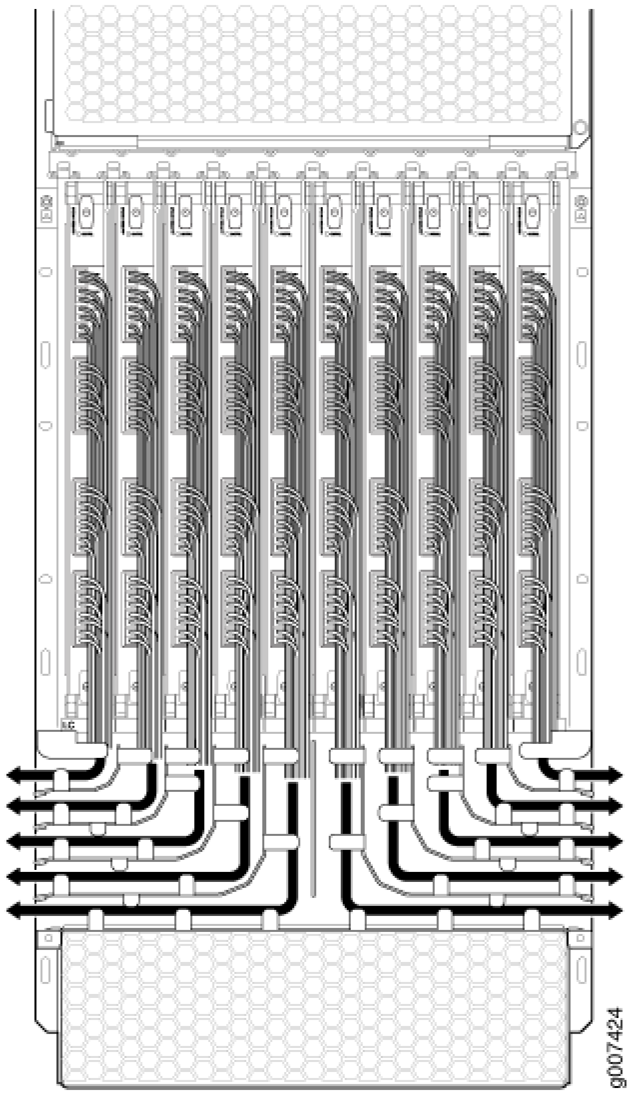
For optimum router performance, verify the condition of the cables that connect to the MPCs or MICs.

Action

On a regular basis:

- Use the lower cable manager (shown in Figure 363 on page 714) to support cables and prevent cables from dislodging or developing stress points.

Figure 363: Lower Cable Manager Cable Routing



NOTE: The MX2010 supports a standard and extended upper and lower cable manager.

- Place excess cable out of the way in the lower cable manager. Do not allow fastened loops of cable to dangle from the connector or cable manager because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them, if necessary, before connecting an interface.
- Label both ends of the cables to identify them.

The following guidelines apply specifically to fiber-optic cables:

- When you unplug a fiber-optic cable, always place a rubber safety plug over the transceiver on the faceplate and on the end of the cable.
- Anchor fiber-optic cables to avoid stress on the connectors. Be sure to secure fiber-optic cables so that they do not support their own weight as they hang to the floor. Never let fiber-optic cable hang free from the connector.
- Avoid bending fiber-optic cable beyond its bend radius. An arc smaller than a few inches can damage the cable and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments can cause damage to the instruments 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.

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

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

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

Maintaining MX2010 MPCs | 763

Maintaining MX2010 MICs | 760

Maintaining and Verifying the Status of the MX2010 Router Components

- "Maintaining the MX2010 Air Filters" on page 716
- "Maintaining the MX2010 Air Vents" on page 717

- "Maintaining the MX2010 Host Subsystem" on page 756
- "Maintaining the MX2010 Control Boards" on page 719
- "Maintaining the MX2010 Cooling System Components" on page 721
- "Maintaining the MX2010 Cooling System Zones" on page 738
- "Maintaining the MX2010 Fan Trays" on page 743
- "Maintaining the Power Supply Modules on the MX2000 Line of Routers" on page 779
- "Maintaining the MX2010 Power Usage" on page 782
- "Maintaining the MX2010 Routing Engines" on page 792
- "Maintaining the MX2010 SFB" on page 794
- "Maintaining the MX2010 Switch Processor Mezzanine Board (SPMB)" on page 796
- "Maintaining and Verifying the MX2010 Router Version" on page 797
- "Maintaining and Verifying the Status of the MX2010 Craft Interface" on page 798

Maintaining the MX2010 Air Filters

IN THIS SECTION

- Purpose | 716
- Action | 716

Purpose

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

Action

On a regular basis:

- Check the air filters for dust and debris. Replace the filter elements. The filter elements degrade over time, so the filter elements in use, as well as spares, must be replaced every 6 months.

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

- 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.

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

MX2010 Cooling System Description | 51

Replacing the MX2010 Air Filters | 522

Installing the MX2010 Air Filter | 422

Maintaining the MX2010 Air Vents

IN THIS SECTION

- Purpose | 717
- Action | 717

Purpose

For optimum cooling, verify the condition of the air vents. Dust can clog air vents, reducing cooling system efficiency.

Action

On a regular basis, check the vents and clean them as necessary.

RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188
MX2010 Cooling System Description | 51

Maintaining the MX2010 Chassis FRU Power-On Sequence

IN THIS SECTION

- Purpose | 718
- Action | 718

Purpose

For optimum router performance, verify the condition of the FRU power-on sequence.

Action

On a regular basis:

- Check the status of the MX2010 chassis FRU power on-sequence by issuing the `show chassis power sequence` command.

  The following output displays the chassis FRU power-on sequence:

```
user@host> show chassis power sequence
Chassis FRU Power On Sequence: 0 1 2 3 4 5 6 7 8 9
```

NOTE: Because the MPCs are combined with the adapter cards, the MPCs might not boot up in a specific power-on sequence.

RELATED DOCUMENTATION

MX2010 Power System Description | 121
Troubleshooting the MX2000 Router Power System
Maintaining the MX2010 Power Usage | 782
Preventing Electrostatic Discharge Damage to an MX Series Router
Troubleshooting the MX2000 Router Power System

Maintaining the MX2010 Control Boards

IN THIS SECTION

- Purpose | 719
- Action | 719

Purpose

For optimum router performance, verify the condition of the Control Board and Routing Engine (CB-RE).

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs and the display, see "MX2010 Craft Interface Description " on page 34 .

  During normal operations:

  - The green host subsystem **ONLINE** LED on the craft interface is lit.
  - The red host subsystem **OFFLINE** LED on the craft interface is not lit.

- Check the LEDs on the Control Board portion of the CB-RE faceplate.

  During normal operations:

  - The green **OK** LED on the CB-RE faceplate is lit.
  - The red **FAIL** LED on the CB-RE faceplate is not lit.

- Issue the `show chassis environment cb` command to check the status of the CB-REs. The output is similar to the following:

```
user@host> show chassis environment cb

CB 0 status:
  State                         Online Master
  IntakeA-Zone0 Temperature  30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature  33 degrees C / 91 degrees F
  IntakeC-Zone0 Temperature  37 degrees C / 98 degrees F
  ExhaustA-Zone0 Temperature 33 degrees C / 91 degrees F
  ExhaustB-Zone1 Temperature 33 degrees C / 91 degrees F
  TCBC-Zone0 Temperature     35 degrees C / 95 degrees F
  Power 1
    1.0 V                     1011 mV
    1.2 V                     1211 mV
    1.8 V                     1814 mV
    2.5 V                     2545 mV
    3.3 V                     3319 mV
    5.0 V                     5014 mV
    5.0 V RE                  4962 mV
    12.0 V                   12123 mV
    12.0 V RE                12007 mV
  Bus Revision               100
  FPGA Revision              270
CB 1 status:
  State                         Online Standby
  IntakeA-Zone0 Temperature  30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature  31 degrees C / 87 degrees F
  IntakeC-Zone0 Temperature  33 degrees C / 91 degrees F
  ExhaustA-Zone0 Temperature 32 degrees C / 89 degrees F
  ExhaustB-Zone1 Temperature 31 degrees C / 87 degrees F
  TCBC-Zone0 Temperature     34 degrees C / 93 degrees F
  Power 1
    1.0 V                     1008 mV
    1.2 V                     1211 mV
    1.8 V                     1798 mV
    2.5 V                     2520 mV
    3.3 V                     3312 mV
    5.0 V                     5020 mV
    5.0 V RE                  4962 mV
    12.0 V                   12065 mV
```

```
  12.0 V RE                 11988 mV
Bus Revision                100
FPGA Revision               0
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

Maintaining the MX2010 Cooling System Components

IN THIS SECTION

- Maintaining the MX2010 Air Vents | 721
- Maintaining the MX2010 Air Filters | 722
- Maintaining the MX2010 Air Baffle | 723
- Maintaining the MX2010 Fan Trays | 724
- Maintaining the MX2010 Cooling System Zones | 736

Maintaining the MX2010 Air Vents

IN THIS SECTION

- Purpose | 721
- Action | 721

Purpose

For optimum cooling, verify the condition of the air vents. Dust can clog air vents, reducing cooling system efficiency.

Action

On a regular basis, check the vents and clean them as necessary.

SEE ALSO

Clearance Requirements for Airflow and Hardware Maintenance for the MX2010 Router | 188
MX2010 Cooling System Description | 51

Maintaining the MX2010 Air Filters

IN THIS SECTION

- Purpose | 722
- Action | 722

Purpose

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

Action

On a regular basis:

- Check the air filters for dust and debris. Replace the filter elements. The filter elements degrade over time, so the filter elements in use, as well as spares, must be replaced every 6 months.

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

- 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.

SEE ALSO

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280
MX2010 Router Hardware Components and CLI Terminology | 29

MX2010 Cooling System Description | 51
Replacing the MX2010 Air Filters | 522
Installing the MX2010 Air Filter | 422

Maintaining the MX2010 Air Baffle

IN THIS SECTION

- Purpose | 723
- Action | 724

Purpose

For optimum cooling, visually inspect the condition of the air baffle (see Figure 364 on page 723 and Figure 365 on page 724).

NOTE: The air baffle is optional.

Figure 364: Air Baffle - Fixed Louvers

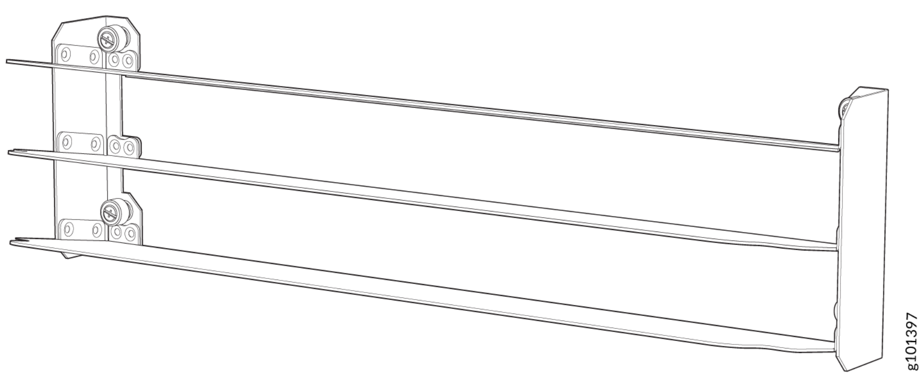
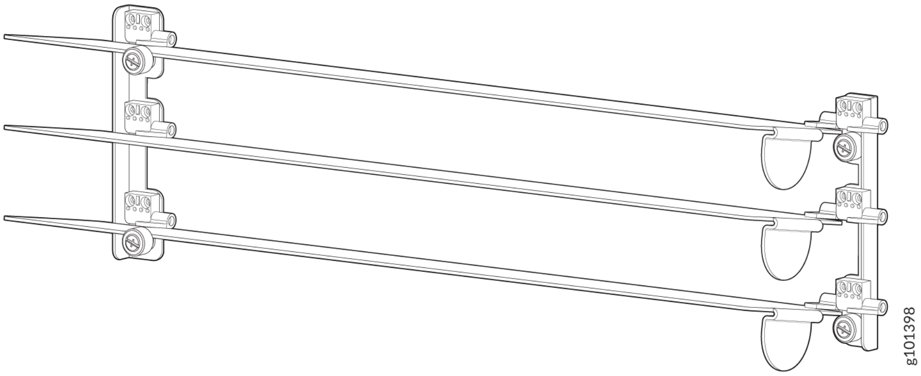


Figure 365: Air Baffle - Adjustable Louvers



Action

- Check the air baffle with adjustable louvers on a regular basis and adjust its louvers to a 10-degree upward tilt/angle to direct the exhaust air away from the router.

SEE ALSO

Tools and Parts Required for Replacing MX2010 Hardware Components | 501
MX2010 Cooling System Description | 51

Maintaining the MX2010 Fan Trays

IN THIS SECTION

- Purpose | 724
- Action | 724

Purpose

For optimum cooling, verify the condition of the fans.

Action

- Monitor the status of the fans. The fan trays each contain multiple fans that work in unison to cool the router 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. During normal operation, the fans in each fan tray function at normal speed.

- To display the status of the cooling system, issue the `show chassis environment` command, `show chassis environment monitored` command, `show chassis temperature-thresholds` command, or `show chassis fan` command.

  For the fan trays, the output for the `show chassis environment` command is similar to the following:

```
user@host> show chassis environment
Class Item                          Status     Measurement
Temp  PSM 0                         OK         31 degrees C / 87 degrees F
      PSM 1                         OK         28 degrees C / 82 degrees F
      PSM 2                         OK         28 degrees C / 82 degrees F
      PSM 3                         OK         26 degrees C / 78 degrees F
      PSM 4                         OK         28 degrees C / 82 degrees F
      PSM 5                         OK         28 degrees C / 82 degrees F
      PSM 6                         OK         27 degrees C / 80 degrees F
      PSM 7                         OK         30 degrees C / 86 degrees F
      PSM 8                         OK         33 degrees C / 91 degrees F
      PDM 0                         OK
      PDM 1                         OK
      CB 0 IntakeA-Zone0            OK         30 degrees C / 86 degrees F
      CB 0 IntakeB-Zone1            OK         32 degrees C / 89 degrees F
      CB 0 IntakeC-Zone0            OK         38 degrees C / 100 degrees F
      CB 0 ExhaustA-Zone0           OK         33 degrees C / 91 degrees F
      CB 0 ExhaustB-Zone1           OK         32 degrees C / 89 degrees F
      CB 0 TCBC-Zone0               OK         34 degrees C / 93 degrees F
      CB 1 IntakeA-Zone0            OK         29 degrees C / 84 degrees F
      CB 1 IntakeB-Zone1            OK         31 degrees C / 87 degrees F
      CB 1 IntakeC-Zone0            OK         33 degrees C / 91 degrees F
      CB 1 ExhaustA-Zone0           OK         33 degrees C / 91 degrees F
      CB 1 ExhaustB-Zone1           OK         31 degrees C / 87 degrees F
      CB 1 TCBC-Zone0               OK         34 degrees C / 93 degrees F
      SPMB 0 Intake                 OK         33 degrees C / 91 degrees F
      SPMB 1 Intake                 OK         34 degrees C / 93 degrees F
      Routing Engine 0              OK         38 degrees C / 100 degrees F
      Routing Engine 0 CPU          OK         34 degrees C / 93 degrees F
      Routing Engine 1              OK         38 degrees C / 100 degrees F
      Routing Engine 1 CPU          OK         34 degrees C / 93 degrees F
      SFB 0 Intake-Zone0            OK         45 degrees C / 113 degrees F
      SFB 0 Exhaust-Zone1           OK         37 degrees C / 98 degrees F
```

```
        SFB 0 IntakeA-Zone0              OK          35 degrees C / 95 degrees F
        SFB 0 IntakeB-Zone1              OK          30 degrees C / 86 degrees F
        SFB 0 Exhaust-Zone0              OK          40 degrees C / 104 degrees F
        SFB 0 SFB-XF2-Zone1              OK          47 degrees C / 116 degrees F
        SFB 0 SFB-XF1-Zone0              OK          50 degrees C / 122 degrees F
        SFB 0 SFB-XF0-Zone0              OK          57 degrees C / 134 degrees F
        SFB 1 Intake-Zone0               OK          52 degrees C / 125 degrees F
        SFB 1 Exhaust-Zone1              OK          36 degrees C / 96 degrees F
        SFB 1 IntakeA-Zone0              OK          39 degrees C / 102 degrees F
        SFB 1 IntakeB-Zone1              OK          30 degrees C / 86 degrees F
        SFB 1 Exhaust-Zone0              OK          43 degrees C / 109 degrees F
        SFB 1 SFB-XF2-Zone1              OK          46 degrees C / 114 degrees F
        SFB 1 SFB-XF1-Zone0              OK          52 degrees C / 125 degrees F
        SFB 1 SFB-XF0-Zone0              OK          63 degrees C / 145 degrees F
        SFB 2 Intake-Zone0               OK          34 degrees C / 93 degrees F
        SFB 2 Exhaust-Zone1              OK          34 degrees C / 93 degrees F
        SFB 2 IntakeA-Zone0              OK          29 degrees C / 84 degrees F
        SFB 2 IntakeB-Zone1              OK          27 degrees C / 80 degrees F
        SFB 2 Exhaust-Zone0              OK          32 degrees C / 89 degrees F
        SFB 2 SFB-XF2-Zone1              OK          44 degrees C / 111 degrees F
        SFB 2 SFB-XF1-Zone0              OK          41 degrees C / 105 degrees F
        SFB 2 SFB-XF0-Zone0              OK          43 degrees C / 109 degrees F
        SFB 3 Intake-Zone0               OK          34 degrees C / 93 degrees F
        SFB 3 Exhaust-Zone1              OK          33 degrees C / 91 degrees F
        SFB 3 IntakeA-Zone0              OK          28 degrees C / 82 degrees F
        SFB 3 IntakeB-Zone1              OK          27 degrees C / 80 degrees F
        SFB 3 Exhaust-Zone0              OK          32 degrees C / 89 degrees F
        SFB 3 SFB-XF2-Zone1              OK          44 degrees C / 111 degrees F
        SFB 3 SFB-XF1-Zone0              OK          41 degrees C / 105 degrees F
        SFB 3 SFB-XF0-Zone0              OK          45 degrees C / 113 degrees F
        SFB 4 Intake-Zone0               OK          33 degrees C / 91 degrees F
        SFB 4 Exhaust-Zone1              OK          34 degrees C / 93 degrees F
        SFB 4 IntakeA-Zone0              OK          27 degrees C / 80 degrees F
        SFB 4 IntakeB-Zone1              OK          27 degrees C / 80 degrees F
        SFB 4 Exhaust-Zone0              OK          31 degrees C / 87 degrees F
        SFB 4 SFB-XF2-Zone1              OK          45 degrees C / 113 degrees F
        SFB 4 SFB-XF1-Zone0              OK          40 degrees C / 104 degrees F
        SFB 4 SFB-XF0-Zone0              OK          42 degrees C / 107 degrees F
        SFB 5 Intake-Zone0               OK          33 degrees C / 91 degrees F
        SFB 5 Exhaust-Zone1              OK          34 degrees C / 93 degrees F
        SFB 5 IntakeA-Zone0              OK          28 degrees C / 82 degrees F
        SFB 5 IntakeB-Zone1              OK          27 degrees C / 80 degrees F
        SFB 5 Exhaust-Zone0              OK          31 degrees C / 87 degrees F
```

```
SFB 5 SFB-XF2-Zone1          OK          44 degrees C / 111 degrees F
SFB 5 SFB-XF1-Zone0          OK          40 degrees C / 104 degrees F
SFB 5 SFB-XF0-Zone0          OK          42 degrees C / 107 degrees F
SFB 6 Intake-Zone0           OK          34 degrees C / 93 degrees F
SFB 6 Exhaust-Zone1          OK          34 degrees C / 93 degrees F
SFB 6 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 6 IntakeB-Zone1          OK          27 degrees C / 80 degrees F
SFB 6 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 6 SFB-XF2-Zone1          OK          46 degrees C / 114 degrees F
SFB 6 SFB-XF1-Zone0          OK          39 degrees C / 102 degrees F
SFB 6 SFB-XF0-Zone0          OK          42 degrees C / 107 degrees F
SFB 7 Intake-Zone0           OK          34 degrees C / 93 degrees F
SFB 7 Exhaust-Zone1          OK          36 degrees C / 96 degrees F
SFB 7 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 7 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 7 SFB-XF2-Zone1          OK          46 degrees C / 114 degrees F
SFB 7 SFB-XF1-Zone0          OK          42 degrees C / 107 degrees F
SFB 7 SFB-XF0-Zone0          OK          43 degrees C / 109 degrees F
FPC 0 Intake                 OK          30 degrees C / 86 degrees F
FPC 0 Exhaust A              OK          37 degrees C / 98 degrees F
FPC 0 Exhaust B              OK          35 degrees C / 95 degrees F
FPC 0 QX 0 TSen              OK          41 degrees C / 105 degrees F
FPC 0 QX 0 Chip              OK          43 degrees C / 109 degrees F
FPC 0 LU 0 TCAM TSen         OK          41 degrees C / 105 degrees F
FPC 0 LU 0 TCAM Chip         OK          43 degrees C / 109 degrees F
FPC 0 LU 0 TSen              OK          41 degrees C / 105 degrees F
FPC 0 LU 0 Chip              OK          49 degrees C / 120 degrees F
FPC 0 MQ 0 TSen              OK          41 degrees C / 105 degrees F
FPC 0 MQ 0 Chip              OK          44 degrees C / 111 degrees F
FPC 1 Intake                 OK          29 degrees C / 84 degrees F
FPC 1 Exhaust A              OK          42 degrees C / 107 degrees F
FPC 1 Exhaust B              OK          36 degrees C / 96 degrees F
FPC 1 LU 0 TCAM TSen         OK          42 degrees C / 107 degrees F
FPC 1 LU 0 TCAM Chip         OK          50 degrees C / 122 degrees F
FPC 1 LU 0 TSen              OK          42 degrees C / 107 degrees F
FPC 1 LU 0 Chip              OK          51 degrees C / 123 degrees F
FPC 1 MQ 0 TSen              OK          42 degrees C / 107 degrees F
FPC 1 MQ 0 Chip              OK          48 degrees C / 118 degrees F
FPC 1 LU 1 TCAM TSen         OK          39 degrees C / 102 degrees F
FPC 1 LU 1 TCAM Chip         OK          42 degrees C / 107 degrees F
FPC 1 LU 1 TSen              OK          39 degrees C / 102 degrees F
FPC 1 LU 1 Chip              OK          44 degrees C / 111 degrees F
```

```
        FPC 1 MQ 1 TSen              OK          39 degrees C / 102 degrees F
        FPC 1 MQ 1 Chip              OK          45 degrees C / 113 degrees F
        FPC 2 Intake                 OK          32 degrees C / 89 degrees F
        FPC 2 Exhaust A              OK          52 degrees C / 125 degrees F
        FPC 2 Exhaust B              OK          60 degrees C / 140 degrees F
        FPC 2 LU 0 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 LU 0 Chip              OK          61 degrees C / 141 degrees F
        FPC 2 LU 1 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 LU 1 Chip              OK          49 degrees C / 120 degrees F
        FPC 2 LU 2 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 LU 2 Chip              OK          54 degrees C / 129 degrees F
        FPC 2 LU 3 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 LU 3 Chip              OK          66 degrees C / 150 degrees F
        FPC 2 XM 0 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 XM 0 Chip              OK          59 degrees C / 138 degrees F
        FPC 2 XF 0 TSen              OK          47 degrees C / 116 degrees F
        FPC 2 XF 0 Chip              OK          71 degrees C / 159 degrees F
        FPC 2 PLX Switch TSen        OK          47 degrees C / 116 degrees F
        FPC 2 PLX Switch Chip        OK          46 degrees C / 114 degrees F
        FPC 9 Intake                 OK          32 degrees C / 89 degrees F
        FPC 9 Exhaust A              OK          40 degrees C / 104 degrees F
        FPC 9 Exhaust B              OK          52 degrees C / 125 degrees F
        FPC 9 LU 0 TSen              OK          49 degrees C / 120 degrees F
        FPC 9 LU 0 Chip              OK          51 degrees C / 123 degrees F
        FPC 9 LU 1 TSen              OK          49 degrees C / 120 degrees F
        FPC 9 LU 1 Chip              OK          54 degrees C / 129 degrees F
        FPC 9 LU 2 TSen              OK          49 degrees C / 120 degrees F
        FPC 9 LU 2 Chip              OK          43 degrees C / 109 degrees F
        FPC 9 LU 3 TSen              OK          49 degrees C / 120 degrees F
        FPC 9 LU 3 Chip              OK          45 degrees C / 113 degrees F
        FPC 9 MQ 0 TSen              OK          39 degrees C / 102 degrees F
        FPC 9 MQ 0 Chip              OK          41 degrees C / 105 degrees F
        FPC 9 MQ 1 TSen              OK          39 degrees C / 102 degrees F
        FPC 9 MQ 1 Chip              OK          44 degrees C / 111 degrees F
        FPC 9 MQ 2 TSen              OK          39 degrees C / 102 degrees F
        FPC 9 MQ 2 Chip              OK          36 degrees C / 96 degrees F
        FPC 9 MQ 3 TSen              OK          39 degrees C / 102 degrees F
        FPC 9 MQ 3 Chip              OK          38 degrees C / 100 degrees F
Fans    Fan Tray 0 Fan 1             Check
        Fan Tray 0 Fan 2             Check
        Fan Tray 0 Fan 3             Check
        Fan Tray 0 Fan 4             Check
        Fan Tray 0 Fan 5             Check
```

```
    Fan Tray 0 Fan 6                Check
    Fan Tray 1 Fan 1                OK          3840 RPM
    Fan Tray 1 Fan 2                OK          3840 RPM
    Fan Tray 1 Fan 3                OK          3840 RPM
    Fan Tray 1 Fan 4                OK          3840 RPM
    Fan Tray 1 Fan 5                OK          3840 RPM
    Fan Tray 1 Fan 6                OK          3960 RPM
    Fan Tray 2 Fan 1                OK          2520 RPM
    Fan Tray 2 Fan 2                OK          2520 RPM
    Fan Tray 2 Fan 3                OK          2520 RPM
    Fan Tray 2 Fan 4                OK          2520 RPM
    Fan Tray 2 Fan 5                OK          2520 RPM
    Fan Tray 2 Fan 6                OK          2520 RPM
    Fan Tray 3 Fan 1                OK          2640 RPM
    Fan Tray 3 Fan 2                OK          2640 RPM
    Fan Tray 3 Fan 3                OK          2640 RPM
    Fan Tray 3 Fan 4                OK          2640 RPM
    Fan Tray 3 Fan 5                OK          2760 RPM
    Fan Tray 3 Fan 6                OK          2640 RPM
```

For monitoring the temperature of specific items in the MX2010 router, the output for the `show chassis environment monitored` command is similar to the following:

```
user@host> show chassis environment monitored
Class Item                           Status     Measurement
Temp  CB 0 IntakeA-Zone0             OK         30 degrees C / 86 degrees F
      CB 0 IntakeB-Zone1             OK         33 degrees C / 91 degrees F
      CB 0 IntakeC-Zone0             OK         38 degrees C / 100 degrees F
      CB 0 ExhaustA-Zone0            OK         33 degrees C / 91 degrees F
      CB 0 ExhaustB-Zone1            OK         33 degrees C / 91 degrees F
      CB 0 TCBC-Zone0                OK         35 degrees C / 95 degrees F
      CB 1 IntakeA-Zone0             OK         30 degrees C / 86 degrees F
      CB 1 IntakeB-Zone1             OK         31 degrees C / 87 degrees F
      CB 1 IntakeC-Zone0             OK         33 degrees C / 91 degrees F
      CB 1 ExhaustA-Zone0            OK         33 degrees C / 91 degrees F
      CB 1 ExhaustB-Zone1            OK         31 degrees C / 87 degrees F
      CB 1 TCBC-Zone0                OK         34 degrees C / 93 degrees F
      SPMB 0 Intake                  OK         33 degrees C / 91 degrees F
      SPMB 1 Intake                  OK         34 degrees C / 93 degrees F
      Routing Engine 0 CPU           OK         35 degrees C / 95 degrees F
      Routing Engine 1 CPU           OK         34 degrees C / 93 degrees F
```

```
SFB 0 Intake-Zone0              OK          45 degrees C / 113 degrees F
SFB 0 Exhaust-Zone1             OK          38 degrees C / 100 degrees F
SFB 0 IntakeA-Zone0             OK          35 degrees C / 95 degrees F
SFB 0 IntakeB-Zone1             OK          31 degrees C / 87 degrees F
SFB 0 Exhaust-Zone0             OK          41 degrees C / 105 degrees F
SFB 0 SFB-XF2-Zone1             OK          48 degrees C / 118 degrees F
SFB 0 SFB-XF1-Zone0             OK          50 degrees C / 122 degrees F
SFB 0 SFB-XF0-Zone0             OK          56 degrees C / 132 degrees F
SFB 1 Intake-Zone0              OK          53 degrees C / 127 degrees F
SFB 1 Exhaust-Zone1             OK          37 degrees C / 98 degrees F
SFB 1 IntakeA-Zone0             OK          40 degrees C / 104 degrees F
SFB 1 IntakeB-Zone1             OK          31 degrees C / 87 degrees F
SFB 1 Exhaust-Zone0             OK          44 degrees C / 111 degrees F
SFB 1 SFB-XF2-Zone1             OK          47 degrees C / 116 degrees F
SFB 1 SFB-XF1-Zone0             OK          52 degrees C / 125 degrees F
SFB 1 SFB-XF0-Zone0             OK          63 degrees C / 145 degrees F
SFB 2 Intake-Zone0              OK          34 degrees C / 93 degrees F
SFB 2 Exhaust-Zone1             OK          34 degrees C / 93 degrees F
SFB 2 IntakeA-Zone0             OK          29 degrees C / 84 degrees F
SFB 2 IntakeB-Zone1             OK          27 degrees C / 80 degrees F
SFB 2 Exhaust-Zone0             OK          32 degrees C / 89 degrees F
SFB 2 SFB-XF2-Zone1             OK          45 degrees C / 113 degrees F
SFB 2 SFB-XF1-Zone0             OK          40 degrees C / 104 degrees F
SFB 2 SFB-XF0-Zone0             OK          42 degrees C / 107 degrees F
SFB 3 Intake-Zone0              OK          33 degrees C / 91 degrees F
SFB 3 Exhaust-Zone1             OK          34 degrees C / 93 degrees F
SFB 3 IntakeA-Zone0             OK          28 degrees C / 82 degrees F
SFB 3 IntakeB-Zone1             OK          27 degrees C / 80 degrees F
SFB 3 Exhaust-Zone0             OK          32 degrees C / 89 degrees F
SFB 3 SFB-XF2-Zone1             OK          45 degrees C / 113 degrees F
SFB 3 SFB-XF1-Zone0             OK          39 degrees C / 102 degrees F
SFB 3 SFB-XF0-Zone0             OK          43 degrees C / 109 degrees F
SFB 4 Intake-Zone0              OK          33 degrees C / 91 degrees F
SFB 4 Exhaust-Zone1             OK          34 degrees C / 93 degrees F
SFB 4 IntakeA-Zone0             OK          27 degrees C / 80 degrees F
SFB 4 IntakeB-Zone1             OK          27 degrees C / 80 degrees F
SFB 4 Exhaust-Zone0             OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1             OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF1-Zone0             OK          39 degrees C / 102 degrees F
SFB 4 SFB-XF0-Zone0             OK          41 degrees C / 105 degrees F
SFB 5 Intake-Zone0              OK          32 degrees C / 89 degrees F
SFB 5 Exhaust-Zone1             OK          34 degrees C / 93 degrees F
SFB 5 IntakeA-Zone0             OK          28 degrees C / 82 degrees F
```

```
SFB 5 IntakeB-Zone1          OK         27 degrees C / 80 degrees F
SFB 5 Exhaust-Zone0          OK         31 degrees C / 87 degrees F
SFB 5 SFB-XF2-Zone1          OK         44 degrees C / 111 degrees F
SFB 5 SFB-XF1-Zone0          OK         39 degrees C / 102 degrees F
SFB 5 SFB-XF0-Zone0          OK         41 degrees C / 105 degrees F
SFB 6 Intake-Zone0           OK         33 degrees C / 91 degrees F
SFB 6 Exhaust-Zone1          OK         34 degrees C / 93 degrees F
SFB 6 IntakeA-Zone0          OK         27 degrees C / 80 degrees F
SFB 6 IntakeB-Zone1          OK         27 degrees C / 80 degrees F
SFB 6 Exhaust-Zone0          OK         31 degrees C / 87 degrees F
SFB 6 SFB-XF2-Zone1          OK         46 degrees C / 114 degrees F
SFB 6 SFB-XF1-Zone0          OK         38 degrees C / 100 degrees F
SFB 6 SFB-XF0-Zone0          OK         41 degrees C / 105 degrees F
SFB 7 Intake-Zone0           OK         33 degrees C / 91 degrees F
SFB 7 Exhaust-Zone1          OK         35 degrees C / 95 degrees F
SFB 7 IntakeA-Zone0          OK         28 degrees C / 82 degrees F
SFB 7 IntakeB-Zone1          OK         28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0          OK         32 degrees C / 89 degrees F
SFB 7 SFB-XF2-Zone1          OK         46 degrees C / 114 degrees F
SFB 7 SFB-XF1-Zone0          OK         40 degrees C / 104 degrees F
SFB 7 SFB-XF0-Zone0          OK         42 degrees C / 107 degrees F
FPC 0 Intake                 OK         30 degrees C / 86 degrees F
FPC 0 Exhaust A              OK         37 degrees C / 98 degrees F
FPC 0 Exhaust B              OK         35 degrees C / 95 degrees F
FPC 0 QX 0 TSen              OK         41 degrees C / 105 degrees F
FPC 0 QX 0 Chip              OK         43 degrees C / 109 degrees F
FPC 0 LU 0 TCAM TSen         OK         41 degrees C / 105 degrees F
FPC 0 LU 0 TCAM Chip         OK         42 degrees C / 107 degrees F
FPC 0 LU 0 TSen              OK         41 degrees C / 105 degrees F
FPC 0 LU 0 Chip              OK         49 degrees C / 120 degrees F
FPC 0 MQ 0 TSen              OK         41 degrees C / 105 degrees F
FPC 0 MQ 0 Chip              OK         44 degrees C / 111 degrees F
FPC 1 Intake                 OK         28 degrees C / 82 degrees F
FPC 1 Exhaust A              OK         42 degrees C / 107 degrees F
FPC 1 Exhaust B              OK         37 degrees C / 98 degrees F
FPC 1 LU 0 TCAM TSen         OK         42 degrees C / 107 degrees F
FPC 1 LU 0 TCAM Chip         OK         49 degrees C / 120 degrees F
FPC 1 LU 0 TSen              OK         42 degrees C / 107 degrees F
FPC 1 LU 0 Chip              OK         49 degrees C / 120 degrees F
FPC 1 MQ 0 TSen              OK         42 degrees C / 107 degrees F
FPC 1 MQ 0 Chip              OK         47 degrees C / 116 degrees F
FPC 1 LU 1 TCAM TSen         OK         38 degrees C / 100 degrees F
FPC 1 LU 1 TCAM Chip         OK         42 degrees C / 107 degrees F
```

```
FPC 1 LU 1 TSen              OK          38 degrees C / 100 degrees F
FPC 1 LU 1 Chip              OK          44 degrees C / 111 degrees F
FPC 1 MQ 1 TSen              OK          38 degrees C / 100 degrees F
FPC 1 MQ 1 Chip              OK          44 degrees C / 111 degrees F
FPC 2 Intake                 OK          32 degrees C / 89 degrees F
FPC 2 Exhaust A              OK          53 degrees C / 127 degrees F
FPC 2 Exhaust B              OK          60 degrees C / 140 degrees F
FPC 2 LU 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 0 Chip              OK          61 degrees C / 141 degrees F
FPC 2 LU 1 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 1 Chip              OK          48 degrees C / 118 degrees F
FPC 2 LU 2 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 2 Chip              OK          53 degrees C / 127 degrees F
FPC 2 LU 3 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 3 Chip              OK          65 degrees C / 149 degrees F
FPC 2 XM 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 XM 0 Chip              OK          58 degrees C / 136 degrees F
FPC 2 XF 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 XF 0 Chip              OK          69 degrees C / 156 degrees F
FPC 2 PLX Switch TSen        OK          47 degrees C / 116 degrees F
FPC 2 PLX Switch Chip        OK          45 degrees C / 113 degrees F
FPC 9 Intake                 OK          32 degrees C / 89 degrees F
FPC 9 Exhaust A              OK          40 degrees C / 104 degrees F
FPC 9 Exhaust B              OK          52 degrees C / 125 degrees F
FPC 9 LU 0 TSen              OK          49 degrees C / 120 degrees F
FPC 9 LU 0 Chip              OK          50 degrees C / 122 degrees F
FPC 9 LU 1 TSen              OK          49 degrees C / 120 degrees F
FPC 9 LU 1 Chip              OK          54 degrees C / 129 degrees F
FPC 9 LU 2 TSen              OK          49 degrees C / 120 degrees F
FPC 9 LU 2 Chip              OK          42 degrees C / 107 degrees F
FPC 9 LU 3 TSen              OK          49 degrees C / 120 degrees F
FPC 9 LU 3 Chip              OK          44 degrees C / 111 degrees F
FPC 9 MQ 0 TSen              OK          39 degrees C / 102 degrees F
FPC 9 MQ 0 Chip              OK          40 degrees C / 104 degrees F
FPC 9 MQ 1 TSen              OK          39 degrees C / 102 degrees F
FPC 9 MQ 1 Chip              OK          43 degrees C / 109 degrees F
FPC 9 MQ 2 TSen              OK          39 degrees C / 102 degrees F
FPC 9 MQ 2 Chip              OK          36 degrees C / 96 degrees F
FPC 9 MQ 3 TSen              OK          39 degrees C / 102 degrees F
FPC 9 MQ 3 Chip              OK          37 degrees C / 98 degrees F
```

For the chassis temperature threshold settings, the output for the `show chassis temperature-thresholds` command is similar to the following:

```
user@host> 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               70    80       95       95      110      110       112
Routing Engine 1               70    80       95       95      110      110       112
CB 0 IntakeA-Zone0             60    65       78       75       85       80        95
CB 0 IntakeB-Zone1             60    65       78       75       85       80        95
CB 0 IntakeC-Zone0             60    65       78       75       85       80        95
CB 0 ExhaustA-Zone0            60    65       78       75       85       80        95
CB 0 ExhaustB-Zone1            60    65       78       75       85       80        95
CB 0 TCBC-Zone0                60    65       78       75       85       80        95
CB 1 IntakeA-Zone0             60    65       78       75       85       80        95
CB 1 IntakeB-Zone1             60    65       78       75       85       80        95
CB 1 IntakeC-Zone0             60    65       78       75       85       80        95
CB 1 ExhaustA-Zone0            60    65       78       75       85       80        95
CB 1 ExhaustB-Zone1            60    65       78       75       85       80        95
CB 1 TCBC-Zone0                60    65       78       75       85       80        95
SPMB 0 Intake                  56    62       75       63       83       76        95
SFB 0 Intake-Zone0             56    62       75       63       82       70        87
SFB 0 Exhaust-Zone1            56    62       75       63       82       70        87
SFB 0 IntakeA-Zone0            56    62       75       63       82       70        87
SFB 0 IntakeB-Zone1            56    62       75       63       82       70        87
SFB 0 Exhaust-Zone0            56    62       75       63       82       70        87
SFB 0 SFB-XF2-Zone1            70    80       90       90      100      107       110
SFB 0 SFB-XF1-Zone0            70    80       90       90      100      107       110
SFB 0 SFB-XF0-Zone0            70    80       90       90      100      107       110
SFB 1 Intake-Zone0             56    62       75       63       82       70        87
SFB 1 Exhaust-Zone1            56    62       75       63       82       70        87
SFB 1 IntakeA-Zone0            56    62       75       63       82       70        87
SFB 1 IntakeB-Zone1            56    62       75       63       82       70        87
SFB 1 Exhaust-Zone0            56    62       75       63       82       70        87
SFB 1 SFB-XF2-Zone1            70    80       90       90      100      107       110
SFB 1 SFB-XF1-Zone0            70    80       90       90      100      107       110
SFB 1 SFB-XF0-Zone0            70    80       90       90      100      107       110
SFB 2 Intake-Zone0             56    62       75       63       82       70        87
SFB 2 Exhaust-Zone1            56    62       75       63       82       70        87
SFB 2 IntakeA-Zone0            56    62       75       63       82       70        87
SFB 2 IntakeB-Zone1            56    62       75       63       82       70        87
```

SFB 2 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 2 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 2 SFB-XF1-Zone0	70	80	90	90	100	107	110
SFB 2 SFB-XF0-Zone0	70	80	90	90	100	107	110
SFB 3 Intake-Zone0	56	62	75	63	82	70	87
SFB 3 Exhaust-Zone1	56	62	75	63	82	70	87
SFB 3 IntakeA-Zone0	56	62	75	63	82	70	87
SFB 3 IntakeB-Zone1	56	62	75	63	82	70	87
SFB 3 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 3 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 3 SFB-XF1-Zone0	70	80	90	90	100	107	110
SFB 3 SFB-XF0-Zone0	70	80	90	90	100	107	110
SFB 4 Intake-Zone0	56	62	75	63	82	70	87
SFB 4 Exhaust-Zone1	56	62	75	63	82	70	87
SFB 4 IntakeA-Zone0	56	62	75	63	82	70	87
SFB 4 IntakeB-Zone1	56	62	75	63	82	70	87
SFB 4 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 4 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 4 SFB-XF1-Zone0	70	80	90	90	100	107	110
SFB 4 SFB-XF0-Zone0	70	80	90	90	100	107	110
SFB 5 Intake-Zone0	56	62	75	63	82	70	87
SFB 5 Exhaust-Zone1	56	62	75	63	82	70	87
SFB 5 IntakeA-Zone0	56	62	75	63	82	70	87
SFB 5 IntakeB-Zone1	56	62	75	63	82	70	87
SFB 5 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 5 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 5 SFB-XF1-Zone0	70	80	90	90	100	107	110
SFB 5 SFB-XF0-Zone0	70	80	90	90	100	107	110
SFB 6 Intake-Zone0	56	62	75	63	82	70	87
SFB 6 Exhaust-Zone1	56	62	75	63	82	70	87
SFB 6 IntakeA-Zone0	56	62	75	63	82	70	87
SFB 6 IntakeB-Zone1	56	62	75	63	82	70	87
SFB 6 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 6 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 6 SFB-XF1-Zone0	70	80	90	90	100	107	110
SFB 6 SFB-XF0-Zone0	70	80	90	90	100	107	110
SFB 7 Intake-Zone0	56	62	75	63	82	70	87
SFB 7 Exhaust-Zone1	56	62	75	63	82	70	87
SFB 7 IntakeA-Zone0	56	62	75	63	82	70	87
SFB 7 IntakeB-Zone1	56	62	75	63	82	70	87
SFB 7 Exhaust-Zone0	56	62	75	63	82	70	87
SFB 7 SFB-XF2-Zone1	70	80	90	90	100	107	110
SFB 7 SFB-XF1-Zone0	70	80	90	90	100	107	110

```
SFB 7 SFB-XF0-Zone0          70    80       90       90      100      107      110
FPC 1                        55    60       75       65       90       80       95
FPC 2                        55    60       75       65       90       80       95
FPC 3                        55    60       75       65       90       80       95
FPC 4                        55    60       75       65       90       80       95
FPC 6                        55    60       75       65       90       80       95
```

For the fan trays, the output for the `show chassis fan` command is similar to the following:

```
user@host> show chassis fan
 Item                      Status   % RPM     Measurement
      Fan Tray 0 Fan 1          OK       100%      9720 RPM
      Fan Tray 0 Fan 2          OK       100%      9000 RPM
      Fan Tray 0 Fan 3          OK       100%      9720 RPM
      Fan Tray 0 Fan 4          OK       97%       8760 RPM
      Fan Tray 0 Fan 5          OK       100%      9600 RPM
      Fan Tray 0 Fan 6          OK       100%      9000 RPM
      Fan Tray 1 Fan 1          OK       100%      9120 RPM
      Fan Tray 1 Fan 2          OK       100%      9120 RPM
      Fan Tray 1 Fan 3          OK       100%      9120 RPM
      Fan Tray 1 Fan 4          OK       100%      9240 RPM
      Fan Tray 1 Fan 5          OK       100%      9240 RPM
      Fan Tray 1 Fan 6          OK       100%      9120 RPM
      Fan Tray 2 Fan 1          OK       49%       4440 RPM
      Fan Tray 2 Fan 2          OK       52%       4680 RPM
      Fan Tray 2 Fan 3          OK       52%       4680 RPM
      Fan Tray 2 Fan 4          OK       52%       4680 RPM
      Fan Tray 2 Fan 5          OK       50%       4560 RPM
      Fan Tray 2 Fan 6          OK       50%       4560 RPM
      Fan Tray 3 Fan 1          OK       50%       4560 RPM
      Fan Tray 3 Fan 2          OK       52%       4680 RPM
      Fan Tray 3 Fan 3          OK       52%       4680 RPM
      Fan Tray 3 Fan 4          OK       52%       4680 RPM
      Fan Tray 3 Fan 5          OK       50%       4560 RPM
      Fan Tray 3 Fan 6          OK       50%       4560 RPMM
```

Fan Tray 0, **Fan Tray 1** refer to the lower rear fan trays, **Fan Tray 2**, and **Fan Tray 3** refer to the upper rear fan trays.

Fan 1, **Fan 2**, **Fan 3**, **Fan 4**, **Fan 5**, and **Fan 6** refer to the fans on the fan tray. There are six fans for each fan tray.

SEE ALSO

Replacing an MX2010 Fan Tray | 606

Maintaining the MX2010 Cooling System Zones

IN THIS SECTION

- Purpose | 736
- Action | 736

Purpose

For optimum router performance, verify the status of the two cooling zones (zone 0 and zone 1) of the chassis. Zone 0 consists of ten MPCs (**0** through **9**) and their respective MICs. Zone 0 is cooled by fan trays (**0** and **1**). Zone 1 consists of the CB-REs and SFBs located in the upper portion of the chassis. Zone 1 is cooled by fan trays **2** and **3**. Two fan trays are at the bottom of the chassis, and two fan trays are at the top of the chassis.

Action

On a regular basis:

- Check the LEDs on the craft interface for upper and lower fan trays. The green status LEDs labeled **0** and **1**, for lower fan trays, and **2** and **3** for the upper fan trays light steadily when a fan tray 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.
- Monitor the status of the fans. During normal operation, the fans in each fan tray function at less than full speed.

  The fan trays each contain multiple fans that work in unison to cool the router 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.

During normal operation:

- The green LEDs next to the fan trays **0**, **1**, **2**, and **3** on the craft interface light steadily when the fan tray is functioning normally for that zone.

- Issue the `show chassis zones` command to check the status of the two cooling zones. The output is similar to the following:

```
user@host> show chassis zones
ZONE 0 Status
    Driving FRU                 ADC 6 Exhaust
    Temperature                 63 degrees C / 145 degrees F
    Condition                   HIGH TEMP
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              27

ZONE 1 Status
    Driving FRU                 SFB 7 Exhaust-Zone1
    Temperature                 64 degrees C / 147 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
```

SEE ALSO

MX2010 Cooling System Description | 51
Troubleshooting the MX2010 Cooling System | 820

RELATED DOCUMENTATION

MX2010 Cooling System Description | 51
Troubleshooting the MX2010 Cooling System | 820
MX2010 Component LEDs on the Craft Interface | 36
Replacing an MX2010 Fan Tray | 606

Maintaining the MX2010 Cooling System Zones

IN THIS SECTION

- Purpose | 738
- Action | 738

Purpose

For optimum router performance, verify the status of the two cooling zones (zone 0 and zone 1) of the chassis. Zone 0 consists of ten MPCs (**0** through **9**) and their respective MICs. Zone 0 is cooled by fan trays (**0** and **1**). Zone 1 consists of the CB-REs and SFBs located in the upper portion of the chassis. Zone 1 is cooled by fan trays **2** and **3**. Two fan trays are at the bottom of the chassis, and two fan trays are at the top of the chassis.

Action

On a regular basis:

- Check the LEDs on the craft interface for upper and lower fan trays. The green status LEDs labeled **0** and **1**, for lower fan trays, and **2** and **3** for the upper fan trays light steadily when a fan tray 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.
- Monitor the status of the fans. During normal operation, the fans in each fan tray function at less than full speed.

  The fan trays each contain multiple fans that work in unison to cool the router 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.

During normal operation:

- The green LEDs next to the fan trays **0**, **1**, **2**, and **3** on the craft interface light steadily when the fan tray is functioning normally for that zone.

- Issue the `show chassis zones` command to check the status of the two cooling zones. The output is similar to the following:

```
user@host> show chassis zones
ZONE 0 Status
    Driving FRU                 ADC 6 Exhaust
    Temperature                 63 degrees C / 145 degrees F
    Condition                   HIGH TEMP
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              27

ZONE 1 Status
    Driving FRU                 SFB 7 Exhaust-Zone1
    Temperature                 64 degrees C / 147 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
```

RELATED DOCUMENTATION

MX2010 Cooling System Description | 51

Troubleshooting the MX2010 Cooling System | 820

Maintaining the MX2010 Ethernet Switch

IN THIS SECTION

- Purpose | 739
- Action | 740

Purpose

For optimum router performance, verify the status of the Gigabit Ethernet ports connected to MPCs.

Action

On a regular basis:

- Check the LEDs on MPC faceplates. The meaning of the LED states differs for various MICs. For more information, see the *MX Series Interface Module Reference*.
- Issue the CLI `show chassis ethernet-switch` command:

```
user@host> show chassis ethernet-switch
Displaying summary for switch 0
Link is good on GE port 0 connected to device: FPC0
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 1 connected to device: FPC1
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 2 connected to device: FPC3
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 3 connected to device: FPC2
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 4 connected to device: FPC5
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
```

```
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 5 connected to device: FPC4
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 6 connected to device: FPC6
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 7 connected to device: FPC7
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 8 connected to device: FPC8
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 9 connected to device: FPC9
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 20 connected to device: Other RE-GigE
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
```

```
  Flow Control RX is Disabled

Link is good on GE port 21 connected to device: RE-GigE
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is down on GE port 22 connected to device: Debug-GigE

Link is good on GE port 23 connected to device: SPMB
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is down on XE port 24 connected to device: SFP+ 0

Link is down on XE port 25 connected to device: SFP+ 1

Link is down on XE port 26 connected to device: RE-10GigE

Link is down on XE port 27 connected to device: Other RE-10GigE
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

Troubleshooting the MX2010 Host Subsystems | 822

Maintaining the MX2010 Fan Trays

IN THIS SECTION

- Purpose | 743
- Action | 743

Purpose

For optimum cooling, verify the condition of the fans.

Action

- Monitor the status of the fans. The fan trays each contain multiple fans that work in unison to cool the router 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. During normal operation, the fans in each fan tray function at normal speed.
- To display the status of the cooling system, issue the `show chassis environment` command, `show chassis environment monitored` command, `show chassis temperature-thresholds` command, or `show chassis fan` command.

  For the fan trays, the output for the `show chassis environment` command is similar to the following:

```
user@host> show chassis environment
Class Item                          Status     Measurement
Temp  PSM 0                         OK         31 degrees C / 87 degrees F
      PSM 1                         OK         28 degrees C / 82 degrees F
      PSM 2                         OK         28 degrees C / 82 degrees F
      PSM 3                         OK         26 degrees C / 78 degrees F
      PSM 4                         OK         28 degrees C / 82 degrees F
      PSM 5                         OK         28 degrees C / 82 degrees F
      PSM 6                         OK         27 degrees C / 80 degrees F
      PSM 7                         OK         30 degrees C / 86 degrees F
      PSM 8                         OK         33 degrees C / 91 degrees F
      PDM 0                         OK
      PDM 1                         OK
```

```
CB 0 IntakeA-Zone0          OK       30 degrees C / 86 degrees F
CB 0 IntakeB-Zone1          OK       32 degrees C / 89 degrees F
CB 0 IntakeC-Zone0          OK       38 degrees C / 100 degrees F
CB 0 ExhaustA-Zone0         OK       33 degrees C / 91 degrees F
CB 0 ExhaustB-Zone1         OK       32 degrees C / 89 degrees F
CB 0 TCBC-Zone0             OK       34 degrees C / 93 degrees F
CB 1 IntakeA-Zone0          OK       29 degrees C / 84 degrees F
CB 1 IntakeB-Zone1          OK       31 degrees C / 87 degrees F
CB 1 IntakeC-Zone0          OK       33 degrees C / 91 degrees F
CB 1 ExhaustA-Zone0         OK       33 degrees C / 91 degrees F
CB 1 ExhaustB-Zone1         OK       31 degrees C / 87 degrees F
CB 1 TCBC-Zone0             OK       34 degrees C / 93 degrees F
SPMB 0 Intake               OK       33 degrees C / 91 degrees F
SPMB 1 Intake               OK       34 degrees C / 93 degrees F
Routing Engine 0            OK       38 degrees C / 100 degrees F
Routing Engine 0 CPU        OK       34 degrees C / 93 degrees F
Routing Engine 1            OK       38 degrees C / 100 degrees F
Routing Engine 1 CPU        OK       34 degrees C / 93 degrees F
SFB 0 Intake-Zone0          OK       45 degrees C / 113 degrees F
SFB 0 Exhaust-Zone1         OK       37 degrees C / 98 degrees F
SFB 0 IntakeA-Zone0         OK       35 degrees C / 95 degrees F
SFB 0 IntakeB-Zone1         OK       30 degrees C / 86 degrees F
SFB 0 Exhaust-Zone0         OK       40 degrees C / 104 degrees F
SFB 0 SFB-XF2-Zone1         OK       47 degrees C / 116 degrees F
SFB 0 SFB-XF1-Zone0         OK       50 degrees C / 122 degrees F
SFB 0 SFB-XF0-Zone0         OK       57 degrees C / 134 degrees F
SFB 1 Intake-Zone0          OK       52 degrees C / 125 degrees F
SFB 1 Exhaust-Zone1         OK       36 degrees C / 96 degrees F
SFB 1 IntakeA-Zone0         OK       39 degrees C / 102 degrees F
SFB 1 IntakeB-Zone1         OK       30 degrees C / 86 degrees F
SFB 1 Exhaust-Zone0         OK       43 degrees C / 109 degrees F
SFB 1 SFB-XF2-Zone1         OK       46 degrees C / 114 degrees F
SFB 1 SFB-XF1-Zone0         OK       52 degrees C / 125 degrees F
SFB 1 SFB-XF0-Zone0         OK       63 degrees C / 145 degrees F
SFB 2 Intake-Zone0          OK       34 degrees C / 93 degrees F
SFB 2 Exhaust-Zone1         OK       34 degrees C / 93 degrees F
SFB 2 IntakeA-Zone0         OK       29 degrees C / 84 degrees F
SFB 2 IntakeB-Zone1         OK       27 degrees C / 80 degrees F
SFB 2 Exhaust-Zone0         OK       32 degrees C / 89 degrees F
SFB 2 SFB-XF2-Zone1         OK       44 degrees C / 111 degrees F
SFB 2 SFB-XF1-Zone0         OK       41 degrees C / 105 degrees F
SFB 2 SFB-XF0-Zone0         OK       43 degrees C / 109 degrees F
SFB 3 Intake-Zone0          OK       34 degrees C / 93 degrees F
```

```
SFB 3 Exhaust-Zone1            OK          33 degrees C / 91 degrees F
SFB 3 IntakeA-Zone0            OK          28 degrees C / 82 degrees F
SFB 3 IntakeB-Zone1            OK          27 degrees C / 80 degrees F
SFB 3 Exhaust-Zone0            OK          32 degrees C / 89 degrees F
SFB 3 SFB-XF2-Zone1            OK          44 degrees C / 111 degrees F
SFB 3 SFB-XF1-Zone0            OK          41 degrees C / 105 degrees F
SFB 3 SFB-XF0-Zone0            OK          45 degrees C / 113 degrees F
SFB 4 Intake-Zone0             OK          33 degrees C / 91 degrees F
SFB 4 Exhaust-Zone1            OK          34 degrees C / 93 degrees F
SFB 4 IntakeA-Zone0            OK          27 degrees C / 80 degrees F
SFB 4 IntakeB-Zone1            OK          27 degrees C / 80 degrees F
SFB 4 Exhaust-Zone0            OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1            OK          45 degrees C / 113 degrees F
SFB 4 SFB-XF1-Zone0            OK          40 degrees C / 104 degrees F
SFB 4 SFB-XF0-Zone0            OK          42 degrees C / 107 degrees F
SFB 5 Intake-Zone0             OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1            OK          34 degrees C / 93 degrees F
SFB 5 IntakeA-Zone0            OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1            OK          27 degrees C / 80 degrees F
SFB 5 Exhaust-Zone0            OK          31 degrees C / 87 degrees F
SFB 5 SFB-XF2-Zone1            OK          44 degrees C / 111 degrees F
SFB 5 SFB-XF1-Zone0            OK          40 degrees C / 104 degrees F
SFB 5 SFB-XF0-Zone0            OK          42 degrees C / 107 degrees F
SFB 6 Intake-Zone0             OK          34 degrees C / 93 degrees F
SFB 6 Exhaust-Zone1            OK          34 degrees C / 93 degrees F
SFB 6 IntakeA-Zone0            OK          28 degrees C / 82 degrees F
SFB 6 IntakeB-Zone1            OK          27 degrees C / 80 degrees F
SFB 6 Exhaust-Zone0            OK          31 degrees C / 87 degrees F
SFB 6 SFB-XF2-Zone1            OK          46 degrees C / 114 degrees F
SFB 6 SFB-XF1-Zone0            OK          39 degrees C / 102 degrees F
SFB 6 SFB-XF0-Zone0            OK          42 degrees C / 107 degrees F
SFB 7 Intake-Zone0             OK          34 degrees C / 93 degrees F
SFB 7 Exhaust-Zone1            OK          36 degrees C / 96 degrees F
SFB 7 IntakeA-Zone0            OK          28 degrees C / 82 degrees F
SFB 7 IntakeB-Zone1            OK          28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0            OK          32 degrees C / 89 degrees F
SFB 7 SFB-XF2-Zone1            OK          46 degrees C / 114 degrees F
SFB 7 SFB-XF1-Zone0            OK          42 degrees C / 107 degrees F
SFB 7 SFB-XF0-Zone0            OK          43 degrees C / 109 degrees F
FPC 0 Intake                   OK          30 degrees C / 86 degrees F
FPC 0 Exhaust A                OK          37 degrees C / 98 degrees F
FPC 0 Exhaust B                OK          35 degrees C / 95 degrees F
FPC 0 QX 0 TSen                OK          41 degrees C / 105 degrees F
```

```
FPC 0 QX 0 Chip              OK          43 degrees C / 109 degrees F
FPC 0 LU 0 TCAM TSen         OK          41 degrees C / 105 degrees F
FPC 0 LU 0 TCAM Chip         OK          43 degrees C / 109 degrees F
FPC 0 LU 0 TSen              OK          41 degrees C / 105 degrees F
FPC 0 LU 0 Chip              OK          49 degrees C / 120 degrees F
FPC 0 MQ 0 TSen              OK          41 degrees C / 105 degrees F
FPC 0 MQ 0 Chip              OK          44 degrees C / 111 degrees F
FPC 1 Intake                 OK          29 degrees C / 84 degrees F
FPC 1 Exhaust A              OK          42 degrees C / 107 degrees F
FPC 1 Exhaust B              OK          36 degrees C / 96 degrees F
FPC 1 LU 0 TCAM TSen         OK          42 degrees C / 107 degrees F
FPC 1 LU 0 TCAM Chip         OK          50 degrees C / 122 degrees F
FPC 1 LU 0 TSen              OK          42 degrees C / 107 degrees F
FPC 1 LU 0 Chip              OK          51 degrees C / 123 degrees F
FPC 1 MQ 0 TSen              OK          42 degrees C / 107 degrees F
FPC 1 MQ 0 Chip              OK          48 degrees C / 118 degrees F
FPC 1 LU 1 TCAM TSen         OK          39 degrees C / 102 degrees F
FPC 1 LU 1 TCAM Chip         OK          42 degrees C / 107 degrees F
FPC 1 LU 1 TSen              OK          39 degrees C / 102 degrees F
FPC 1 LU 1 Chip              OK          44 degrees C / 111 degrees F
FPC 1 MQ 1 TSen              OK          39 degrees C / 102 degrees F
FPC 1 MQ 1 Chip              OK          45 degrees C / 113 degrees F
FPC 2 Intake                 OK          32 degrees C / 89 degrees F
FPC 2 Exhaust A              OK          52 degrees C / 125 degrees F
FPC 2 Exhaust B              OK          60 degrees C / 140 degrees F
FPC 2 LU 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 0 Chip              OK          61 degrees C / 141 degrees F
FPC 2 LU 1 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 1 Chip              OK          49 degrees C / 120 degrees F
FPC 2 LU 2 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 2 Chip              OK          54 degrees C / 129 degrees F
FPC 2 LU 3 TSen              OK          47 degrees C / 116 degrees F
FPC 2 LU 3 Chip              OK          66 degrees C / 150 degrees F
FPC 2 XM 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 XM 0 Chip              OK          59 degrees C / 138 degrees F
FPC 2 XF 0 TSen              OK          47 degrees C / 116 degrees F
FPC 2 XF 0 Chip              OK          71 degrees C / 159 degrees F
FPC 2 PLX Switch TSen        OK          47 degrees C / 116 degrees F
FPC 2 PLX Switch Chip        OK          46 degrees C / 114 degrees F
FPC 9 Intake                 OK          32 degrees C / 89 degrees F
FPC 9 Exhaust A              OK          40 degrees C / 104 degrees F
FPC 9 Exhaust B              OK          52 degrees C / 125 degrees F
FPC 9 LU 0 TSen              OK          49 degrees C / 120 degrees F
```

```
      FPC 9 LU 0 Chip                OK         51 degrees C / 123 degrees F
      FPC 9 LU 1 TSen                OK         49 degrees C / 120 degrees F
      FPC 9 LU 1 Chip                OK         54 degrees C / 129 degrees F
      FPC 9 LU 2 TSen                OK         49 degrees C / 120 degrees F
      FPC 9 LU 2 Chip                OK         43 degrees C / 109 degrees F
      FPC 9 LU 3 TSen                OK         49 degrees C / 120 degrees F
      FPC 9 LU 3 Chip                OK         45 degrees C / 113 degrees F
      FPC 9 MQ 0 TSen                OK         39 degrees C / 102 degrees F
      FPC 9 MQ 0 Chip                OK         41 degrees C / 105 degrees F
      FPC 9 MQ 1 TSen                OK         39 degrees C / 102 degrees F
      FPC 9 MQ 1 Chip                OK         44 degrees C / 111 degrees F
      FPC 9 MQ 2 TSen                OK         39 degrees C / 102 degrees F
      FPC 9 MQ 2 Chip                OK         36 degrees C / 96 degrees F
      FPC 9 MQ 3 TSen                OK         39 degrees C / 102 degrees F
      FPC 9 MQ 3 Chip                OK         38 degrees C / 100 degrees F
Fans  Fan Tray 0 Fan 1               Check
      Fan Tray 0 Fan 2               Check
      Fan Tray 0 Fan 3               Check
      Fan Tray 0 Fan 4               Check
      Fan Tray 0 Fan 5               Check
      Fan Tray 0 Fan 6               Check
      Fan Tray 1 Fan 1               OK         3840 RPM
      Fan Tray 1 Fan 2               OK         3840 RPM
      Fan Tray 1 Fan 3               OK         3840 RPM
      Fan Tray 1 Fan 4               OK         3840 RPM
      Fan Tray 1 Fan 5               OK         3840 RPM
      Fan Tray 1 Fan 6               OK         3960 RPM
      Fan Tray 2 Fan 1               OK         2520 RPM
      Fan Tray 2 Fan 2               OK         2520 RPM
      Fan Tray 2 Fan 3               OK         2520 RPM
      Fan Tray 2 Fan 4               OK         2520 RPM
      Fan Tray 2 Fan 5               OK         2520 RPM
      Fan Tray 2 Fan 6               OK         2520 RPM
      Fan Tray 3 Fan 1               OK         2640 RPM
      Fan Tray 3 Fan 2               OK         2640 RPM
      Fan Tray 3 Fan 3               OK         2640 RPM
      Fan Tray 3 Fan 4               OK         2640 RPM
      Fan Tray 3 Fan 5               OK         2760 RPM
      Fan Tray 3 Fan 6               OK         2640 RPM
```

For monitoring the temperature of specific items in the MX2010 router, the output for the `show chassis environment monitored` command is similar to the following:

```
user@host> show chassis environment monitored
Class Item                           Status     Measurement
Temp  CB 0 IntakeA-Zone0             OK         30 degrees C / 86 degrees F
      CB 0 IntakeB-Zone1             OK         33 degrees C / 91 degrees F
      CB 0 IntakeC-Zone0             OK         38 degrees C / 100 degrees F
      CB 0 ExhaustA-Zone0            OK         33 degrees C / 91 degrees F
      CB 0 ExhaustB-Zone1            OK         33 degrees C / 91 degrees F
      CB 0 TCBC-Zone0                OK         35 degrees C / 95 degrees F
      CB 1 IntakeA-Zone0             OK         30 degrees C / 86 degrees F
      CB 1 IntakeB-Zone1             OK         31 degrees C / 87 degrees F
      CB 1 IntakeC-Zone0             OK         33 degrees C / 91 degrees F
      CB 1 ExhaustA-Zone0            OK         33 degrees C / 91 degrees F
      CB 1 ExhaustB-Zone1            OK         31 degrees C / 87 degrees F
      CB 1 TCBC-Zone0                OK         34 degrees C / 93 degrees F
      SPMB 0 Intake                  OK         33 degrees C / 91 degrees F
      SPMB 1 Intake                  OK         34 degrees C / 93 degrees F
      Routing Engine 0 CPU           OK         35 degrees C / 95 degrees F
      Routing Engine 1 CPU           OK         34 degrees C / 93 degrees F
      SFB 0 Intake-Zone0             OK         45 degrees C / 113 degrees F
      SFB 0 Exhaust-Zone1            OK         38 degrees C / 100 degrees F
      SFB 0 IntakeA-Zone0            OK         35 degrees C / 95 degrees F
      SFB 0 IntakeB-Zone1            OK         31 degrees C / 87 degrees F
      SFB 0 Exhaust-Zone0            OK         41 degrees C / 105 degrees F
      SFB 0 SFB-XF2-Zone1            OK         48 degrees C / 118 degrees F
      SFB 0 SFB-XF1-Zone0            OK         50 degrees C / 122 degrees F
      SFB 0 SFB-XF0-Zone0            OK         56 degrees C / 132 degrees F
      SFB 1 Intake-Zone0             OK         53 degrees C / 127 degrees F
      SFB 1 Exhaust-Zone1            OK         37 degrees C / 98 degrees F
      SFB 1 IntakeA-Zone0            OK         40 degrees C / 104 degrees F
      SFB 1 IntakeB-Zone1            OK         31 degrees C / 87 degrees F
      SFB 1 Exhaust-Zone0            OK         44 degrees C / 111 degrees F
      SFB 1 SFB-XF2-Zone1            OK         47 degrees C / 116 degrees F
      SFB 1 SFB-XF1-Zone0            OK         52 degrees C / 125 degrees F
      SFB 1 SFB-XF0-Zone0            OK         63 degrees C / 145 degrees F
      SFB 2 Intake-Zone0             OK         34 degrees C / 93 degrees F
      SFB 2 Exhaust-Zone1            OK         34 degrees C / 93 degrees F
      SFB 2 IntakeA-Zone0            OK         29 degrees C / 84 degrees F
      SFB 2 IntakeB-Zone1            OK         27 degrees C / 80 degrees F
      SFB 2 Exhaust-Zone0            OK         32 degrees C / 89 degrees F
```

```
SFB 2 SFB-XF2-Zone1          OK          45 degrees C / 113 degrees F
SFB 2 SFB-XF1-Zone0          OK          40 degrees C / 104 degrees F
SFB 2 SFB-XF0-Zone0          OK          42 degrees C / 107 degrees F
SFB 3 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 3 Exhaust-Zone1          OK          34 degrees C / 93 degrees F
SFB 3 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 3 IntakeB-Zone1          OK          27 degrees C / 80 degrees F
SFB 3 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 3 SFB-XF2-Zone1          OK          45 degrees C / 113 degrees F
SFB 3 SFB-XF1-Zone0          OK          39 degrees C / 102 degrees F
SFB 3 SFB-XF0-Zone0          OK          43 degrees C / 109 degrees F
SFB 4 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 4 Exhaust-Zone1          OK          34 degrees C / 93 degrees F
SFB 4 IntakeA-Zone0          OK          27 degrees C / 80 degrees F
SFB 4 IntakeB-Zone1          OK          27 degrees C / 80 degrees F
SFB 4 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1          OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF1-Zone0          OK          39 degrees C / 102 degrees F
SFB 4 SFB-XF0-Zone0          OK          41 degrees C / 105 degrees F
SFB 5 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 5 Exhaust-Zone1          OK          34 degrees C / 93 degrees F
SFB 5 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1          OK          27 degrees C / 80 degrees F
SFB 5 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 5 SFB-XF2-Zone1          OK          44 degrees C / 111 degrees F
SFB 5 SFB-XF1-Zone0          OK          39 degrees C / 102 degrees F
SFB 5 SFB-XF0-Zone0          OK          41 degrees C / 105 degrees F
SFB 6 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 6 Exhaust-Zone1          OK          34 degrees C / 93 degrees F
SFB 6 IntakeA-Zone0          OK          27 degrees C / 80 degrees F
SFB 6 IntakeB-Zone1          OK          27 degrees C / 80 degrees F
SFB 6 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 6 SFB-XF2-Zone1          OK          46 degrees C / 114 degrees F
SFB 6 SFB-XF1-Zone0          OK          38 degrees C / 100 degrees F
SFB 6 SFB-XF0-Zone0          OK          41 degrees C / 105 degrees F
SFB 7 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 7 Exhaust-Zone1          OK          35 degrees C / 95 degrees F
SFB 7 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 7 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 7 SFB-XF2-Zone1          OK          46 degrees C / 114 degrees F
SFB 7 SFB-XF1-Zone0          OK          40 degrees C / 104 degrees F
SFB 7 SFB-XF0-Zone0          OK          42 degrees C / 107 degrees F
```

```
FPC 0 Intake                     OK          30 degrees C / 86 degrees F
FPC 0 Exhaust A                  OK          37 degrees C / 98 degrees F
FPC 0 Exhaust B                  OK          35 degrees C / 95 degrees F
FPC 0 QX 0 TSen                  OK          41 degrees C / 105 degrees F
FPC 0 QX 0 Chip                  OK          43 degrees C / 109 degrees F
FPC 0 LU 0 TCAM TSen             OK          41 degrees C / 105 degrees F
FPC 0 LU 0 TCAM Chip             OK          42 degrees C / 107 degrees F
FPC 0 LU 0 TSen                  OK          41 degrees C / 105 degrees F
FPC 0 LU 0 Chip                  OK          49 degrees C / 120 degrees F
FPC 0 MQ 0 TSen                  OK          41 degrees C / 105 degrees F
FPC 0 MQ 0 Chip                  OK          44 degrees C / 111 degrees F
FPC 1 Intake                     OK          28 degrees C / 82 degrees F
FPC 1 Exhaust A                  OK          42 degrees C / 107 degrees F
FPC 1 Exhaust B                  OK          37 degrees C / 98 degrees F
FPC 1 LU 0 TCAM TSen             OK          42 degrees C / 107 degrees F
FPC 1 LU 0 TCAM Chip             OK          49 degrees C / 120 degrees F
FPC 1 LU 0 TSen                  OK          42 degrees C / 107 degrees F
FPC 1 LU 0 Chip                  OK          49 degrees C / 120 degrees F
FPC 1 MQ 0 TSen                  OK          42 degrees C / 107 degrees F
FPC 1 MQ 0 Chip                  OK          47 degrees C / 116 degrees F
FPC 1 LU 1 TCAM TSen             OK          38 degrees C / 100 degrees F
FPC 1 LU 1 TCAM Chip             OK          42 degrees C / 107 degrees F
FPC 1 LU 1 TSen                  OK          38 degrees C / 100 degrees F
FPC 1 LU 1 Chip                  OK          44 degrees C / 111 degrees F
FPC 1 MQ 1 TSen                  OK          38 degrees C / 100 degrees F
FPC 1 MQ 1 Chip                  OK          44 degrees C / 111 degrees F
FPC 2 Intake                     OK          32 degrees C / 89 degrees F
FPC 2 Exhaust A                  OK          53 degrees C / 127 degrees F
FPC 2 Exhaust B                  OK          60 degrees C / 140 degrees F
FPC 2 LU 0 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 LU 0 Chip                  OK          61 degrees C / 141 degrees F
FPC 2 LU 1 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 LU 1 Chip                  OK          48 degrees C / 118 degrees F
FPC 2 LU 2 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 LU 2 Chip                  OK          53 degrees C / 127 degrees F
FPC 2 LU 3 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 LU 3 Chip                  OK          65 degrees C / 149 degrees F
FPC 2 XM 0 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 XM 0 Chip                  OK          58 degrees C / 136 degrees F
FPC 2 XF 0 TSen                  OK          47 degrees C / 116 degrees F
FPC 2 XF 0 Chip                  OK          69 degrees C / 156 degrees F
FPC 2 PLX Switch TSen            OK          47 degrees C / 116 degrees F
FPC 2 PLX Switch Chip            OK          45 degrees C / 113 degrees F
```

```
        FPC 9 Intake                   OK          32 degrees C / 89 degrees F
        FPC 9 Exhaust A                OK          40 degrees C / 104 degrees F
        FPC 9 Exhaust B                OK          52 degrees C / 125 degrees F
        FPC 9 LU 0 TSen                OK          49 degrees C / 120 degrees F
        FPC 9 LU 0 Chip                OK          50 degrees C / 122 degrees F
        FPC 9 LU 1 TSen                OK          49 degrees C / 120 degrees F
        FPC 9 LU 1 Chip                OK          54 degrees C / 129 degrees F
        FPC 9 LU 2 TSen                OK          49 degrees C / 120 degrees F
        FPC 9 LU 2 Chip                OK          42 degrees C / 107 degrees F
        FPC 9 LU 3 TSen                OK          49 degrees C / 120 degrees F
        FPC 9 LU 3 Chip                OK          44 degrees C / 111 degrees F
        FPC 9 MQ 0 TSen                OK          39 degrees C / 102 degrees F
        FPC 9 MQ 0 Chip                OK          40 degrees C / 104 degrees F
        FPC 9 MQ 1 TSen                OK          39 degrees C / 102 degrees F
        FPC 9 MQ 1 Chip                OK          43 degrees C / 109 degrees F
        FPC 9 MQ 2 TSen                OK          39 degrees C / 102 degrees F
        FPC 9 MQ 2 Chip                OK          36 degrees C / 96 degrees F
        FPC 9 MQ 3 TSen                OK          39 degrees C / 102 degrees F
        FPC 9 MQ 3 Chip                OK          37 degrees C / 98 degrees F
```

For the chassis temperature threshold settings, the output for the `show chassis temperature-thresholds` command is similar to the following:

```
user@host> 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             70    80       95       95      110      110       112
Routing Engine 1             70    80       95       95      110      110       112
CB 0 IntakeA-Zone0           60    65       78       75       85       80        95
CB 0 IntakeB-Zone1           60    65       78       75       85       80        95
CB 0 IntakeC-Zone0           60    65       78       75       85       80        95
CB 0 ExhaustA-Zone0          60    65       78       75       85       80        95
CB 0 ExhaustB-Zone1          60    65       78       75       85       80        95
CB 0 TCBC-Zone0              60    65       78       75       85       80        95
CB 1 IntakeA-Zone0           60    65       78       75       85       80        95
CB 1 IntakeB-Zone1           60    65       78       75       85       80        95
CB 1 IntakeC-Zone0           60    65       78       75       85       80        95
CB 1 ExhaustA-Zone0          60    65       78       75       85       80        95
CB 1 ExhaustB-Zone1          60    65       78       75       85       80        95
CB 1 TCBC-Zone0              60    65       78       75       85       80        95
```

```
SPMB 0 Intake               56    62      75      63      83      76      95
SFB 0 Intake-Zone0          56    62      75      63      82      70      87
SFB 0 Exhaust-Zone1         56    62      75      63      82      70      87
SFB 0 IntakeA-Zone0         56    62      75      63      82      70      87
SFB 0 IntakeB-Zone1         56    62      75      63      82      70      87
SFB 0 Exhaust-Zone0         56    62      75      63      82      70      87
SFB 0 SFB-XF2-Zone1         70    80      90      90     100     107     110
SFB 0 SFB-XF1-Zone0         70    80      90      90     100     107     110
SFB 0 SFB-XF0-Zone0         70    80      90      90     100     107     110
SFB 1 Intake-Zone0          56    62      75      63      82      70      87
SFB 1 Exhaust-Zone1         56    62      75      63      82      70      87
SFB 1 IntakeA-Zone0         56    62      75      63      82      70      87
SFB 1 IntakeB-Zone1         56    62      75      63      82      70      87
SFB 1 Exhaust-Zone0         56    62      75      63      82      70      87
SFB 1 SFB-XF2-Zone1         70    80      90      90     100     107     110
SFB 1 SFB-XF1-Zone0         70    80      90      90     100     107     110
SFB 1 SFB-XF0-Zone0         70    80      90      90     100     107     110
SFB 2 Intake-Zone0          56    62      75      63      82      70      87
SFB 2 Exhaust-Zone1         56    62      75      63      82      70      87
SFB 2 IntakeA-Zone0         56    62      75      63      82      70      87
SFB 2 IntakeB-Zone1         56    62      75      63      82      70      87
SFB 2 Exhaust-Zone0         56    62      75      63      82      70      87
SFB 2 SFB-XF2-Zone1         70    80      90      90     100     107     110
SFB 2 SFB-XF1-Zone0         70    80      90      90     100     107     110
SFB 2 SFB-XF0-Zone0         70    80      90      90     100     107     110
SFB 3 Intake-Zone0          56    62      75      63      82      70      87
SFB 3 Exhaust-Zone1         56    62      75      63      82      70      87
SFB 3 IntakeA-Zone0         56    62      75      63      82      70      87
SFB 3 IntakeB-Zone1         56    62      75      63      82      70      87
SFB 3 Exhaust-Zone0         56    62      75      63      82      70      87
SFB 3 SFB-XF2-Zone1         70    80      90      90     100     107     110
SFB 3 SFB-XF1-Zone0         70    80      90      90     100     107     110
SFB 3 SFB-XF0-Zone0         70    80      90      90     100     107     110
SFB 4 Intake-Zone0          56    62      75      63      82      70      87
SFB 4 Exhaust-Zone1         56    62      75      63      82      70      87
SFB 4 IntakeA-Zone0         56    62      75      63      82      70      87
SFB 4 IntakeB-Zone1         56    62      75      63      82      70      87
SFB 4 Exhaust-Zone0         56    62      75      63      82      70      87
SFB 4 SFB-XF2-Zone1         70    80      90      90     100     107     110
SFB 4 SFB-XF1-Zone0         70    80      90      90     100     107     110
SFB 4 SFB-XF0-Zone0         70    80      90      90     100     107     110
SFB 5 Intake-Zone0          56    62      75      63      82      70      87
SFB 5 Exhaust-Zone1         56    62      75      63      82      70      87
```

```
SFB 5 IntakeA-Zone0          56    62      75      63      82      70      87
SFB 5 IntakeB-Zone1          56    62      75      63      82      70      87
SFB 5 Exhaust-Zone0          56    62      75      63      82      70      87
SFB 5 SFB-XF2-Zone1          70    80      90      90     100     107     110
SFB 5 SFB-XF1-Zone0          70    80      90      90     100     107     110
SFB 5 SFB-XF0-Zone0          70    80      90      90     100     107     110
SFB 6 Intake-Zone0           56    62      75      63      82      70      87
SFB 6 Exhaust-Zone1          56    62      75      63      82      70      87
SFB 6 IntakeA-Zone0          56    62      75      63      82      70      87
SFB 6 IntakeB-Zone1          56    62      75      63      82      70      87
SFB 6 Exhaust-Zone0          56    62      75      63      82      70      87
SFB 6 SFB-XF2-Zone1          70    80      90      90     100     107     110
SFB 6 SFB-XF1-Zone0          70    80      90      90     100     107     110
SFB 6 SFB-XF0-Zone0          70    80      90      90     100     107     110
SFB 7 Intake-Zone0           56    62      75      63      82      70      87
SFB 7 Exhaust-Zone1          56    62      75      63      82      70      87
SFB 7 IntakeA-Zone0          56    62      75      63      82      70      87
SFB 7 IntakeB-Zone1          56    62      75      63      82      70      87
SFB 7 Exhaust-Zone0          56    62      75      63      82      70      87
SFB 7 SFB-XF2-Zone1          70    80      90      90     100     107     110
SFB 7 SFB-XF1-Zone0          70    80      90      90     100     107     110
SFB 7 SFB-XF0-Zone0          70    80      90      90     100     107     110
FPC 1                        55    60      75      65      90      80      95
FPC 2                        55    60      75      65      90      80      95
FPC 3                        55    60      75      65      90      80      95
FPC 4                        55    60      75      65      90      80      95
FPC 6                        55    60      75      65      90      80      95
```

For the fan trays, the output for the `show chassis fan` command is similar to the following:

```
user@host> show chassis fan
 Item                      Status   % RPM     Measurement
      Fan Tray 0 Fan 1          OK       100%      9720 RPM
      Fan Tray 0 Fan 2          OK       100%      9000 RPM
      Fan Tray 0 Fan 3          OK       100%      9720 RPM
      Fan Tray 0 Fan 4          OK       97%       8760 RPM
      Fan Tray 0 Fan 5          OK       100%      9600 RPM
      Fan Tray 0 Fan 6          OK       100%      9000 RPM
      Fan Tray 1 Fan 1          OK       100%      9120 RPM
      Fan Tray 1 Fan 2          OK       100%      9120 RPM
      Fan Tray 1 Fan 3          OK       100%      9120 RPM
      Fan Tray 1 Fan 4          OK       100%      9240 RPM
```

```
        Fan Tray 1 Fan 5            OK         100%        9240 RPM
        Fan Tray 1 Fan 6            OK         100%        9120 RPM
        Fan Tray 2 Fan 1            OK         49%         4440 RPM
        Fan Tray 2 Fan 2            OK         52%         4680 RPM
        Fan Tray 2 Fan 3            OK         52%         4680 RPM
        Fan Tray 2 Fan 4            OK         52%         4680 RPM
        Fan Tray 2 Fan 5            OK         50%         4560 RPM
        Fan Tray 2 Fan 6            OK         50%         4560 RPM
        Fan Tray 3 Fan 1            OK         50%         4560 RPM
        Fan Tray 3 Fan 2            OK         52%         4680 RPM
        Fan Tray 3 Fan 3            OK         52%         4680 RPM
        Fan Tray 3 Fan 4            OK         52%         4680 RPM
        Fan Tray 3 Fan 5            OK         50%         4560 RPM
        Fan Tray 3 Fan 6            OK         50%         4560 RPMM
```

Fan Tray 0, **Fan Tray 1** refer to the lower rear fan trays, **Fan Tray 2**, and **Fan Tray 3** refer to the upper rear fan trays.

Fan 1, **Fan 2**, **Fan 3**, **Fan 4**, **Fan 5**, and **Fan 6** refer to the fans on the fan tray. There are six fans for each fan tray.

RELATED DOCUMENTATION

Replacing an MX2010 Fan Tray | 606

Maintaining the MX2010 Air Baffle

IN THIS SECTION

- Purpose | 754
- Action | 755

Purpose

For optimum cooling, visually inspect the condition of the air baffle (see Figure 366 on page 755 and Figure 367 on page 755).

NOTE: The air baffle is optional.

Figure 366: Air Baffle - Fixed Louvers

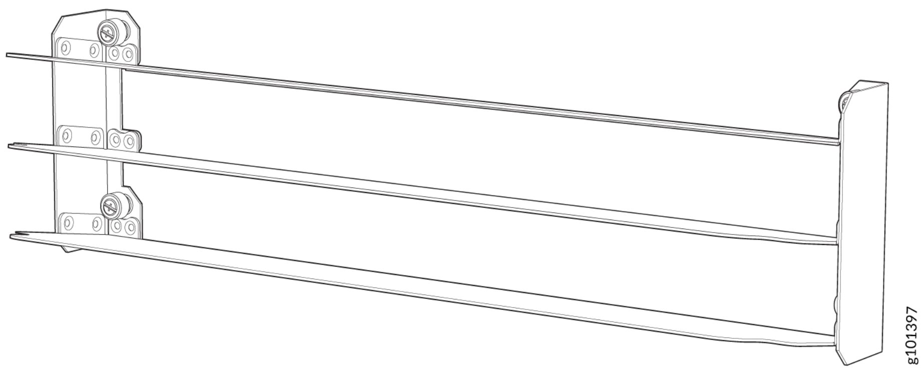
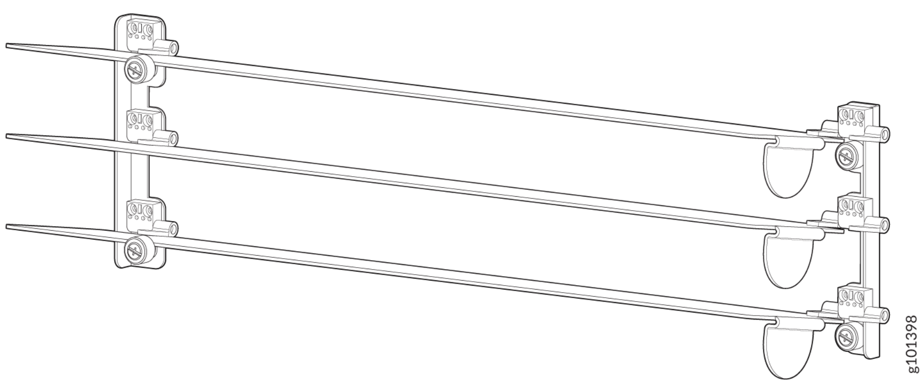


Figure 367: Air Baffle - Adjustable Louvers



Action

- Check the air baffle with adjustable louvers on a regular basis and adjust its louvers to a 10-degree upward tilt/angle to direct the exhaust air away from the router.

RELATED DOCUMENTATION

Tools and Parts Required for Replacing MX2010 Hardware Components | 501

MX2010 Cooling System Description | 51

Maintaining the MX2010 Host Subsystem

IN THIS SECTION

- Maintaining the MX2010 Routing Engines | 756
- Maintaining the MX2010 Control Boards | 758

Maintaining the MX2010 Routing Engines

IN THIS SECTION

- Purpose | 756
- Action | 756

Purpose

Each host subsystem comprises a Control Board and Routing Engine (CB-RE) functioning together.

To maintain the host subsystem, check the LEDs (**RE0** and **RE1**) on the craft interface. For more information about the LEDs and the display, see "MX2010 Craft Interface Description " on page 34.

NOTE: Even though the Routing Engine is combined with a Control Board (CB-RE), separate LEDs on the craft interface show the status of the Routing Engines, and separate LEDs show the status of the Control Boards.

For optimum router performance, verify the condition of the Routing Engines and the Control Boards.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs, and the display, see "MX2010 Craft Interface Description " on page 34. During normal operations:

  > **NOTE**: Even though the Routing Engine is combined with a Control Board (CB-RE), separate LEDs on the craft interface show the status of the Routing Engines, and separate LEDs show the status of the Control Boards.

  - The green host subsystem **ONLINE** LED on the craft interface is lit.
  - The red host subsystem **OFFLINE** LED on the craft interface is not lit.

- Check the LEDs on the Routing Engine portion of the CB-RE faceplate. During normal operations, the **ONLINE** LED is lit steadily green.

- Issue the `show chassis routing-engine` command to check the status of the Routing Engines. The output is similar to the following:

```
user@host> show chassis routing-engine

Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature                 39 degrees C / 102 degrees F
    CPU temperature             35 degrees C / 95 degrees F
    DRAM                      16351 MB (16384 MB installed)
    Memory utilization          7 percent
    CPU utilization:
      User                      0 percent
      Background                0 percent
      Kernel                    2 percent
      Interrupt                 1 percent
      Idle                     97 percent
    Model                          RE-S-1800x4
    Serial ID                      9009094145
    Start time                     2013-02-16 18:06:28 PST
    Uptime                         2 days, 20 hours, 54 minutes, 15 seconds
    Last reboot reason             Router rebooted after a normal shutdown.
    Load averages:                 1 minute   5 minute  15 minute
                                       0.10       0.03       0.01
Routing Engine status:
  Slot 1:
```

```
Current state                  Backup
Election priority              Backup (default)
Temperature                 38 degrees C / 100 degrees F
CPU temperature             34 degrees C / 93 degrees F
DRAM                      16351 MB (16384 MB installed)
Memory utilization           7 percent
CPU utilization:
  User                       0 percent
  Background                 0 percent
  Kernel                     0 percent
  Interrupt                  0 percent
  Idle                      99 percent
Model                          RE-S-1800x4
Serial ID                      9009094136
Start time                     2013-02-16 18:06:36 PST
Uptime                         2 days, 20 hours, 54 minutes, 5 seconds
Last reboot reason             Router rebooted after a normal shutdown.
Load averages:                 1 minute   5 minute  15 minute
                                   0.00       0.00       0.00
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

Maintaining the MX2010 Control Boards

IN THIS SECTION

- Purpose | 758
- Action | 758

Purpose

For optimum router performance, verify the condition of the Control Board and Routing Engine (CB-RE).

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs and the display, see "MX2010 Craft Interface Description " on page 34 .

During normal operations:

- The green host subsystem **ONLINE** LED on the craft interface is lit.
- The red host subsystem **OFFLINE** LED on the craft interface is not lit.

- Check the LEDs on the Control Board portion of the CB-RE faceplate.

  During normal operations:

  - The green **OK** LED on the CB-RE faceplate is lit.
  - The red **FAIL** LED on the CB-RE faceplate is not lit.

- Issue the `show chassis environment cb` command to check the status of the CB-REs. The output is similar to the following:

```
user@host> show chassis environment cb

CB 0 status:
  State                        Online Master
  IntakeA-Zone0 Temperature   30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature   33 degrees C / 91 degrees F
  IntakeC-Zone0 Temperature   37 degrees C / 98 degrees F
  ExhaustA-Zone0 Temperature 33 degrees C / 91 degrees F
  ExhaustB-Zone1 Temperature 33 degrees C / 91 degrees F
  TCBC-Zone0 Temperature     35 degrees C / 95 degrees F
  Power 1
    1.0 V                       1011 mV
    1.2 V                       1211 mV
    1.8 V                       1814 mV
    2.5 V                       2545 mV
    3.3 V                       3319 mV
    5.0 V                       5014 mV
    5.0 V RE                    4962 mV
    12.0 V                     12123 mV
    12.0 V RE                  12007 mV
  Bus Revision                 100
  FPGA Revision                270
CB 1 status:
  State                        Online Standby
  IntakeA-Zone0 Temperature   30 degrees C / 86 degrees F
  IntakeB-Zone1 Temperature   31 degrees C / 87 degrees F
  IntakeC-Zone0 Temperature   33 degrees C / 91 degrees F
  ExhaustA-Zone0 Temperature 32 degrees C / 89 degrees F
```

```
ExhaustB-Zone1 Temperature 31 degrees C / 87 degrees F
TCBC-Zone0 Temperature     34 degrees C / 93 degrees F
Power 1
  1.0 V                     1008 mV
  1.2 V                     1211 mV
  1.8 V                     1798 mV
  2.5 V                     2520 mV
  3.3 V                     3312 mV
  5.0 V                     5020 mV
  5.0 V RE                  4962 mV
  12.0 V                   12065 mV
  12.0 V RE                11988 mV
Bus Revision               100
FPGA Revision              0
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57
MX2010 Component LEDs on the Craft Interface | 36
Troubleshooting the MX2010 Host Subsystems | 822

Maintaining MX2010 MICs

IN THIS SECTION

- Purpose | 760
- Action | 761

Purpose

For optimum router performance, verify the condition of the Modular Interface Cards (MICs).

Action

On a regular basis:

- Check the LEDs on MIC faceplates. The meaning of the LED states differs for various MICs. For more information, see the *MX Series Interface Module Reference*. If the MPC that houses the MIC detects a MIC failure, the MPC generates an alarm message to be sent to the Routing Engine.

- Issue the CLI `show chassis fpc pic-status` command. The MIC slots in an MPC are numbered **PIC 0/1** and **PIC 2/3**, top to bottom:

```
user@host> show chassis fpc pic-status
Slot 0   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 1   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 2   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 3   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 4   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 5   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 6   Online       MPC 3D 16x 10GE
```

```
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 7   Online       MPC 3D 16x 10GE EM
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 8   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 9   Online       MPCE Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | **280**

MX2010 Router Hardware Components and CLI Terminology | **29**

MX2010 Modular Port Concentrator Description | **92**

Maintaining the MX2010 Ethernet Switch | **739**

MX2010 Modular Interface Card LEDs | **117**

Troubleshooting the MX2010 MICs | **832**

Replacing an MX2010 MIC | **613**

Maintaining MX2010 MPCs

IN THIS SECTION

- Purpose | 763
- Action | 763

Purpose

The router can have up to 10 Modular Port Concentrators (MPCs) mounted vertically in the MPC card cage at the front of the chassis. For optimum router performance, verify the condition of the MPCs.

Action

On a regular basis:

- Check the LEDs on the craft interface directly above each MPC slot. The green LED labeled **OK** lights steadily when a MPC is functioning normally.
- Check the **OK/FAIL** LED on the MPC. For more information, see *MX Series Interface Module Reference*. If the MPC detects a failure, the MPC sends an alarm message to the Routing Engine.
- Check the status of installed MPCs by issuing the CLI `show chassis fpc` command to check the status of installed MPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the MPC is functioning normally:

```
user@host> show chassis fpc
                     Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State            (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online            59     13          0       2048       16         14
  1  Online            59     13          0       2048       16         14
  2  Online            58     14          0       2048       17         14
  3  Online            58     18          0       2048       17         14
  4  Online            58     13          0       2048       16         14
  5  Online            61     10          0       2048       18         13
  6  Online            62     10          0       2048       18         13
  7  Online            61      9          0       2048       18         13
```

```
  8  Online            61     10          0        2048       18          13
  9  Online            60      9          0        2048       11          13
```

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

```
user@host> show chassis fpc detail
Slot 0 information:
  State                                 Online
  Temperature                        29
  Total CPU DRAM                   2048 MB
  Total RLDRAM                      403 MB
  Total DDR DRAM                   1572 MB
  Start time:                           2013-02-17 02:21:23 PST
  Uptime:                               2 days, 12 hours, 41 minutes, 29 seconds
  Max Power Consumption             249 Watts
Slot 1 information:
  State                                 Online
  Temperature                        27
  Total CPU DRAM                   2048 MB
  Total RLDRAM                      662 MB
  Total DDR DRAM                   3072 MB
  Start time:                           2013-02-17 02:21:31 PST
  Uptime:                               2 days, 12 hours, 41 minutes, 21 seconds
  Max Power Consumption             348 Watts
Slot 2 information:
  State                                 Online
  Temperature                        30
  Total CPU DRAM                   2048 MB
  Total RLDRAM                     1036 MB
  Total DDR DRAM                   6656 MB
  Start time:                           2013-02-17 02:21:36 PST
  Uptime:                               2 days, 12 hours, 41 minutes, 16 seconds
  Max Power Consumption             520 Watts
Slot 9 information:
  State                                 Online
  Temperature                        31
  Total CPU DRAM                   2048 MB
  Total RLDRAM                     1324 MB
  Total DDR DRAM                   6144 MB
  Start time:                           2013-02-17 02:21:47 PST
```

```
  Uptime:                                    2 days, 12 hours, 41 minutes, 5 seconds
  Max Power Consumption                  440 Watts
```

- Issue the CLI `show chassis fpc pic-status` command. The MPC slots are numbered from 0 through 9 (left to right):

```
user@host> show chassis fpc pic-status
Slot 0   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 1   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 2   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 3   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 4   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 5   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 6   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
```

```
Slot 7   Online       MPC 3D 16x 10GE EM
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 8   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 9   Online       MPCE Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

MX2010 Chassis Description | 6

MX2010 Modular Port Concentrator Description | 92

MX2010 Component LEDs on the Craft Interface | 36

Troubleshooting the MX2010 MPCs | 833

Replacing an MX2010 MPC and Adapter Card | 625

Maintaining MX2010 Packet Forwarding Engine Components

IN THIS SECTION

- Maintaining MX2010 MPCs | 767
- Maintaining MX2010 MICs | 770

- Maintaining the MX2010 Ethernet Switch | 773
- Maintaining Cables That Connect to MX2010 MPCs or MICs | 776

Maintaining MX2010 MPCs

IN THIS SECTION

- Purpose | 767
- Action | 767

Purpose

The router can have up to 10 Modular Port Concentrators (MPCs) mounted vertically in the MPC card cage at the front of the chassis. For optimum router performance, verify the condition of the MPCs.

Action

On a regular basis:

- Check the LEDs on the craft interface directly above each MPC slot. The green LED labeled **OK** lights steadily when a MPC is functioning normally.
- Check the **OK/FAIL** LED on the MPC. For more information, see *MX Series Interface Module Reference*. If the MPC detects a failure, the MPC sends an alarm message to the Routing Engine.
- Check the status of installed MPCs by issuing the CLI `show chassis fpc` command to check the status of installed MPCs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the MPC is functioning normally:

```
user@host> show chassis fpc
                     Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State            (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online            59     13          0       2048        16        14
  1  Online            59     13          0       2048        16        14
  2  Online            58     14          0       2048        17        14
  3  Online            58     18          0       2048        17        14
```

```
  4  Online            58     13          0       2048       16          14
  5  Online            61     10          0       2048       18          13
  6  Online            62     10          0       2048       18          13
  7  Online            61      9          0       2048       18          13
  8  Online            61     10          0       2048       18          13
  9  Online            60      9          0       2048       11          13
```

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

```
user@host> show chassis fpc detail
Slot 0 information:
  State                                  Online
  Temperature                         29
  Total CPU DRAM                    2048 MB
  Total RLDRAM                       403 MB
  Total DDR DRAM                    1572 MB
  Start time:                            2013-02-17 02:21:23 PST
  Uptime:                                2 days, 12 hours, 41 minutes, 29 seconds
  Max Power Consumption              249 Watts
Slot 1 information:
  State                                  Online
  Temperature                         27
  Total CPU DRAM                    2048 MB
  Total RLDRAM                       662 MB
  Total DDR DRAM                    3072 MB
  Start time:                            2013-02-17 02:21:31 PST
  Uptime:                                2 days, 12 hours, 41 minutes, 21 seconds
  Max Power Consumption              348 Watts
Slot 2 information:
  State                                  Online
  Temperature                         30
  Total CPU DRAM                    2048 MB
  Total RLDRAM                      1036 MB
  Total DDR DRAM                    6656 MB
  Start time:                            2013-02-17 02:21:36 PST
  Uptime:                                2 days, 12 hours, 41 minutes, 16 seconds
  Max Power Consumption              520 Watts
Slot 9 information:
  State                                  Online
  Temperature                         31
  Total CPU DRAM                    2048 MB
```

```
  Total RLDRAM                      1324 MB
  Total DDR DRAM                    6144 MB
  Start time:                            2013-02-17 02:21:47 PST
  Uptime:                                2 days, 12 hours, 41 minutes, 5 seconds
  Max Power Consumption              440 Watts
```

- Issue the CLI `show chassis fpc pic-status` command. The MPC slots are numbered from **0** through **9** (left to right):

```
user@host> show chassis fpc pic-status
Slot 0   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 1   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 2   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 3   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 4   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 5   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 6   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
```

```
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 7   Online       MPC 3D 16x 10GE EM
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 8   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 9   Online       MPCE Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

MX2010 Chassis Description | 6

MX2010 Modular Port Concentrator Description | 92

MX2010 Component LEDs on the Craft Interface | 36

Troubleshooting the MX2010 MPCs | 833

Replacing an MX2010 MPC and Adapter Card | 625

Maintaining MX2010 MICs

IN THIS SECTION

- Purpose | 771
- Action | 771

Purpose

For optimum router performance, verify the condition of the Modular Interface Cards (MICs).

Action

On a regular basis:

- Check the LEDs on MIC faceplates. The meaning of the LED states differs for various MICs. For more information, see the *MX Series Interface Module Reference*. If the MPC that houses the MIC detects a MIC failure, the MPC generates an alarm message to be sent to the Routing Engine.
- Issue the CLI `show chassis fpc pic-status` command. The MIC slots in an MPC are numbered **PIC 0/1** and **PIC 2/3**, top to bottom:

```
user@host> show chassis fpc pic-status
Slot 0   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 1   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 2   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 3   Online       MPC4E 3D 32XGE
  PIC 0  Online       8X10GE SFPP
  PIC 1  Online       8X10GE SFPP
  PIC 2  Online       8X10GE SFPP
  PIC 3  Online       8X10GE SFPP
Slot 4   Online       MPC4E 3D 2CGE+8XGE
  PIC 0  Online       4x10GE SFPP
  PIC 1  Online       1X100GE CFP
  PIC 2  Online       4x10GE SFPP
  PIC 3  Online       1X100GE CFP
Slot 5   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
```

```
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 6   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 7   Online       MPC 3D 16x 10GE EM
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 8   Online       MPC 3D 16x 10GE
  PIC 0  Online       4x 10GE(LAN) SFP+
  PIC 1  Online       4x 10GE(LAN) SFP+
  PIC 2  Online       4x 10GE(LAN) SFP+
  PIC 3  Online       4x 10GE(LAN) SFP+
Slot 9   Online       MPCE Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

Tools and Parts Required to Maintain the MX2010 Hardware Components | **280**

MX2010 Router Hardware Components and CLI Terminology | **29**

MX2010 Modular Port Concentrator Description | **92**

Maintaining the MX2010 Ethernet Switch | **739**

MX2010 Modular Interface Card LEDs | **117**

Troubleshooting the MX2010 MICs | **832**

Replacing an MX2010 MIC | **613**

Maintaining the MX2010 Ethernet Switch

IN THIS SECTION

- Purpose | 773
- Action | 773

Purpose

For optimum router performance, verify the status of the Gigabit Ethernet ports connected to MPCs.

Action

On a regular basis:

- Check the LEDs on MPC faceplates. The meaning of the LED states differs for various MICs. For more information, see the *MX Series Interface Module Reference*.
- Issue the CLI `show chassis ethernet-switch` command:

```
user@host> show chassis ethernet-switch
Displaying summary for switch 0
Link is good on GE port 0 connected to device: FPC0
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 1 connected to device: FPC1
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 2 connected to device: FPC3
  Speed is 1000Mb
  Duplex is full
```

```
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 3 connected to device: FPC2
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 4 connected to device: FPC5
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 5 connected to device: FPC4
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 6 connected to device: FPC6
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 7 connected to device: FPC7
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 8 connected to device: FPC8
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
```

```
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 9 connected to device: FPC9
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 20 connected to device: Other RE-GigE
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is good on GE port 21 connected to device: RE-GigE
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is down on GE port 22 connected to device: Debug-GigE

Link is good on GE port 23 connected to device: SPMB
  Speed is 1000Mb
  Duplex is full
  Autonegotiate is Enabled
  Flow Control TX is Disabled
  Flow Control RX is Disabled

Link is down on XE port 24 connected to device: SFP+ 0

Link is down on XE port 25 connected to device: SFP+ 1

Link is down on XE port 26 connected to device: RE-10GigE

Link is down on XE port 27 connected to device: Other RE-10GigE
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

MX2000 Host Subsystem CB-RE Description | 57
Troubleshooting the MX2010 Host Subsystems | 822

Maintaining Cables That Connect to MX2010 MPCs or MICs

IN THIS SECTION

- Purpose | 776
- Action | 776

Purpose

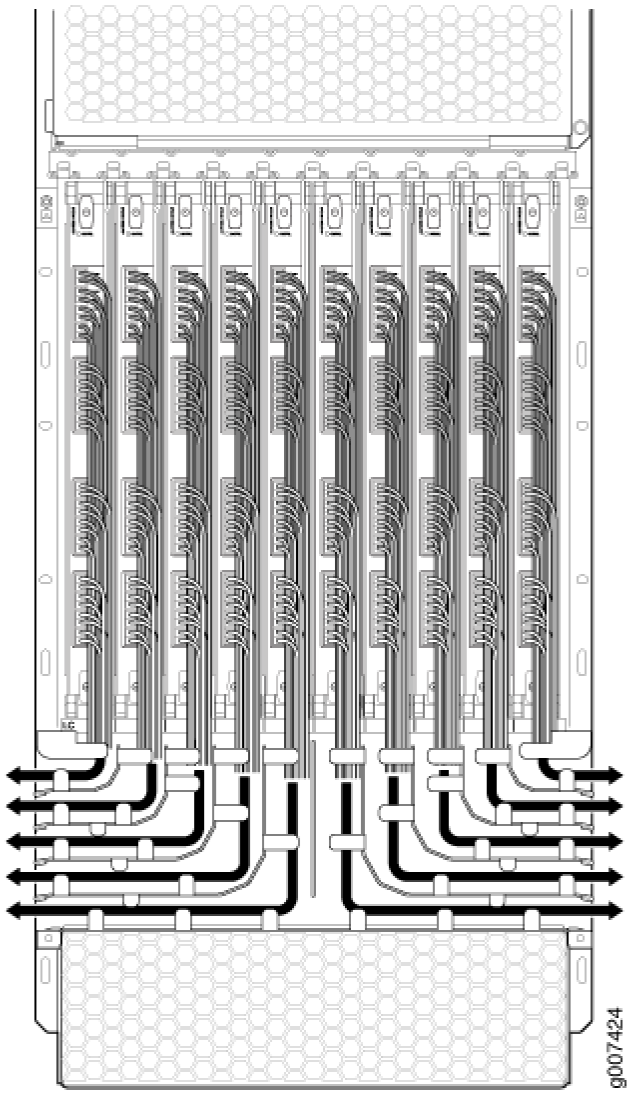
For optimum router performance, verify the condition of the cables that connect to the MPCs or MICs.

Action

On a regular basis:

- Use the lower cable manager (shown in Figure 368 on page 777) to support cables and prevent cables from dislodging or developing stress points.

Figure 368: Lower Cable Manager Cable Routing



NOTE: The MX2010 supports a standard and extended upper and lower cable manager.

- Place excess cable out of the way in the lower cable manager. Do not allow fastened loops of cable to dangle from the connector or cable manager because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.
- Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them, if necessary, before connecting an interface.
- Label both ends of the cables to identify them.

The following guidelines apply specifically to fiber-optic cables:

- When you unplug a fiber-optic cable, always place a rubber safety plug over the transceiver on the faceplate and on the end of the cable.
- Anchor fiber-optic cables to avoid stress on the connectors. Be sure to secure fiber-optic cables so that they do not support their own weight as they hang to the floor. Never let fiber-optic cable hang free from the connector.
- Avoid bending fiber-optic cable beyond its bend radius. An arc smaller than a few inches can damage the cable and cause problems that are difficult to diagnose.
- Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments can cause damage to the instruments 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.

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

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

SEE ALSO

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

Maintaining MX2010 MPCs | 763

Maintaining MX2010 MICs | 760

Maintaining the Power Supply Modules on the MX2000 Line of Routers

IN THIS SECTION

- Purpose | 779
- Action | 779

Purpose

For optimum router performance, verify the condition of the power supply modules (PSMs).

Action

On a regular basis:

- Check the status of the PSMs by issuing the `show chassis environment psm` command.

  The following output displays environmental information about the PSMs in an MX2010:

```
user@host> show chassis environment psm
PSM 2 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         50.00       18.90     945.00
                             INP1         0.00        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.75      16.50      853.88     40.66
  Hours Used                 6140
PSM 3 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         50.40       18.90     952.56
                             INP1         0.00        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.75      16.50      853.88     40.66
  Hours Used                 6140
```

```
40
...
```

Here is an example of the AC PSM input status for an MX2010:

```
user@host> show chassis environment psm

PSM 0 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         223.75      1.40      313.25
                             INP1         0.00        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
PSM 1 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         225.00      1.40      315.00
                             INP1         2.50        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
PSM 2 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         225.00      1.30      292.50
                             INP1         3.75        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
P...
```

Here is an example of the universal PSM (HVAC/HVDC) input status for an MX2010:

```
user@host> show chassis environment psm
PSM 0 status:
  State                      Online
```

```
  Temperature                         OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         209.10      0.10       20.91
                           INP1         209.10      0.10       20.91
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.50      5.10       267.75     7.87
  Hours Used               1832
PSM 1 status:
  State                    Online
  Temperature                         OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         209.10      0.20       41.82
                           INP1         209.10      0.90       188.19
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.50      6.46       339.15     9.98
  Hours Used               2571
PSM 2 status:
  State                    Online
  Temperature                         OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         209.10      3.70       773.67
                           INP1         210.80      2.70       569.16
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.50      17.34      910.35     26.78
  Hours Used               3404
PSM 3 status:
  State                    Online
  Temperature                         OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         209.10      3.60       752.76
                           INP1         209.10      0.60       125.46
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.50      11.90      624.75     18.37
  Hours Used               2571
...
```

- Make sure that the power and grounding cables are arranged so that they do not obstruct access to other router components.

- Routinely check the status LEDs on the AC or DC PSM faceplates and the craft interface to determine whether the PSMs are functioning normally.

- Check the red and yellow alarm LEDs on the craft interface. PSM failure or removal triggers an alarm that causes one or both of the LEDs to light. You can display the associated error messages by issuing the following command:

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

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

RELATED DOCUMENTATION

MX2010 Power System Description | 121
MX2010 Troubleshooting Resources | 816
Troubleshooting the MX2000 Router Power System
Overview of Preparing the Site for the MX2010 Router | 162
MX2020 Power Subsystem Description
MX2020 Troubleshooting Resources
Overview of Preparing the Site for the MX2020 Router

Maintaining the MX2010 Power Usage

IN THIS SECTION

- Purpose | 782
- Action | 782

Purpose

For optimum router performance, verify the AC or DC power usage.

Action

On a regular basis:

- Make sure that the total system power consumption and capacity does not exceed the maximum allocated.
    - Issue the `show chassis power` command to display the information about the AC or DC power system.

The following output displays the AC chassis power for 2500 W capacity.

```
user@hostshow chassis power
PSM 0:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 349.31 W (6.75 A at 51.75 V, 13.97% of capacity)

PSM 1:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 325.00 W (6.25 A at 52.00 V, 13.00% of capacity)

PSM 2:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 375.19 W (7.25 A at 51.75 V, 15.01% of capacity)

PSM 3:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 362.25 W (7.00 A at 51.75 V, 14.49% of capacity)

PSM 4:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 364.00 W (7.00 A at 52.00 V, 14.56% of capacity)

PSM 5:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
```

```
  DC output: 364.00 W (7.00 A at 52.00 V, 14.56% of capacity)

PSM 6:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 362.25 W (7.00 A at 51.75 V, 14.49% of capacity)

PSM 7:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 364.00 W (7.00 A at 52.00 V, 14.56% of capacity)

PSM 8:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 414.00 W (8.00 A at 51.75 V, 16.56% of capacity)

System:
  Capacity:            22500 W (maximum 22500 W)
  Allocated power:     6660 W (15840 W remaining)
  Actual usage:        3280.00 W
```

The following output displays the DC chassis power for 2500 W capacity.

NOTE: The capacity of the DC PSM is fixed and is limited by the power feeds as indicated by the 60 A/80 A switch on the PDM.

```
user@host> show chassis power
PSM 0:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 627.81 W (12.25 A at 51.25 V, 25.11% of capacity)

PSM 1:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
```

```
  Capacity:  2500 W (maximum 2500 W)
  DC output: 624.75 W (12.25 A at 51.00 V, 24.99% of capacity)

PSM 2:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 612.00 W (12.00 A at 51.00 V, 24.48% of capacity)

PSM 3:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 627.81 W (12.25 A at 51.25 V, 25.11% of capacity)

PSM 4:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 627.81 W (12.25 A at 51.25 V, 25.11% of capacity)

PSM 5:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 624.75 W (12.25 A at 51.00 V, 24.99% of capacity)

PSM 6:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 637.50 W (12.50 A at 51.00 V, 25.50% of capacity)

PSM 7:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
  DC output: 624.75 W (12.25 A at 51.00 V, 24.99% of capacity)

PSM 8:
  State:     Online
  DC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2500 W (maximum 2500 W)
```

```
  DC output: 624.75 W (12.25 A at 51.00 V, 24.99% of capacity)

System:
  Capacity:              22500 W (maximum 22500 W)
  Allocated power:       13318 W (9182 W remaining)
  Actual usage:          5631.94 W
```

The output displays the 240 V China DC chassis power for 2100 W capacity.

```
user@host> show chassis power

PSM 0:
  State:     Empty
  Input:     Absent

PSM 1:
  State:     Empty
  Input:     Absent

PSM 2:
  State:     Empty
  Input:     Absent

PSM 3:
  State:     Empty
  Input:     Absent

PSM 4:
  State:     Empty
  Input:     Absent

PSM 5:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 345.94 W (Lower Zone, 6.75 A at 51.25 V, 16.47% of capacity)

PSM 6:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 333.12 W (Lower Zone, 6.50 A at 51.25 V, 15.86% of capacity)
```

```
PSM 7:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 333.12 W (Lower Zone, 6.50 A at 51.25 V, 15.86% of capacity)

PSM 8:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 333.12 W (Lower Zone, 6.50 A at 51.25 V, 15.86% of capacity)

PSM 9:
  State:     Empty
  Input:     Absent

PSM 10:
  State:     Empty
  Input:     Absent

PSM 11:
  State:     Empty
  Input:     Absent

PSM 12:
  State:     Empty
  Input:     Absent

PSM 13:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 269.06 W (Upper Zone, 5.25 A at 51.25 V, 12.81% of capacity)

PSM 14:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 281.88 W (Upper Zone, 5.50 A at 51.25 V, 13.42% of capacity)

PSM 15:
  State:     Online
```

```
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 269.06 W (Upper Zone, 5.25 A at 51.25 V, 12.81% of capacity)

PSM 16:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 269.06 W (Upper Zone, 5.25 A at 51.25 V, 12.81% of capacity)

PSM 17:
  State:     Online
  DC input:  OK (INP1 feed expected, INP1 feed connected)
  Capacity:  2100 W (maximum 2500 W)
  DC output: 281.88 W (Upper Zone, 5.50 A at 51.25 V, 13.42% of capacity)

System:
  Upper Zone:
      Capacity:          10500 W (maximum 12500 W)
      Allocated power:   7760 W (2740 W remaining)
      Actual usage:      1370.94 W
  Lower Zone:
      Capacity:          8400 W (maximum 10000 W)
      Allocated power:   7760 W (640 W remaining)
      Actual usage:      1345.31 W
  Total system capacity: 18900 W (maximum 22500 W)
  Total remaining power: 3380 W
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2010 Power System Description | 121

Preventing Electrostatic Discharge Damage to an MX Series Router

Troubleshooting the MX2000 Router Power System

Converting an MX2000 Router Between AC and DC Power

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

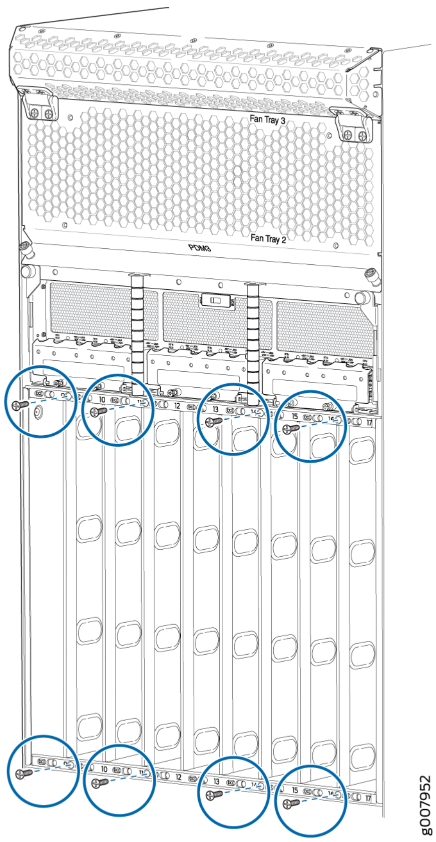
NOTE: A system cannot operate with a mix of AC and DC power supplies.

To convert an MX2000 router between AC and DC power or HVAC/HVDC power, you must completely power off the system, remove the power distribution modules (PDMs), remove the power supplies, and then adjust the AC/DC setting as described here.

1. Power off the router. See "Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router" on page 812 or "Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router" on page 813.
2. Switch off the dedicated customer-site circuit breakers to the PDMs being removed. Make sure that the voltage across the power source cord is 0 V and that there is no chance that the cord might become active during the removal process.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Remove the PDMs. Depending on your configuration, see:
   - *Removing an MX2000 Three-Phase Wye AC Power Distribution Module*
   - *Removing an MX2000 Three-Phase Delta AC Power Distribution Module*
   - *Removing an MX2000 Single-Phase AC Power Distribution Module*
   - "Removing an MX2000 Router DC Power Distribution Module (-48 V)" on page 572
   - "Replacing an MX2000 DC Power Distribution Module (240 V China)" on page 578
   - *Replacing an MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module*
5. Remove the Power Supply Modules (PSMs). See "Removing an MX2000 AC Power Supply Module" on page 659 or *Removing an MX2000 Router DC Power Supply Module (-48 V)*, "Replacing an MX2000 DC Power Supply Module (240 V China)" on page 559, *Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module* .
6. Remove the adjustment bar locking screws shown in Figure 369 on page 790 using a Phillips screw driver. There are eight screws per PSM.

NOTE: The AC/DC settings and the screw locations are the same for MX2008, MX2010, and MX2020 routers.

Figure 369: Removing the MX2000 Router Adjustment Bar Locking Screws

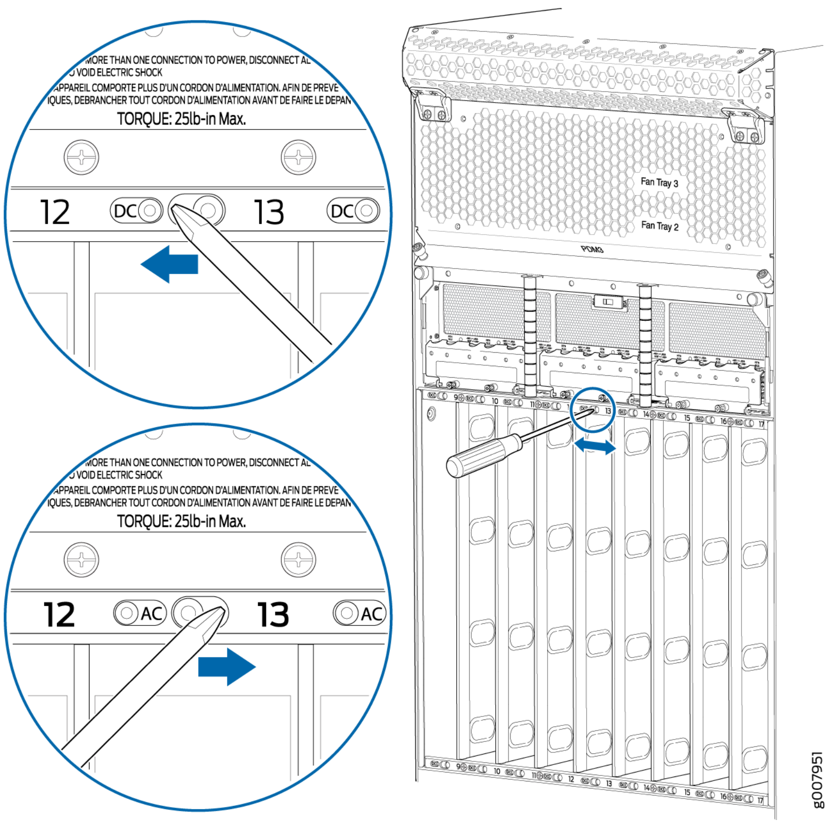


NOTE: If you are switching from AC PDMs or 48-V DC PDMs to high-voltage universal (HVAC/HVDC) PDMs, they work with either AC or DC bar setting and no mechanical change is needed. You can skip steps 6 to 8.

The 240 VDC China PDMs and PSMs require setting the locking bars to the **DC** position as described below.

7. Insert a screw driver into each adjustment slot and slide the adjustment bar to the right for DC configurations or to the left for AC configurations. Refer to Figure 370 on page 791.

Figure 370: Changing the AC and DC Setting on an MX2000 Router



8. Reinstall the screws removed in step 6 and tighten them. Apply between 7 lb-in (0.8 Nm) and 9 lb-in. (1.01 Nm) of torque to each screw.
9. Install the PSMs. See "Installing MX2000 Router DC Power Supply Modules (-48 V)" on page 476, "Installing MX2000 Router AC Power Supply Modules" on page 473, *Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module* , or "Replacing an MX2000 DC Power Supply Module (240 V China)" on page 559.
10. Install the PDMs. Depending on your configuration, see:
    - *Installing an MX2000 Router Three-Phase Wye AC Power Distribution Module*
    - *Installing an MX2000 Router Three-Phase Delta AC Power Distribution Module*
    - "Installing an MX2000 Single-Phase AC Power Distribution Module" on page 494
    - "Installing an MX2000 Router DC Power Distribution Module (-48 V)" on page 431
    - "Replacing an MX2000 DC Power Distribution Module (240 V China)" on page 578
    - *Replacing an MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module*
11. Switch on the dedicated customer-site circuit breaker.

> **NOTE**: The circuit breaker might bounce back to the off position if you move the breaker too quickly.

12. Verify that the LED on each PDM is lit steadily green.
13. Turn the power switch to the on (|) position for the PSMs that will be powered by the installed PDMs.

RELATED DOCUMENTATION

Tools and Parts Required for Connecting an MX2000 Router to Power | 280

Troubleshooting the MX2000 Router Power System

MX2000 Router Grounding Specifications | 183

Maintaining the MX2010 Routing Engines

IN THIS SECTION

- Purpose | 792
- Action | 793

Purpose

Each host subsystem comprises a Control Board and Routing Engine (CB-RE) functioning together.

To maintain the host subsystem, check the LEDs (**RE0** and **RE1**) on the craft interface. For more information about the LEDs and the display, see "MX2010 Craft Interface Description " on page 34.

> **NOTE**: Even though the Routing Engine is combined with a Control Board (CB-RE), separate LEDs on the craft interface show the status of the Routing Engines, and separate LEDs show the status of the Control Boards.

For optimum router performance, verify the condition of the Routing Engines and the Control Boards.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs, and the display, see "MX2010 Craft Interface Description " on page 34. During normal operations:

  > **NOTE**: Even though the Routing Engine is combined with a Control Board (CB-RE), separate LEDs on the craft interface show the status of the Routing Engines, and separate LEDs show the status of the Control Boards.

  - The green host subsystem **ONLINE** LED on the craft interface is lit.
  - The red host subsystem **OFFLINE** LED on the craft interface is not lit.

- Check the LEDs on the Routing Engine portion of the CB-RE faceplate. During normal operations, the **ONLINE** LED is lit steadily green.

- Issue the `show chassis routing-engine` command to check the status of the Routing Engines. The output is similar to the following:

```
user@host> show chassis routing-engine

Routing Engine status:
  Slot 0:
    Current state                  Master
    Election priority              Master (default)
    Temperature                 39 degrees C / 102 degrees F
    CPU temperature             35 degrees C / 95 degrees F
    DRAM                      16351 MB (16384 MB installed)
    Memory utilization           7 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     2 percent
      Interrupt                  1 percent
      Idle                      97 percent
    Model                          RE-S-1800x4
    Serial ID                      9009094145
    Start time                     2013-02-16 18:06:28 PST
    Uptime                         2 days, 20 hours, 54 minutes, 15 seconds
    Last reboot reason             Router rebooted after a normal shutdown.
```

```
    Load averages:                  1 minute   5 minute  15 minute
                                        0.10       0.03       0.01
Routing Engine status:
  Slot 1:
    Current state                   Backup
    Election priority               Backup (default)
    Temperature                  38 degrees C / 100 degrees F
    CPU temperature              34 degrees C / 93 degrees F
    DRAM                       16351 MB (16384 MB installed)
    Memory utilization            7 percent
    CPU utilization:
      User                        0 percent
      Background                  0 percent
      Kernel                      0 percent
      Interrupt                   0 percent
      Idle                       99 percent
    Model                           RE-S-1800x4
    Serial ID                       9009094136
    Start time                      2013-02-16 18:06:36 PST
    Uptime                          2 days, 20 hours, 54 minutes, 5 seconds
    Last reboot reason              Router rebooted after a normal shutdown.
    Load averages:                  1 minute   5 minute  15 minute
                                        0.00       0.00       0.00
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

Maintaining the MX2010 SFB

IN THIS SECTION

- Purpose | 794
- Action | 795

Purpose

For optimum router performance, verify the condition of the SFBs.

Action

On a regular basis:

- Check the LED on the SFB faceplate.

  During normal operations:

  - The bicolor **OK/FAIL** LED on the SFB faceplate is lit green steadily.
  - The bicolor **OK/FAIL** LED on the SFB faceplate is blinking green.
  - The bicolor **OK/FAIL** red LED on the SFB faceplate is off.

- Issue the `show chassis sfb` command to display information about the SFBs. The output is similar to the following:

```
user@host> show chassis sfb
Slot  State              Uptime
 0    Online              2 days, 12 hours, 55 minutes, 20 seconds
 1    Online              2 days, 12 hours, 55 minutes, 9 seconds
 2    Online              2 days, 12 hours, 54 minutes, 58 seconds
 3    Online              2 days, 12 hours, 54 minutes, 47 seconds
 4    Online              2 days, 12 hours, 54 minutes, 36 seconds
 5    Online              2 days, 12 hours, 54 minutes, 25 seconds
 6    Online              2 days, 12 hours, 54 minutes, 15 seconds
 7    Online              2 days, 12 hours, 54 minutes, 4 seconds
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Replacing an MX2000 SFB | **637**

Maintaining the MX2010 Switch Processor Mezzanine Board (SPMB)

IN THIS SECTION

- Purpose | 796
- Action | 796

Purpose

For optimum router performance, verify the switch processor mezzanine board (SPMB) status.

Action

On a regular basis:

- Issue the `show chassis spmb` command to display the status information. The output is similar to the following:

```
user@host> show chassis spmb
Slot 0 information:
  State                           Online
  Total CPU Utilization             98%
  Interrupt CPU Utilization          0%
  Memory Heap Utilization            1%
  Buffer Utilization                44%
  Start time:                     2012-12-03 11:47:23 PST
  Uptime:                         2 hours, 16 minutes, 39 seconds
Slot 1 information:
  State                           Online - Standby
  Total CPU Utilization              0%
  Interrupt CPU Utilization          0%
  Memory Heap Utilization            0%
  Buffer Utilization                22%
  Start time:                     2012-12-03 11:47:19 PST
  Uptime:                         2 hours, 16 minutes, 43 seconds
```

```
{master}
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Maintaining and Verifying the Status of the MX2010 Router Components | 715

Maintaining and Verifying the MX2010 Router Version

IN THIS SECTION

- Purpose | 797
- Action | 797

Purpose

Verify the router model, Junos OS version, and system software installed.

Action

On a regular basis:

- To display the router system information, issue the `show version` command. The output is similar to the following:

```
user@host> show version
Hostname: mx2010host
Model: mx2010
JUNOS Base OS boot [12.3-20130216.0]
JUNOS Base OS Software Suite [12.3-20130216.0]
JUNOS 64-bit Kernel Software Suite [12.3-20130216.0]
JUNOS Crypto Software Suite [12.3-20130216.0]
```

```
JUNOS Packet Forwarding Engine Support (M/T/EX Common) [12.3-20130216.0]
JUNOS Packet Forwarding Engine Support (X2000) [12.3-20130216.0]
JUNOS Online Documentation [12.3-20130216.0]
JUNOS Services AACL Container package [12.3-20130216.0]
JUNOS Services Application Level Gateways [12.3-20130216.0]
JUNOS AppId Services [12.3-20130216.0]
JUNOS Border Gateway Function package [12.3-20130216.0]
JUNOS Services Captive Portal and Content Delivery Container package [12.3-20130216.0]
JUNOS Services HTTP Content Management package [12.3-20130216.0]
JUNOS IDP Services [12.3-20130216.0]
JUNOS Services LL-PDF Container package [12.3-20130216.0]
JUNOS Services NAT [12.3-20130216.0]
JUNOS Services PTSP Container package [12.3-20130216.0]
JUNOS Services RPM [12.3-20130216.0]
JUNOS Services Stateful Firewall [12.3-20130216.0]
JUNOS Voice Services Container package [12.3-20130216.0]
JUNOS Services Example Container package [12.3-20130216.0]
JUNOS Services SSL [12.3-20130216.0]
JUNOS Services Crypto [12.3-20130216.0]
JUNOS Services IPSec [12.3-20130216.0]
JUNOS Runtime Software Suite [12.3-20130216.0]
JUNOS platform Software Suite [12.3-20130216.0]
JUNOS Routing Software Suite [12.3-20130216.0]
```

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280

MX2010 Router Hardware Components and CLI Terminology | 29

Maintaining and Verifying the Status of the MX2010 Craft Interface

IN THIS SECTION

- Purpose | 799
- Action | 799

Purpose

Verify the system status of the craft interface.

Action

On a regular basis, check the status of the craft interface.

- To display the status of the craft interface, issue the `show chassis craft-interface` command.

```
user@host> show chassis craft-interface

Front Panel System LEDs:
Routing Engine    0    1
--------------------------
OK                *    *
Fail              .    .
Master            *    .

Front Panel Alarm Indicators:
-----------------------------
Red LED      *
Yellow LED   .
Major relay  *
Minor relay  .

Front Panel FPC LEDs:
FPC    0    1    2    3    4    5    6    7    8    9
-----------------------------------------------------
Red    .    .    .    .    .    .    .    .    .    .
Green  .    .    .    .    *    .    *    .    .    .

CB LEDs:
 CB    0   1
------------
Amber  .   .
Green  *   *

PS LEDs:
  PS    0    1    2    3    4    5    6    7    8
-------------------------------------------------
Red     .    .    .    .    .    .    .    .    .
```

```
Green   *    *    *    *    *    *    *    *    *

Fan Tray LEDs:
  FT   0   1   2   3
--------------------
Red    .   .   .   .
Green  *   *   *   *

Front Panel SFB LEDs:
SFB    0   1   2   3   4   5   6   7
------------------------------------
Red    .   .   .   .   .   .   .   .
Green  *   *   *   *   *   *   *   *

Front Panel Chassis Info:
Chassis Number    0x0
Chassis Role      S
```

- Check the status-reporting devices on the craft interface—system alarms and LEDs.

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | **280**

MX2010 Router Hardware Components and CLI Terminology | **29**

Maintaining the MX2010 Cooling System Components | **721**

Maintaining the MX2010 Fan Trays | **743**

Maintaining the MX2010 Control Boards | **719**

Maintaining the Power Supply Modules on the MX2000 Line of Routers | **779**

Taking an MX2000 Host Subsystem Offline

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:

    - Check the Routing Engine LEDs on the craft interface. If the green **MASTER** LED is lit, the corresponding host subsystem is functioning as the primary.

- Issue the following 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
    Election priority              Master (default)
    Temperature                 35 degrees C / 95 degrees F
    CPU temperature             32 degrees C / 89 degrees F
    DRAM                      16351 MB (16384 MB installed)
    Memory utilization           7 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     4 percent
      Interrupt                  1 percent
      Idle                      95 percent
    Model                          RE-S-1800x4
    Serial ID                      9009094145
    Start time                     2013-02-19 18:06:24 PST
    Uptime                         14 hours, 29 minutes, 41 seconds
    Last reboot reason             Router rebooted after a normal shutdown.
    Load averages:                 1 minute   5 minute  15 minute
                                       0.00       0.00       0.00
Routing Engine status:
  Slot 1:
    Current state                  Backup
    Election priority              Backup (default)
    Temperature                 36 degrees C / 96 degrees F
    CPU temperature             32 degrees C / 89 degrees F
    DRAM                      16351 MB (16384 MB installed)
    Memory utilization           7 percent
    CPU utilization:
      User                       0 percent
      Background                 0 percent
      Kernel                     0 percent
      Interrupt                  0 percent
      Idle                      99 percent
    Model                          RE-S-1800x4
    Serial ID                      9009094136
    Start time                     2013-02-19 18:06:33 PST
```

```
Uptime                          14 hours, 29 minutes, 22 seconds
Last reboot reason              Router rebooted after a normal shutdown.
Load averages:                  1 minute   5 minute  15 minute
                                    0.00       0.00       0.00
```

2. If the host subsystem is functioning as the primary, switch it to backup by using the command:

```
user@host> request chassis routing-engine master switch
```

> **CAUTION**: When you request the host subsystem primary to switch to backup, a message appears indicating that the network traffic will be interrupted while the Packet Forwarding Engine is reinitialized.

3. On the console or other management device connected to the Routing Engine you are removing, enter CLI operational mode and issue the following command. The command shuts down the Routing Engine cleanly, so its state information is preserved:

```
user@host> request system halt
```

> **CAUTION**: When you request a host subsystem halt, only one Routing Engine will be halted. You must use the **request chassis both-routing-engines** command to halt both Routing Engines.

Wait until a message appears on the console confirming that the operating system has halted.

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

> **NOTE**: The Routing Engine might continue forwarding traffic for approximately 5 minutes after the `request system halt` command has been issued.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

Maintaining the MX2010 Host Subsystem | 756

Maintaining the MX2020 Host Subsystem

Holding an MX2010 MPC

When carrying an MPC, you can hold it either vertically or horizontally.

> **NOTE**: A typical MPC can weigh 25 lb (11.34 kg) or more. Be prepared to accept the full weight of the MPC as you lift it.

To hold an MPC vertically:

1. Orient the MPC so that the faceplate faces you. To verify orientation, confirm that the text on the MPC is right-side up and the electromagnetic interference (EMI) strip is on the right-hand side.
2. Place one hand around the MPC faceplate about a quarter of the way down from the top edge. To avoid deforming the EMI shielding strip, do not press hard on it.
3. Place your other hand at the bottom edge of the MPC.

If the MPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge.

To hold an MPC horizontally:

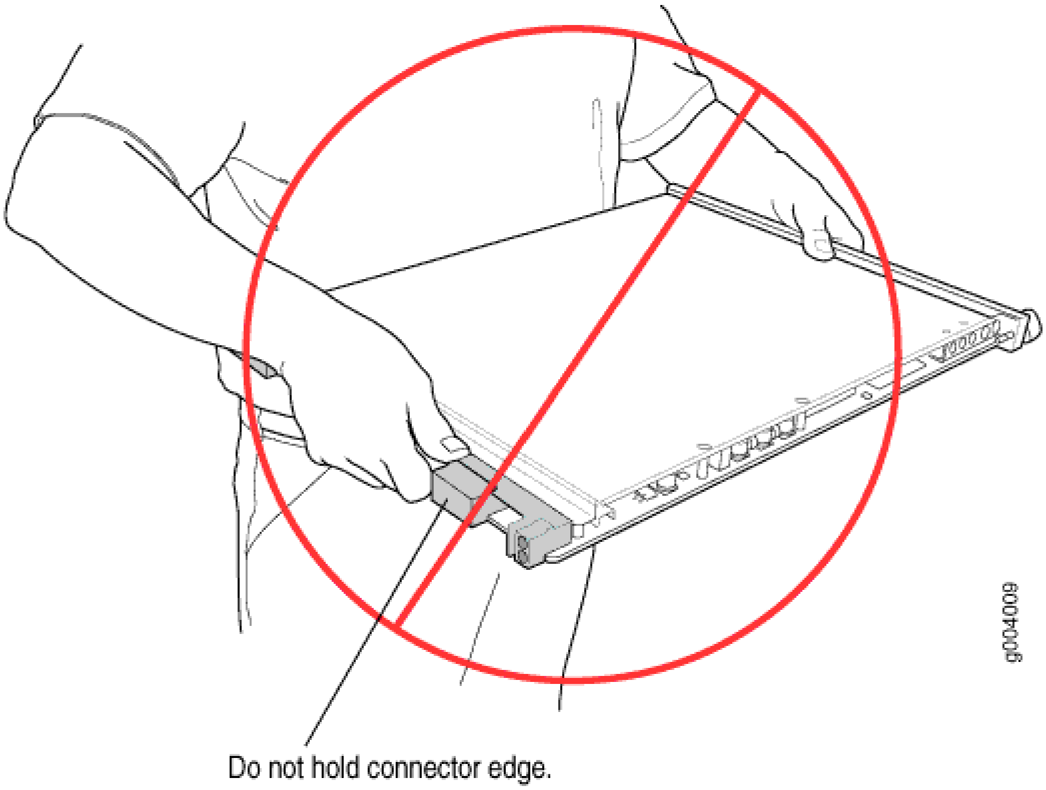
1. Orient the MPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

You can rest the faceplate of the MPC against your body as you carry it.

As you carry the MPC, do not bump it against anything. MPC components are fragile.

Never hold or grasp the MPC 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.

Figure 371: Do Not Grasp the Connector Edge

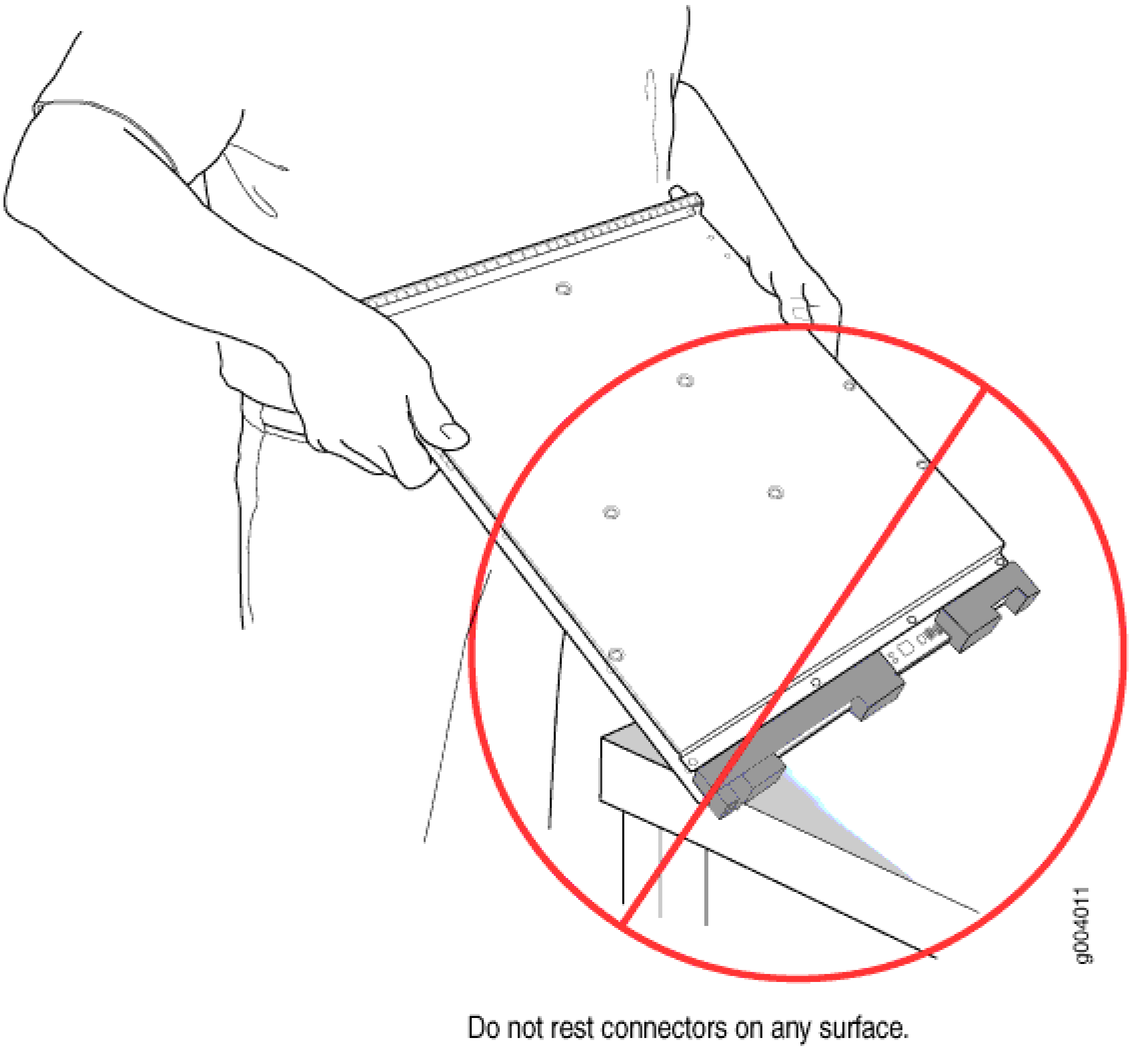


Never carry the MPC by the faceplate with only one hand.

Do not rest any edge of an MPC directly against a hard surface (see Figure 372 on page 805).

Do not stack MPCs.

Figure 372: Do Not Rest the MPC on an Edge



If you must rest the MPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

RELATED DOCUMENTATION

MX2010 MPC Terminology | **101**
Storing an MX2010 MPC | **806**
Troubleshooting the MX2010 MPCs | **833**
Replacing an MX2010 MPC and Adapter Card | **625**

Storing an MX2010 MPC

You must store an MPC as follows:

- In the router
- In the container in which a spare MPC is shipped
- Horizontally and sheet metal side down

When you store an MPC on a horizontal surface or in the shipping container, always place it inside an antistatic bag. Because the MPC is heavy, and because antistatic bags are fragile, inserting the MPC into the bag is easier with two people. To do this, one person holds the MPC in the horizontal position with the faceplate facing the body, and the other person slides the opening of the bag over the MPC connector edge.

If you must insert the MPC into a bag by yourself, first lay the MPC horizontally on a flat, stable surface, sheet metal side down. Orient the MPC with the faceplate facing you. Carefully insert the MPC connector edge into the opening of the bag, and pull the bag toward you to cover the MPC.

Never stack an MPC under or on top of any other component.

RELATED DOCUMENTATION

MX2010 MPC Terminology | 101
Holding an MX2010 MPC | 803
Maintaining MX2010 MPCs | 763
Replacing an MX2010 MPC and Adapter Card | 625
Troubleshooting the MX2010 MPCs | 833

Routine Maintenance Procedures for the MX2010 Router

IN THIS SECTION

- Purpose | 807
- Action | 807

Purpose

For optimum router performance, perform preventive maintenance procedures.

NOTE: Some components, such as the craft interface, require no maintenance.

Action

- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the router and into the air intake vents.
- Check the status-reporting devices on the craft interface—system alarms and LEDs.
- Inspect the two air filters located just below the upper and lower power supply modules (PSMs), replacing them every 6 months for optimum cooling system performance.
- Inspect the air filter at the bottom rear of the router, replacing it every 6 months for optimum cooling system performance. Do not run the router for more than a few minutes without the air filter in place.
- Inspect the air filter in the front of the middle cable manager of the router, replacing it every 6 months for optimum cooling system performance. Do not run the router for more than a few minutes without the air filter in place.

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2010 Hardware Components | 280
MX2010 Router Hardware Components and CLI Terminology | 29
Maintaining the MX2010 Air Filters | 716
Maintaining the MX2010 Fan Trays | 743

CHAPTER 25

Packing and Returning Components

IN THIS CHAPTER

- Guidelines for Packing Hardware Components for Shipment | 808
- Packing the MX2010 Router for Shipment | 808
- How to Return a Hardware Component to Juniper Networks, Inc. | 810

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure that they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: Do not stack any of the hardware components.

Packing the MX2010 Router for Shipment

To pack the router for shipment:

1. Retrieve the shipping crate and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.

2. On the console or other management device connected to the primary CB-RE, enter CLI operational mode and issue the following command to shut down the router software. (If two CB-REs are installed, also issue the command on the backup CB-RE.)

```
user@host> request system halt
```

   Wait until a message appears on the console confirming that the operating system has halted.

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Shut down power to the router by switching the AC or DC circuit breaker for all PDMs to the off (**O**) position.
5. Disconnect power from the router.
6. Remove the cables that connect to all external devices.
7. Remove all field replaceable units (FRUs) from the router.
8. Attach the front and rear shipping covers.

   CAUTION: Apply force to any other parts of chassis other than the shipping covers can damage the chassis.

9. Remove the router from the rack:

   - Install the pallet jack attachment to a pallet jack. Position the pallet jack in front of the rack, and unscrew and remove the mounting screws from the rack.

     NOTE: The pallet jack attachment fits only on a standard pallet jack. The standard pallet jack is approximately 48 in. (121.92 cm) deep and 27 in. (68.58 cm) wide.

     WARNING: Juniper Networks recommends using a pallet jack with the attachment. Not using a pallet jack with the attachment can result in personal injury and can damage to the equipment.

   - A minimum of four people can then slide the router onto the pallet jack by using the handles on the shipping covers. Attach the four shipping brackets and hardware to the pallet jack attachment. Securing the brackets to the router chassis.

- Position the router in front of the shipping crate and raise the pallet jack.
- Remove the shipping brackets and hardware and set aside.

10. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.
11. Re-attach the shipping brackets to the router chassis and the pallet.
12. Cover the router with an ESD bag and place the packing foam on top of and around the router.
13. Replace the accessory box on top of the packing foam.
14. Securely place the crate cover over the router.
15. Close all latches to secure the shipping crate to the pallet.
16. Write the RMA number on the exterior of the box to ensure proper tracking.

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX Series Router
Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | 813
Replacing an MX2010 Three-Phase Delta AC Power Cord | 667
Replacing an MX2010 Three-Phase Wye AC Power Cord | 688
Disconnecting an MX2010 DC Power Distribution Module Cable | 593

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

If a hardware component fails, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

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

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

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Service Request Manager link at https://support.juniper.net/support/ or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.
2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.
3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
   - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the component.
5. Pack the component for shipment.

CHAPTER 26

Powering Off the Router

IN THIS CHAPTER

- Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router | **812**
- Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router | **813**

Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router

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

To power off the router:

1. On the external management device connected to the CB-RE, issue the **request system halt both-routing-engines** operational mode command. The command shuts down the Routing Engine cleanly, so the state information is preserved. If the router contains only one CB-RE, 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. For more information about the command, see the *Junos OS System Basics and Services Command Reference*.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Move the AC power switch on the AC or HVAC/HVDC PSM faceplate for each AC or HVAC/HVDC PSM to the off (**O**) position.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router

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

To power off an MX2010 or MX2020 DC-powered or router:

1. On the external management device connected to the CB-RE, issue the **request system halt both-routing-engines** operational mode command. The command shuts down the Routing Engines cleanly, so the state information is preserved. If the router contains only one CB-RE, 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. For more information about the command, see the *Junos OS System Basics and Services Command Reference*.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Move the DC power switch on the DC PSM faceplate for each DC PSM or DC-Powered (240 V China) to the off (**O**) position, and move the DC circuit breaker from the power source input for each DC PDM to the (**OFF**) position.

To power off an MX2008 DC-powered router:

1. On the external management device connected to the RCB, issue the **request vmhost power-off** operational mode command individually on both the RCBs. The command shuts down the RCB cleanly, so the state information is preserved.

```
user@host> request vmhost power-off
```

2. Wait until a message appears on the console confirming that the operating system has halted. For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

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

4. Move the DC power switch on the DC PSM faceplate for each DC PSM to the off (**O**) position, and move the DC circuit breaker from the power source input for each DC PDM to the (**OFF**) position.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

Grounding an MX2000 Router | **362**

Powering On the DC-Powered MX2010 Router | **390**

Powering On the DC-Powered (-48 V) MX2020 Router

Powering On the DC-Powered (240 V China) MX2000 Router

6

PART

Troubleshooting Hardware

Troubleshooting Components | 816

CHAPTER 27

Troubleshooting Components

IN THIS CHAPTER

- MX2010 Troubleshooting Resources | 816
- Troubleshooting the MX2010 Cooling System | 820
- Troubleshooting the MX2010 Host Subsystems | 822
- Troubleshooting the MX2000 Router Power System | 823
- Troubleshooting the MX2010 MICs | 832
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MX2010 Troubleshooting Resources

IN THIS SECTION

- Command-Line Interface | 816
- Chassis and Interface Alarm Messages | 817
- Alarm Relay Contacts | 817
- Craft Interface LEDs | 818
- Component LEDs | 819

Command-Line Interface

To troubleshoot an MX2010 router, you use the Junos OS CLI, 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. In addition, you can also use the component-specific LEDs on the craft interface and on the faceplate of a component to troubleshoot the routing matrix.

- Alarm devices connected to the alarm relay contact—When a red or yellow alarm occurs, it trips the corresponding alarm relay.
- CLI—The CLI is the primary tool for controlling and troubleshooting hardware, Junos OS, routing protocols, and network connectivity. CLI commands display information about routing tables, information specific to routing protocols, and information about network connectivity derived from the **ping** and **traceroute** utilities.

You enter CLI commands on one or more external management devices connected to ports on the Routing Engine.

For information about using the CLI to troubleshoot Junos OS, see the appropriate Junos OS configuration guide.

- JTAC—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

Chassis and Interface Alarm Messages

When the Control Board and Routing Engine (CB-RE) detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate, trips the alarm relay, and reports the cause of the alarm in the craft interface. To view a more detailed description of the alarm cause, issue the `show chassis alarms` command:

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

There are two classes of alarm messages:

- Chassis alarms indicate a problem with a chassis component such as the cooling system or power system.
- Interface alarms indicate a problem with a specific network interface.

Alarm Relay Contacts

The craft interface has two alarm relay contacts for connecting the router to external alarm devices. Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located on the upper right of the craft interface.

Craft Interface LEDs

The craft interface displays system status messages and enables you to troubleshoot the MX2010 router. The craft interface is located on the upper front of the router and contains LEDs for the router components, the alarm relay contacts, and alarm cutoff button.

The craft interface includes the following LEDs:

- Alarm LEDs—One large red circular LED and one large yellow triangular LED, located on the upper right of the craft interface, indicate two levels of alarm conditions. 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. Both LEDs can be lit simultaneously. A condition that causes an alarm LED to light also activates the corresponding alarm relay contact on the craft interface.

- Host subsystem LEDs—The host subsystem consists of a Control Board with a Routing Engine (CB-RE). Three LEDs, **MASTER**, **ONLINE**, and **OFFLINE**, indicate the status of the Routing Engine function of the host subsystem. A green **MASTER** LED indicates that the host is functioning as the primary. The **ONLINE** LED indicates that the host is online. The **OFFLINE** LED indicates that the host is installed but the Routing Engine is offline. The Routing Engine component of the host subsystem LEDs is located on the upper right of the craft interface and labeled **RE0** and **RE1**.

- Power supply module LEDs—A set of nine bicolor LEDs, labeled (**PSM**), indicates the status of each PSM. Green indicates that the PSM is functioning normally. Red indicates that the PSM is not functioning normally. The PSM LEDs are located at the top of the craft interface, and are labeled **0** through **8**.

- Line-card LEDs—Ten bicolor LEDs, **LC0** through **LC9**, for the ten line cards (MPCs), indicate the status. Green indicates the line card is online, green blinking indicates that the line card is booting, and red indicates a failure. The line-card LEDs are located along the bottom of the craft interface.

- SFB LEDs—Eight bicolor LEDs, **SFB0** through **SFB7**, indicate the status of each SFB. Green indicates the SFB is online, green blinking indicates the SFB is booting, and red indicates a failure. The SFB LEDs are located along the middle of the craft interface along the bottom.

- CB-RE—Two bicolor LEDs, **CB-RE0** and **CB-RE1**, indicate the status of each CB-RE. Green indicates the CB-RE is online, green blinking indicates the CB-RE is booting, and red indicates a failure. The CB-RE LEDs are located along the bottom far left and far right of the craft interface.

- Fan tray LEDs—Four bicolor LEDs, **0** through **3**, indicate the status of the upper two and lower two fan trays. Green indicates the fan trays are functioning normally, and red indicates that a fan tray has failed. The fan tray LEDs are located on the upper middle of the craft interface.

Component LEDs

The following LEDs are located on various router components and display the status of those components:

- MPC LED—One LED labeled **OK/FAIL** on each MPC faceplate indicates the MPC's status. For more information, see the *MX Series Interface Module Reference*.
- MIC LED—One LED labeled **OK/FAIL** on each MIC faceplate indicates the MIC's status. For more information, see the *MX Series Interface Module Reference*.
- SFB LEDs—One LED, labeled **OK/FAIL**, on each SFB faceplate indicate the status of the SFB. If no LEDs are lit, the primary CB-RE might still be booting or the SFB is not receiving power.
- Control Board and Routing Engine (CB-RE) LEDs—For the Control Board portion of the CB-RE, there is a set of bicolor LEDs, labeled **OK/FAIL**, **LINK**, **ExtClk-0**, **ExtClk-1**, **BITS**, and **GPS**. For the Routing Engine portion of the CB-RE, there are three LEDs, labeled **ONLINE**, **MASTER**, and **OK/FAIL**. These LEDs on the faceplate indicate the status of the CB-RE.

  > **NOTE**: Even though the Control Board and Routing Engine (CB-RE) are combined into one unit; the LED functionality is separate for the Control Board and Routing Engine.

- AC delta or wye PDM LEDs—One LED for each input terminal block indicating the input feed status.
- DC PDM LEDs—One LED on each PDM next to each of the nine –48VDC power feeds indicates the status of that PDM's incoming power.
- AC or DC PSM LEDs—Four LEDs, labeled **PWR OK**, **FAULT**, **INP0**, and **INP1**, on each PSM faceplate indicate the status of that PSM.

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34
Troubleshooting the MX2010 Cooling System | 820
Troubleshooting the MX2010 MPCs | 833
Troubleshooting the MX2010 MICs | 832
Troubleshooting the MX2000 Router Power System

Troubleshooting the MX2010 Cooling System

IN THIS SECTION

- Problem | 820
- Solution | 820

Problem

Description

The following alarms, LEDs, and other conditions indicate a problem with the cooling system:

- A red alarm indicates that temperature of the router exceeds the maximum (“temperature hot”) threshold.
- Automatic shutdown of the power system was caused by the temperature of the router exceeding the maximum (“temperature hot”) threshold.
- A red alarm indicates that a fan failed.
- A yellow alarm indicates that the router temperature exceeds the “temperature warm” threshold.
- A yellow alarm indicates that one of the fan trays was removed.
- One or more fans in a fan tray function at full speed. The CB-RE constantly monitors the temperatures detected by sensors on the midplane and router components, adjusting the speed of the fans as necessary.

Solution

To troubleshoot the cooling system:

1. Place your hand near the exhaust vents at the back of the chassis to determine whether the fans are pushing air out of the chassis.
2. If the red alarm LED on the craft interface lights, look at the craft interface display to find the source of the problem. The number of alarm conditions, as well as the source of each alarm, appears on the screen.

3. If the craft interface display lists only one fan failure and the other fans are functioning normally, the fan is probably faulty and you need to replace the fan tray.

4. Use the CLI to check the status of the fans. For example, you can issue the following command to get information about the source of an alarm condition:

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

   For information about the alarms (see Table 116 on page 821).

   Table 116: MX2010 Cooling System Alarms

Component	Alarm Type	CLI Message	Alarm Condition	Solution
Fans	Red	*fan-name* Failure	A fan has failed.	Replace the fan tray.
Temperature sensors	Red	Temperature Hot	The chassis temperature exceeded the hot temperature threshold. If this condition persists, the router shuts down.	• 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.
		Temperature sensor failure	A temperature sensor failed.	Contact JTAC

Table 116: MX2010 Cooling System Alarms *(Continued)*

Component	Alarm Type	CLI Message	Alarm Condition	Solution
	Yellow	**Temperature Warm**	The chassis temperature exceeded the warm temperature threshold.	• 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.

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34

Replacing an MX2010 Fan Tray | 606

Maintaining the MX2010 Air Filters | 716

Maintaining the MX2010 Fan Trays | 743

Troubleshooting the MX2010 Host Subsystems

IN THIS SECTION

- Problem | 823
- Solution | 823

Problem

Description

The following alarms and LEDs indicate a problem with a host subsystem Control Board and Routing Engine (CB-RE):

- A red alarm indicates that the host subsystem has been removed.
- The red host subsystem **OFFLINE** LED on the craft interface is lit.
- The green host subsystem **ONLINE** LED on the craft interface is not lit.

Solution

To troubleshooting the host subsystems:

1. Check the LEDs on the faceplate of each CB-RE.
2. Check the LEDs on the craft interface.
3. Use the CLI to check the alarms.
   - Issue the `show chassis alarms` command to view the alarms.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description | 57

MX2010 Craft Interface Description | 34

Troubleshooting the MX2000 Router Power System

IN THIS SECTION

- Problem | 824
- Solution | 824

Problem

Description

The following alarms, LEDs, and other conditions indicate a problem with the AC or DC power system:

- If all AC, DC, universal power supply modules (PSMs) have failed, the system temperature might have exceeded the threshold, causing the system to shut down.
- The yellow **PWR OK** LED blinks when an AC or a DC PSM is out of the power limit or is in an overcurrent condition.
- The red **FAULT** LED lights when the PSM is not receiving enough airflow to maintain the proper temperature.
- The red **FAULT** LED lights when the AC or DC output voltages are not within range.
- The yellow **INP0** LED blinks when the AC or DC voltage is present, but out of limits. This LED blinks continuously for approximately a few seconds on and a few seconds off.
- The yellow **INP1** LED blinks when the AC or DC voltage is present, but out of limits. This LED blinks continuously for approximately a few seconds on and a few seconds off.
- The red **-48V** LED lights when the wrong polarity of DC input voltage is connected on the DC PDM.

> **NOTE**: For the universal power supply LEDs, see *MX2020 High-Voltage Universal Power Supply Module LEDs* and "MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs" on page 159.

Solution

To troubleshoot the MX2000 router power system:

1. Check the LEDs on all AC, DC, or universal PSM faceplates.
    - **PWR OK** PSM LED is blinking—Check the fans and air filters to be sure that they are functioning and providing sufficient airflow through the chassis.
    - **PWR OK** PSM LED is off and no red alarm condition exists—Check that the circuit breakers are switched to the **ON** position. Check that the AC or DC power switch is in the on (|) position.
    - **PWR OK** LED on PSMs is not lit—Check that the PSMs are inserted and are operating.
    - If an AC PSM, or a DC PSM, or a universal PSM is correctly installed and functioning normally, the **PWR OK**, **INP0**, and **INP1** LEDs light steadily, and the **FAULT** LED is not lit.

2. Check the LEDs on each DC power distribution module (PDM) faceplate.

   - **–48V** or 240 V China PDM LED is off—Check that the PDM is receiving voltage.
   - **–48V** or 240 V China PDM LED is lit red—Check that the PDM is connected to correct input voltage and polarity.

     NOTE: This does not apply to the 240 V China DC PDM.

   - Check that the DC PDM switch is set to **60 A** or **80 A** depending on the current feed coming from the DC source circuit breaker.
   - **–48V** or 240 V China LED on a DC PDM is not lit—Check that the input is receiving source DC power.
   - If a DC PDM is correctly installed and functioning normally, the **–48V** source input LEDs light green steadily.

3. Check the LEDs on each AC PDM faceplate. There is one LED for each input feed. See "Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers" on page 229.

   - On the three-phase delta AC PDM, the left arrow (←) green LED is lit steadily, indicating that the left input feed is receiving voltage.
   - On the three-phase delta AC PDM, the right arrow (→) green LED is lit steadily, indicating that the right input feed is receiving voltage.
   - On the three-phase wye AC PDM, the left arrow (←) green LED is lit steadily, indicating that the left input feed is receiving voltage.
   - On the three-phase wye AC PDM, the right arrow (→) green LED is lit steadily, indicating that the right input feed is receiving voltage.
   - On the single-phase AC PDM or universal PDM, the green LED for each feed is lit steadily, indicating the input feed is receiving voltage.

4. Verify that the source circuit breaker has the proper current rating. Each PDM must be connected to a separate source circuit breaker. Check that the AC or DC circuit breaker is in the on (**ON**) position.

5. Verify that the DC power cable, or the AC power cord, or the universal power cord from the power source to the router is not damaged. If the insulation is cracked or broken, immediately replace the power cord.

6. Connect the PDM to a different power source with new power cables. If the PSM **PWR OK** LED still does not light, the PSM is the source of the problem. Replace the PSM with a spare.

If the **PWR OK** LED on the installed spare does not light, the replaced PSM might be faulty. To return it for replacement, see *Contact Customer Support*.

7. Check the status of a PSM, issuing the following CLI command. The value **Online** in the rows labeled **State** indicates that each of the PSMs is functioning normally.

NOTE: For the MX2010, the PSMs are referred to as **PSM0** through **PSM8**.

For the MX2020, the PSMs are referred to as **PSM0** through **PSM8** (bottom) and **PSM9** through **PSM17** (top).

Here is an example of the AC PSM input status for an MX2020:

```
user@host> show chassis environment psm

PSM 0 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0        223.75      1.40       313.25
                             INP1        0.00        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
PSM 1 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0        225.00      1.40       315.00
                             INP1        2.50        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
PSM 2 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0        225.00      1.30       292.50
                             INP1        3.75        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      4.25       221.00     10.52
  Hours Used                 6862
```

```
PSM 3 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         223.75      1.50      335.62
                             INP1         3.75        0.00      0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00      5.00       260.00     12.38
  Hours Used                 6861
...
```

Here is an example of the DC PSM (-48) input status for an MX2020:

```
user@host> show chassis environment psm
PSM 4 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         51.20       11.55     591.36
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.25      10.25      525.31     25.01
  Hours Used                 1369
PSM 5 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         50.80       11.55     586.74
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.25      10.50      538.12     25.62
  Hours Used                 1722
PSM 6 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         50.80       11.20     568.96
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.25      10.00      512.50     24.40
  Hours Used                 2969
PSM 7 status:
```

```
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         51.60       11.20     577.92
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.25      10.00      512.50     24.40
  Hours Used                 2970
PSM 8 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         51.60       11.20     577.92
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.25      10.00      512.50     24.40
  Hours Used                 2970
...
```

Here is an example of the DC PSM (240 V China) input status for an MX2020:

```
user@host> show chassis environment psm
PSM 0 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         240.00      1.10      264.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.75      4.50       237.38     9.49
  Hours Used                 2640
PSM 1 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00      0.00
                             INP1         240.00      1.00      240.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.75      4.00       211.00     8.44
  Hours Used                 3144
PSM 2 status:
  State                      Online
```

```
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
                             INP1         240.00      1.00       240.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.75      4.00        211.00     8.44
  Hours Used                 3144
......
```

NOTE: If two input sources are grounded at the positive terminal (i.e. -240 V DC source) and if both positive input wiring are connected to the PDM, the PSM reports both inputs to be active and reports the higher of the two -240V DC input source. This is the case even if one negative input source is switched off through a breaker.

NOTE: For midpoint impedance grounded source, the CLI display of the input voltage is inaccurate for the input source with lower input voltage. For example, if one source is +/-120V, and the other source is +/-125V, the CLI input voltage display is 250 V for one input, and is 245 V (should be 240 V) for the other.

Here is an example of the universal PSM (HVAC/HVDC) input status for an MX2020:

```
user@host> show chassis environment psm
  PSM 0 status:
  State                      Online
  Temperature                             OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         209.10      0.10       20.91
                             INP1         209.10      0.10       20.91
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.50      5.10        267.75     7.87
  Hours Used                 1832
PSM 1 status:
  State                      Online
  Temperature                             OK
  AC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         209.10      0.20       41.82
                             INP1         209.10      0.90       188.19
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
```

```
                             52.50      6.46       339.15     9.98
  Hours Used                2571
PSM 2 status:
  State                     Online
  Temperature                            OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         209.10      3.70       773.67
                            INP1         210.80      2.70       569.16
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              52.50      17.34      910.35     26.78
  Hours Used                3404
PSM 3 status:
  State                     Online
  Temperature                            OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         209.10      3.60       752.76
                            INP1         209.10      0.60       125.46
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              52.50      11.90      624.75     18.37
  Hours Used                2571
...
```

Here is an example of the universal PSM (HVAC/HVDC) input status for an MX2008:

```
user@host> show chassis environment psm
 PSM 0 status:
  State                     Online
  Temperature                            OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         268.60      0.90       241.74
                            INP1         268.60      0.80       214.88
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              51.75      7.82       404.69     11.90
  Fan 0                     5280 RPM
  Fan 1                     5280 RPM
  Fan 2                     5280 RPM
  Hours Used                706
PSM 1 status:
  State                     Online
  Hours Used                707
PSM 2 status:
  State                     Online
```

```
  Temperature                        OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         270.30      0.80       216.24
                            INP1         270.30      0.70       189.21
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              51.75      6.46        334.31     9.83
  Fan 0                     5310 RPM
  Fan 1                     5310 RPM
  Fan 2                     5310 RPM
  Hours Used                707
PSM 3 status:
  State                     Online
  Temperature                        OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         270.30      0.90       243.27
                            INP1         270.30      0.80       216.24
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              51.75      7.82        404.69     11.90
  Fan 0                     5280 RPM
  Fan 1                     5310 RPM
  Fan 2                     5310 RPM
  Hours Used                707

...
```

8. If a red alarm condition occurs, issue the `show chassis alarms` command to determine the source of the problem.

9. If all PSMs have failed, the system temperature might have exceeded the threshold, causing the system to shut down.

> **NOTE**: If the system temperature exceeds the threshold, the Junos OS shuts down all power supplies so that no status is displayed.
>
> The Junos OS also can shut down one of the power supplies for other reasons. In this case, the remaining power supplies provide power to the router, and you can still view the system status through the CLI or display.

Troubleshooting the MX2010 MICs

IN THIS SECTION

- Problem | 832
- Solution | 832

Problem

Description

A MIC LED lit red indicates a problem with the MIC.

Solution

To troubleshoot a MIC:

1. Check the status of each port on a MIC by looking at the LED located on the MIC faceplate. For information about the meaning of LED states on different MICs, see the *MX Series Interface Module Reference*

2. Check the status of a MIC by issuing the `show chassis fpc pic-status` CLI command. The MIC slots in the MPC are labeled **PIC 0/1** and **PIC 2/3**, top to bottom:

```
user@host> show chassis fpc pic-status
Slot 0   Online       MPCE Type 1 3D Q
  PIC 0  Online       10x 1GE(LAN) SFP
  PIC 1  Online       10x 1GE(LAN) SFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 1   Online       MPCE Type 2 3D
  PIC 2  Online       2x 10GE  XFP
  PIC 3  Online       2x 10GE  XFP
Slot 2   Online       MPCE Type 3 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1X100GE CFP
Slot 9   Online       MPC 3D 16x 10GE EM
```

```
PIC 0  Online       4x 10GE(LAN) SFP+
PIC 1  Online       4x 10GE(LAN) SFP+
PIC 2  Online       4x 10GE(LAN) SFP+
PIC 3  Online       4x 10GE(LAN) SFP+
```

For further description of the command output, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2010 Modular Port Concentrator Description | 92
Maintaining MX2010 MICs | 760
Maintaining Cables That Connect to MX2010 MPCs or MICs | 713
Replacing an MX2010 MIC | 613

Troubleshooting the MX2010 MPCs

IN THIS SECTION

Problem | 833
Solution | 833

Problem

Description

The following LEDs indicate a problem with an MPC:

- The red **FAIL** LED above the MPC is lit.
- The green **OK** LED above the MPC is not lit.

Solution

To troubleshoot an MPC:

1. Monitor the green LED labeled **OK** above the MPC on the craft interface as soon as an MPC is seated in an operating router.

   NOTE: The Control Board and Routing Engine (CB-RE) downloads the software to the MPC under two conditions: The MPC is present when the CB-RE boots Junos OS, and the MPC is installed and requested online through the CLI or the push button on the front panel. The MPC then runs diagnostics, during which the **OK** LED blinks. When the MPC is online and functioning normally, the **OK** LED lights green steadily.

2. Look at the display on the craft interface to check the status of the MPC and the MICs that are plugged into it.

3. Verify that the MPC is properly seated in the top and bottom backplanes of the adapter card (ADC). Check that each knob has been turned clockwise and is tight.

4. Check the **OK/FAIL** LED on the MPC, and the **OK** and **FAIL** line-card LEDs, **LC0** through **LC9**, on the craft interface. When the MPC is online and functioning normally, the **OK** LED lights green steadily.

5. Check the status of an MPC by using the `show chassis fpc` CLI command. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the MPC is functioning normally:

```
user@host> show chassis fpc
              Temp  CPU Utilization (%)   Memory    Utilization (%)
Slot State          (C)  Total  Interrupt      DRAM (MB) Heap     Buffer
  0  Online          37      8          0       2048      10         13
  1  Online          35      6          0       2048      13         13
  2  Online          37      9          0       2048      17         13
  3  Empty
  4  Online          37      9          0       2048      17         13
  5  Empty
  6  Empty
  7  Empty
  8  Empty
  9  Online          37     11          0       2048      21         13
```

   Use the **detail** option to display more detailed information. The following example does not specify a slot number, which is optional:

For further description of the command output, see the *Junos OS System Basics Configuration Guide*.

```
user@host> show chassis fpc detail
Slot 0 information:
  State                                Online
  Temperature                       26
  Total CPU DRAM                  2048 MB
  Total RLDRAM                     403 MB
  Total DDR DRAM                  1572 MB
  Start time:                          2013-02-20 02:21:40 PST
  Uptime:                              5 hours, 28 minutes, 57 seconds
  Max Power Consumption            249 Watts
Slot 1 information:
  State                                Online
  Temperature                       25
  Total CPU DRAM                  2048 MB
  Total RLDRAM                     662 MB
  Total DDR DRAM                  3072 MB
  Start time:                          2013-02-20 02:21:51 PST
  Uptime:                              5 hours, 28 minutes, 46 seconds
  Max Power Consumption            348 Watts
Slot 2 information:
  State                                Online
  Temperature                       28
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1036 MB
  Total DDR DRAM                  6656 MB
  Start time:                          2013-02-20 02:22:01 PST
  Uptime:                              5 hours, 28 minutes, 36 seconds
  Max Power Consumption            520 Watts
Slot 9 information:
  State                                Online
  Temperature                       29
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1324 MB
  Total DDR DRAM                  6144 MB
  Start time:                          2013-02-20 02:22:06 PST
  Uptime:                              5 hours, 28 minutes, 31 seconds
  Max Power Consumption            440 Watts
```

RELATED DOCUMENTATION

MX2010 Craft Interface Description | 34

MX2010 Modular Port Concentrator Description | 92

Maintaining MX2010 MPCs | 763

Replacing an MX2010 MPC and Adapter Card | 625

7
PART

Contacting Customer Support and Returning the Chassis or Components

Contacting Customer Support | 838

Locating Component Serial Numbers | 840

Packing and Returning Components | 861

CHAPTER 28

Contacting Customer Support

IN THIS CHAPTER

- Contact Customer Support | 838

Contact Customer Support

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

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

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

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

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

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

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

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

CHAPTER 29

Locating Component Serial Numbers

IN THIS CHAPTER

- Displaying MX2010 Router Components and Serial Numbers | 840
- MX2010 CB-RE Serial Number Label | 846
- MX2010 Chassis Serial Number Label | 848
- MX2010 Craft Interface Serial Number Label | 850
- MX2010 Fan Tray Serial Number Label | 851
- MX2010 MIC Serial Number Label | 851
- MX2010 MPC Serial Number Label | 853
- MX2010 Power Distribution Module Serial Number Label | 854
- MX2010 Power Supply Module Serial Number Label | 856
- MX2010 SFB Serial Number Label | 859

Displaying MX2010 Router Components and Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the router or component. To display all the router components and their serial numbers, enter the following command-line interface (CLI) command:

The sample output below shows the AC power chassis hardware:

```
user@host> show chassis hardware
Hardware inventory:
Item                Version  Part number  Serial number     Description
Chassis                                   JN11E26D3AFK      MX2010
Midplane            REV 01   750-044636   ABAB8511          Lower Backplane
Midplane 1          REV 01   711-044557   ZY8294            Upper Backplane
PMP                 REV 03   711-032426   ACAJ1389          Power Midplane
FPM Board           REV 06   711-032349   ZX8742            Front Panel Display
PSM 0               Rev 0C   740-033726   WA00018           AC 52V Power Supply Module
```

```
PSM 1             Rev 0C   740-033726   WA00062          AC 52V Power Supply Module
PSM 2             Rev 0C   740-033726   WA00034          AC 52V Power Supply Module
PSM 3             Rev 0C   740-033726   WA00048          AC 52V Power Supply Module
PSM 4             Rev 0C   740-033726   WA00092          AC 52V Power Supply Module
PSM 5             Rev 0C   740-033726   WA00020          AC 52V Power Supply Module
PSM 6             Rev 0C   740-033726   WA00002          AC 52V Power Supply Module
PDM 0             REV 0D   740-038281   VK00013          AC Y Power Dist Module
PDM 1             REV 0D   740-038281   VK00009          AC Y Power Dist Module
Routing Engine 0 REV 02    740-041821   9009094145       RE-S-1800x4
Routing Engine 1 REV 02    740-041821   9009094136       RE-S-1800x4
CB 0              REV 08   750-040257   CAAB3490         Control Board
CB 1              REV 08   750-040257   CAAB3481         Control Board
SPMB 0            REV 02   711-041855   CAAA6136
SPMB 1            REV 02   711-041855   CAAA6145         PMB Board
SFB 0             REV 07   711-032385   ZZ2589           Switch Fabric Board
SFB 1             REV 07   711-032385   ZZ2571           Switch Fabric Board
SFB 2             REV 07   711-032385   CAAB4886         Switch Fabric Board
SFB 3             REV 07   711-032385   CAAB4906         Switch Fabric Board
SFB 4             REV 06   711-032385   ZV1826           Switch Fabric Board
SFB 5             REV 07   711-032385   CAAB4900         Switch Fabric Board
SFB 6             REV 06   711-032385   ZV1821           Switch Fabric Board
SFB 7             REV 06   711-032385   ZV8471           Switch Fabric Board
FPC 0             REV 09   750-038490   ZN7120           MPCE Type 1 3D Q
  CPU             REV 04   711-038484   ZZ4585           MPCE PMB 2G
  MIC 0           REV 26   750-028392   CAAC5653         3D 20x 1GE(LAN) SFP
    PIC 0                  BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0      REV 02   740-011613   PH40QAV          SFP-SX
      Xcvr 1      REV 01   740-011613   P9F16YM          SFP-SX
      Xcvr 8      REV 01   740-011613   P8E2SSX          SFP-SX
      Xcvr 9      REV 01   740-011613   PCD4FLT          SFP-SX
    PIC 1                  BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0      REV 01   740-013111   6482546          SFP-T
      Xcvr 1      REV 02   740-013111   9277936          SFP-T
      Xcvr 8      REV 01   740-011782   PB832A0          SFP-SX
      Xcvr 9      REV 02   740-011613   PGL36GR          SFP-SX
  MIC 1           REV 21   750-028380   ZZ0840           3D 2x 10GE XFP
    PIC 2                  BUILTIN      BUILTIN          1x 10GE XFP
      Xcvr 0      REV 02   740-014289   C826XU08J        XFP-10G-SR
    PIC 3                  BUILTIN      BUILTIN          1x 10GE XFP
      Xcvr 0      REV 02   740-014289   T10A30227        XFP-10G-SR
  QXM 0           REV 06   711-028408   ZY8200           MPC QXM
FPC 1             REV 08   750-038491   ZY8894           MPCE Type 2 3D
  CPU             REV 04   711-038484   ZZ4574           MPCE PMB 2G
```

```
  MIC 1          REV 27   750-028387   CAAB4862          3D 4x 10GE  XFP
    PIC 2                 BUILTIN      BUILTIN           2x 10GE  XFP
      Xcvr 0     REV 03   740-014289   C907BQ026         XFP-10G-SR
    PIC 3                 BUILTIN      BUILTIN           2x 10GE  XFP
FPC 2            REV 03   750-045372   CAAD9393          MPCE Type 3 3D
  CPU            REV 08   711-035209   CAAD9067          HMPC PMB 2G
  MIC 0          REV 02   750-028380   JG8549            3D 2x 10GE XFP
    PIC 0                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0              NON-JNPR     T10A91680         XFP-10G-SR
    PIC 1                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 03   740-014289   C907BQ00T         XFP-10G-SR
  MIC 1          REV 10   750-033199   YX4509            1X100GE CFP
    PIC 2                 BUILTIN      BUILTIN           1X100GE CFP
      Xcvr 0     REV 01   740-045420   UNE902            CFP-100G-ER4
FPC 4            REV 03   750-045372   CAAD9452          MPCE Type 3 3D
  CPU            REV 08   711-035209   CAAD9034          HMPC PMB 2G
  MIC 0          REV 21   750-028380   ZY2980            3D 2x 10GE XFP
    PIC 0                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0              NON-JNPR     T09K08083         XFP-10G-SR
    PIC 1                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 01   740-014289   98S803A90378      XFP-10G-SR
  MIC 1          REV 08   750-036233   CAAM1168          2X40GE QSFP
    PIC 2                 BUILTIN      BUILTIN           2X40GE QSFP
      Xcvr 0     REV 01   740-043308   2XDX44N00007      QSFP+-40G-LR4
      Xcvr 1     REV 01   740-046565   QC480260          QSFP+-40G-SR4
FPC 6            REV 17   750-037355   CAAT3989          MPC4E 3D 2CGE+8XGE
  CPU            REV 08   711-035209   CAAR3985          HMPC PMB 2G
  PIC 0                   BUILTIN      BUILTIN           4x10GE SFPP
    Xcvr 3       REV 01   740-031981   ALT19NU           SFP+-10G-LR
  PIC 1                   BUILTIN      BUILTIN           1X100GE CFP
    Xcvr 0       REV 01   740-035329   UN1085T           CFP-100G-SR10
  PIC 2                   BUILTIN      BUILTIN           4x10GE SFPP
    Xcvr 3       REV 01   740-031981   ALT19N6           SFP+-10G-LR
  PIC 3                   BUILTIN      BUILTIN           1X100GE CFP
    Xcvr 0       REV 01   740-035329   UMS06WS           CFP-100G-SR10
FPC 9            REV 11   750-036284   ZL3660            MPC 3D 16x 10GE EM
  CPU            REV 10   711-029089   ZK8306            AMPC PMB
  PIC 0                   BUILTIN      BUILTIN           4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   AJ71KEH           SFP+-10G-SR
    Xcvr 3       REV 01   740-031980   B11F00069         SFP+-10G-SR
  PIC 1                   BUILTIN      BUILTIN           4x 10GE(LAN) SFP+
  PIC 2                   BUILTIN      BUILTIN           4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   AMB0HYT           SFP+-10G-SR
```

```
  PIC 3                   BUILTIN      BUILTIN          4x 10GE(LAN) SFP+
ADC 0            REV 07   750-043596   ABBV7171         Adapter Card
ADC 1            REV 05   750-043596   ZZ6194           Adapter Card
ADC 2            REV 06   750-043596   ABBT3817         Adapter Card
ADC 4            REV 01   750-032317   ZJ0343           ADC Etch1
ADC 6            REV 05   750-043596   ZZ6200           Adapter Card
ADC 9            REV 13   750-043596   ABBX5549         Adapter Card
Fan Tray 0       REV 06   760-046960   ACAY0274         172mm FanTray - 6 Fans
Fan Tray 1       REV 06   760-046960   ACAY0273         172mm FanTray - 6 Fans
Fan Tray 2       REV 06   760-046960   ACAY0272         172mm FanTray - 6 Fans
Fan Tray 3       REV 06   760-046960   ACAY0271         172mm FanTray - 6 Fans
```

The sample output below shows the DC power chassis hardware:

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number    Description
Chassis                                JN120BCC4AFK     MX2010
Midplane         REV 35   750-044636   ABAB8695         Lower Backplane
Midplane 1       REV 02   711-044557   ABAB9172         Upper Backplane
PMP              REV 04   711-032426   ACAJ1887         Power Midplane
FPM Board        REV 09   760-044634   ABCA1163         Front Panel Display
PSM 0            REV 03   740-045050   1EDB23500AZ      DC 52V Power Supply Module
PSM 1            REV 01   740-045050   1E022240006      DC 52V Power Supply Module
PSM 2            REV 03   740-045050   1EDB2350091      DC 52V Power Supply Module
PSM 3            REV 01   740-045050   1E02224000X      DC 52V Power Supply Module
PSM 4            REV 03   740-045050   1EDB235008Y      DC 52V Power Supply Module
PSM 5            REV 01   740-045050   1E02224000D      DC 52V Power Supply Module
PSM 6            REV 01   740-045050   1E02224001D      DC 52V Power Supply Module
PSM 7            REV 01   740-045050   1E02224001B      DC 52V Power Supply Module
PSM 8            REV 01   740-045050   1E022240007      DC 52V Power Supply Module
PDM 0            REV 01   740-045234   1E262250067      DC Power Dist Module
Routing Engine 0 REV 02   740-041821   9009110761       RE-S-1800x4
Routing Engine 1 REV 02   740-041821   9009099703       RE-S-1800x4
CB 0             REV 20   750-040257   CAAL2942         Control Board
CB 1             REV 13   750-040257   CAAF8435         Control Board
SPMB 0           REV 02   711-041855   ABBX0406         PMB Board
SPMB 1
SFB 0            REV 05   711-044466   ABBT2142         Switch Fabric Board
SFB 1            REV 05   711-044466   ABBT2144         Switch Fabric Board
SFB 2            REV 05   711-044466   ABBT2151         Switch Fabric Board
SFB 3            REV 05   711-044466   ABBT2140         Switch Fabric Board
```

```
SFB 4            REV 05   711-044466   ABBT2148         Switch Fabric Board
SFB 5            REV 05   711-044466   ABBT2146         Switch Fabric Board
SFB 6            REV 05   711-044466   ABBT2143         Switch Fabric Board
SFB 7            REV 05   711-044466   ABBT2147         Switch Fabric Board
FPC 1            REV 36   750-028467   CAAS7536         MPC 3D 16x 10GE
  CPU
FPC 2            REV 06   750-036284   YZ6735           MPCE 3D 16x 10GE
  CPU
FPC 3            REV 33   750-028467   CAAF5552         MPC 3D 16x 10GE
  CPU
FPC 4            REV 16.0.05 750-044130 ABCA5352        MPC6E 3D
  CPU            REV 07   711-045719   ABCA5141         RMPC PMB
FPC 6            REV 16.0.05 750-044130 ABCC0320        MPC6E 3D
  CPU            REV 07   711-045719   ABCA3870         RMPC PMB
  MIC 0          REV 07   750-046535   ABBZ9635         24X10GE SFPP
    PIC 0                 BUILTIN      BUILTIN          24X10GE SFPP
      Xcvr 0     REV 01   740-021308   ANA03FH          SFP+-10G-SR
      Xcvr 1     REV 01   740-021308   ANA0MX7          SFP+-10G-SR
      Xcvr 2     REV 01   740-021308   ANA0QHL          SFP+-10G-SR
      Xcvr 3     REV 01   740-021308   973152A00022     SFP+-10G-SR
      Xcvr 4     REV 01   740-021308   ANA0MZA          SFP+-10G-SR
      Xcvr 5     REV 01   740-021308   ANA0Q2W          SFP+-10G-SR
      Xcvr 6     REV 01   740-021308   ANA0N5L          SFP+-10G-SR
      Xcvr 7     REV 01   740-021308   ANA0NJ1          SFP+-10G-SR
      Xcvr 8     REV 01   740-021308   ANA0N5C          SFP+-10G-SR
      Xcvr 9     REV 01   740-021308   ANA0MMT          SFP+-10G-SR
      Xcvr 10    REV 01   740-021308   ANA09VW          SFP+-10G-SR
      Xcvr 11    REV 01   740-021308   ANA09VV          SFP+-10G-SR
      Xcvr 12    REV 01   740-021308   ANA0QLB          SFP+-10G-SR
      Xcvr 13    REV 01   740-021308   ANA0MMS          SFP+-10G-SR
      Xcvr 14    REV 01   740-021308   ANA0NHP          SFP+-10G-SR
      Xcvr 15    REV 01   740-021308   ANA0NFD          SFP+-10G-SR
      Xcvr 16    REV 01   740-021308   ANA0NJE          SFP+-10G-SR
      Xcvr 17    REV 01   740-021308   ANA0QGF          SFP+-10G-SR
      Xcvr 18    REV 01   740-021308   ANA0N82          SFP+-10G-SR
      Xcvr 19    REV 01   740-021308   ANA0QHH          SFP+-10G-SR
      Xcvr 20    REV 01   740-021308   ANA03FF          SFP+-10G-SR
      Xcvr 21    REV 01   740-021308   ANA0NCY          SFP+-10G-SR
      Xcvr 22    REV 01   740-021308   ANA0BMF          SFP+-10G-SR
      Xcvr 23    REV 01   740-021308   ANA0BMQ          SFP+-10G-SR
  MIC 1          REV 07   750-046535   ABBZ9639         24X10GE SFPP
    PIC 1                 BUILTIN      BUILTIN          24X10GE SFPP
      Xcvr 0     REV 01   740-021308   ANA0NDW          SFP+-10G-SR
```

```
      Xcvr 1      REV 01   740-021308   ANA0PXK          SFP+-10G-SR
      Xcvr 2      REV 01   740-021308   ANA0QG7          SFP+-10G-SR
      Xcvr 3      REV 01   740-021308   ANA0QJQ          SFP+-10G-SR
      Xcvr 4      REV 01   740-021308   ANA0MLR          SFP+-10G-SR
      Xcvr 5      REV 01   740-021308   ANA0PXW          SFP+-10G-SR
      Xcvr 6      REV 01   740-021308   ANA0MZC          SFP+-10G-SR
      Xcvr 7      REV 01   740-021308   ANA0PXU          SFP+-10G-SR
      Xcvr 8      REV 01   740-021308   ANA0NFH          SFP+-10G-SR
      Xcvr 9      REV 01   740-021308   ANA09YS          SFP+-10G-SR
      Xcvr 10     REV 01   740-021308   ANA0NG6          SFP+-10G-SR
      Xcvr 11     REV 01   740-021308   ANA0N5B          SFP+-10G-SR
      Xcvr 12     REV 01   740-021308   ANA0QJT          SFP+-10G-SR
      Xcvr 13     REV 01   740-021308   ANA0MME          SFP+-10G-SR
      Xcvr 14     REV 01   740-021308   ANA0PY4          SFP+-10G-SR
      Xcvr 15     REV 01   740-021308   ANA0PXH          SFP+-10G-SR
      Xcvr 16     REV 01   740-021308   ANA0NGY          SFP+-10G-SR
      Xcvr 17     REV 01   740-021308   ANA0PY1          SFP+-10G-SR
      Xcvr 18     REV 01   740-021308   ANA0QG4          SFP+-10G-SR
      Xcvr 19     REV 01   740-021308   ANA0MLW          SFP+-10G-SR
      Xcvr 20     REV 01   740-021308   ANA0QHZ          SFP+-10G-SR
      Xcvr 21     REV 01   740-021308   ANA0NGA          SFP+-10G-SR
      Xcvr 22     REV 01   740-021308   ANA0QJ3          SFP+-10G-SR
      Xcvr 23     REV 01   740-021308   ANA0NDV          SFP+-10G-SR
ADC 1             REV 13   750-043596   ABBX5578         Adapter Card
ADC 2             REV 13   750-043596   ABBX5572         Adapter Card
ADC 3             REV 07   750-043596   ABBV7188         Adapter Card
ADC 5             REV 13   750-043596   ABBX5552         Adapter Card
ADC 7             REV 13   750-043596   ABBX5546         Adapter Card
ADC 8             REV 13   750-043596   ABBX5561         Adapter Card
ADC 9             REV 13   750-043596   ABBX5559         Adapter Card
Fan Tray 0        REV 06   760-046960   ACAY0207         172mm FanTray - 6 Fans
Fan Tray 1        REV 06   760-046960   ACAY0209         172mm FanTray - 6 Fans
Fan Tray 2        REV 06   760-046960   ACAY0227         172mm FanTray - 6 Fans
Fan Tray 3        REV 06   760-046960   ACAY0229         172mm FanTray - 6 Fans
```

Most components also have a small rectangular serial number ID label attached to the component body (see Figure 373 on page 845).

Figure 373: Serial Number ID Label

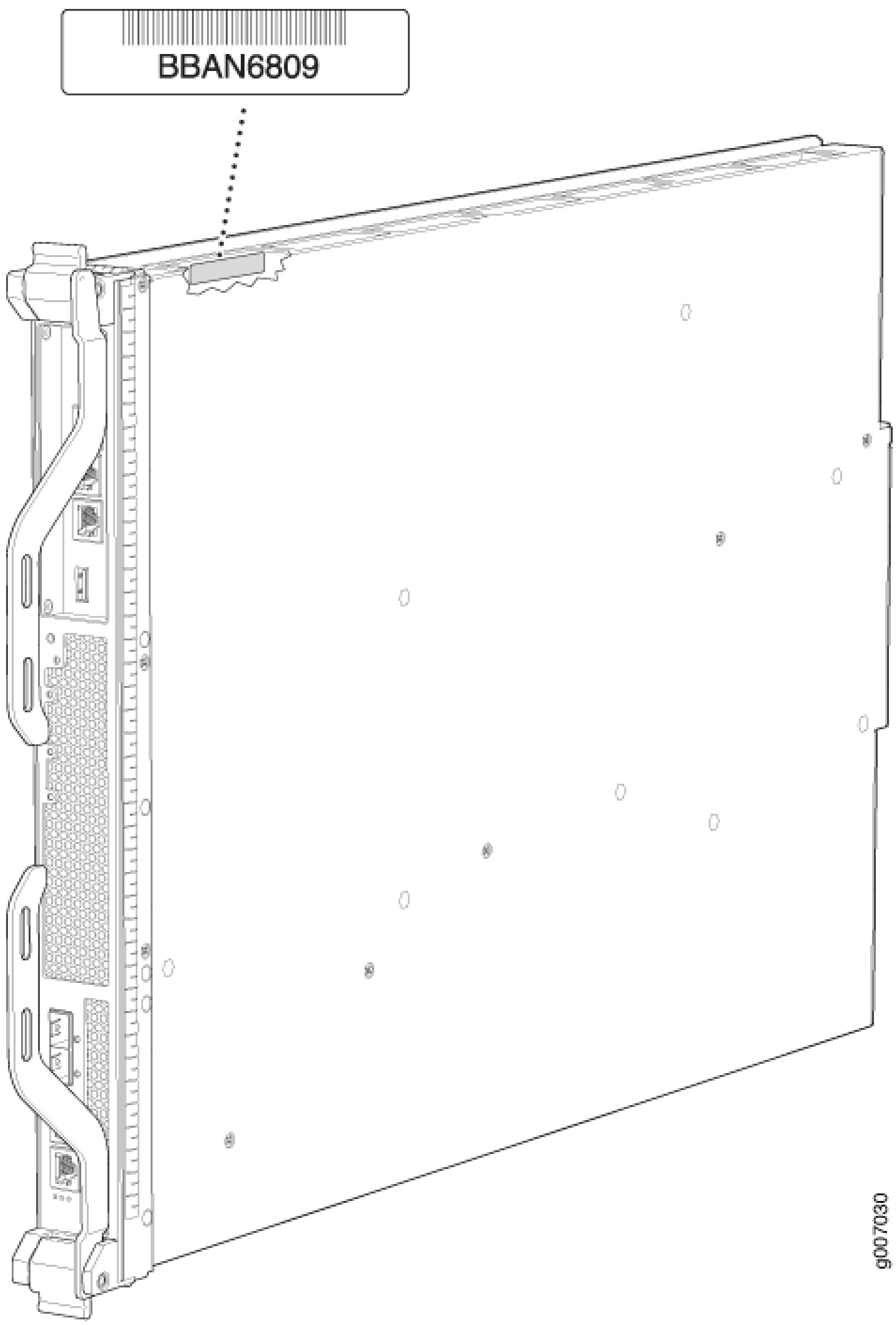
RELATED DOCUMENTATION

MX2010 Chassis Serial Number Label | 848
MX2010 Craft Interface Serial Number Label | 850
MX2010 MPC Serial Number Label | 853
MX2010 MIC Serial Number Label | 851
MX2010 CB-RE Serial Number Label | 846
MX2010 SFB Serial Number Label | 859
MX2010 Power Distribution Module Serial Number Label | 854
MX2010 Power Supply Module Serial Number Label | 856
MX2010 Fan Tray Serial Number Label | 851

MX2010 CB-RE Serial Number Label

The serial number label is located on the left side of the top of the CB-RE (see Figure 374 on page 847).

Figure 374: CB-RE Serial Number Label



RELATED DOCUMENTATION

Removing a CB-RE from an MX2000 Router | 504

Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support | 838

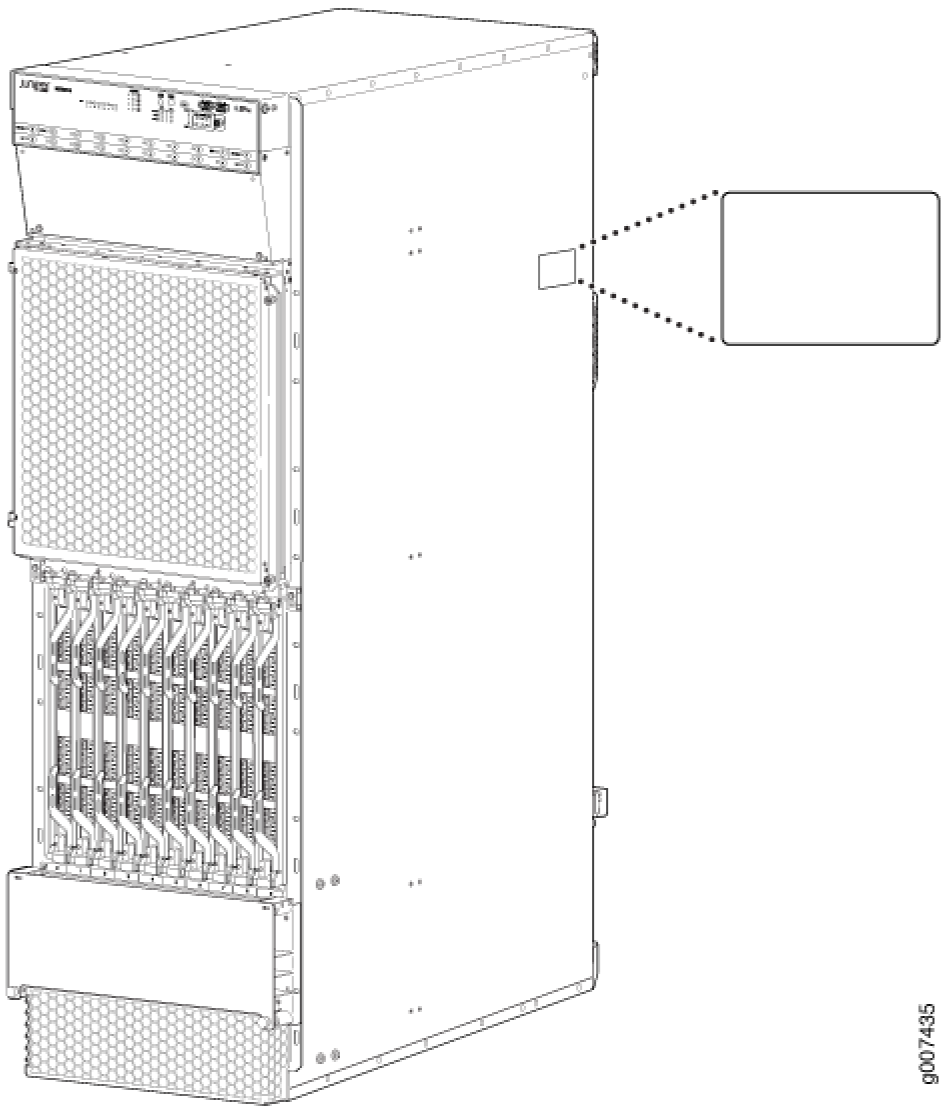
How to Return a Hardware Component to Juniper Networks, Inc. | 810

Guidelines for Packing Hardware Components for Shipment | 808

MX2010 Chassis Serial Number Label

The chassis serial number is located on the side of the chassis (see Figure 375 on page 849).

Figure 375: MX2010 Chassis Serial Number Label



RELATED DOCUMENTATION

Displaying MX2010 Router Components and Serial Numbers | **840**

MX2010 Craft Interface Serial Number Label | **850**

MX2010 MPC Serial Number Label | **853**

MX2010 MIC Serial Number Label | **851**

MX2010 CB-RE Serial Number Label | **846**

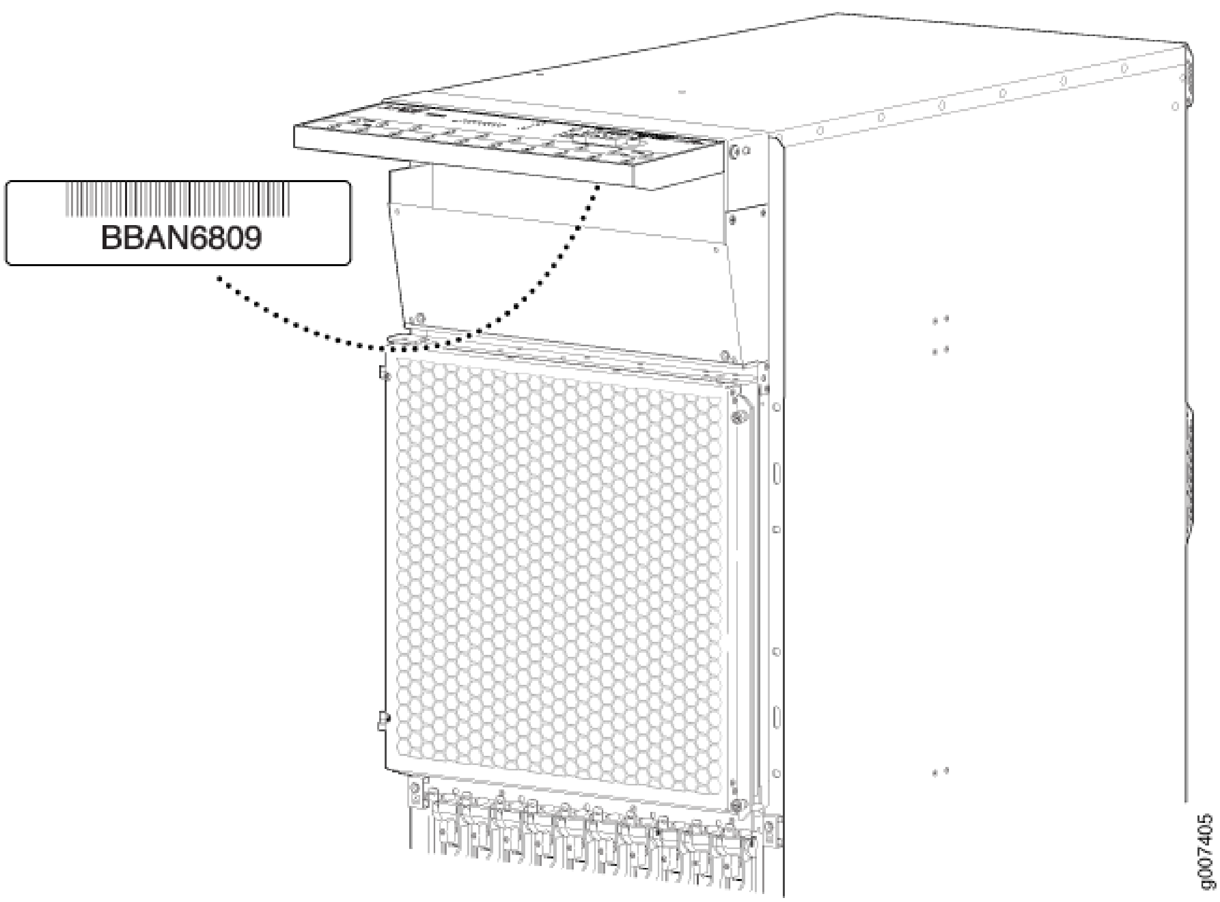
MX2010 SFB Serial Number Label | **859**

MX2010 Power Distribution Module Serial Number Label | 854
MX2010 Power Supply Module Serial Number Label | 856
MX2010 Fan Tray Serial Number Label | 851

MX2010 Craft Interface Serial Number Label

The serial number is located on the back of the craft interface panel (see Figure 376 on page 850).

Figure 376: Craft Interface Serial Number Label



RELATED DOCUMENTATION

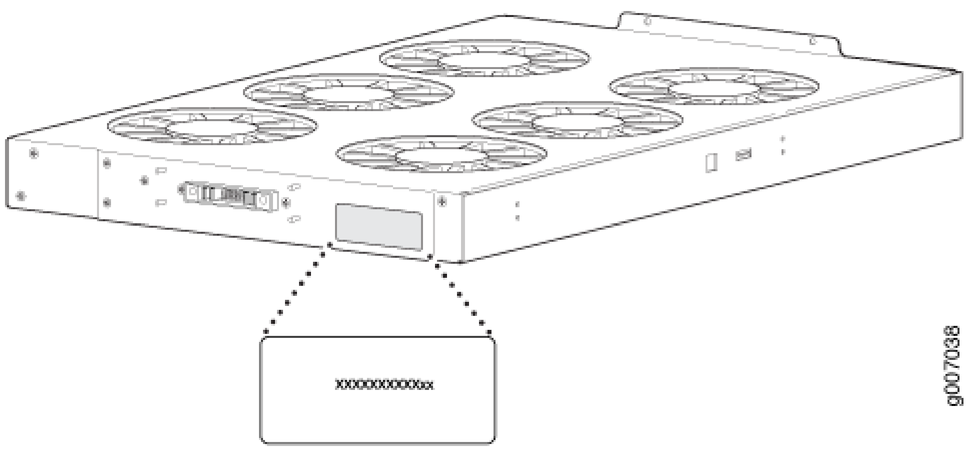
Replacing the MX2010 Craft Interface | 547
Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support | 838
How to Return a Hardware Component to Juniper Networks, Inc. | 810
Guidelines for Packing Hardware Components for Shipment | 808

MX2010 Fan Tray Serial Number Label

The serial number is located on the top left-hand corner of the fan tray, near the captive screw (see Figure 377 on page 851).

Figure 377: MX2010 Fan Tray Serial Number Label



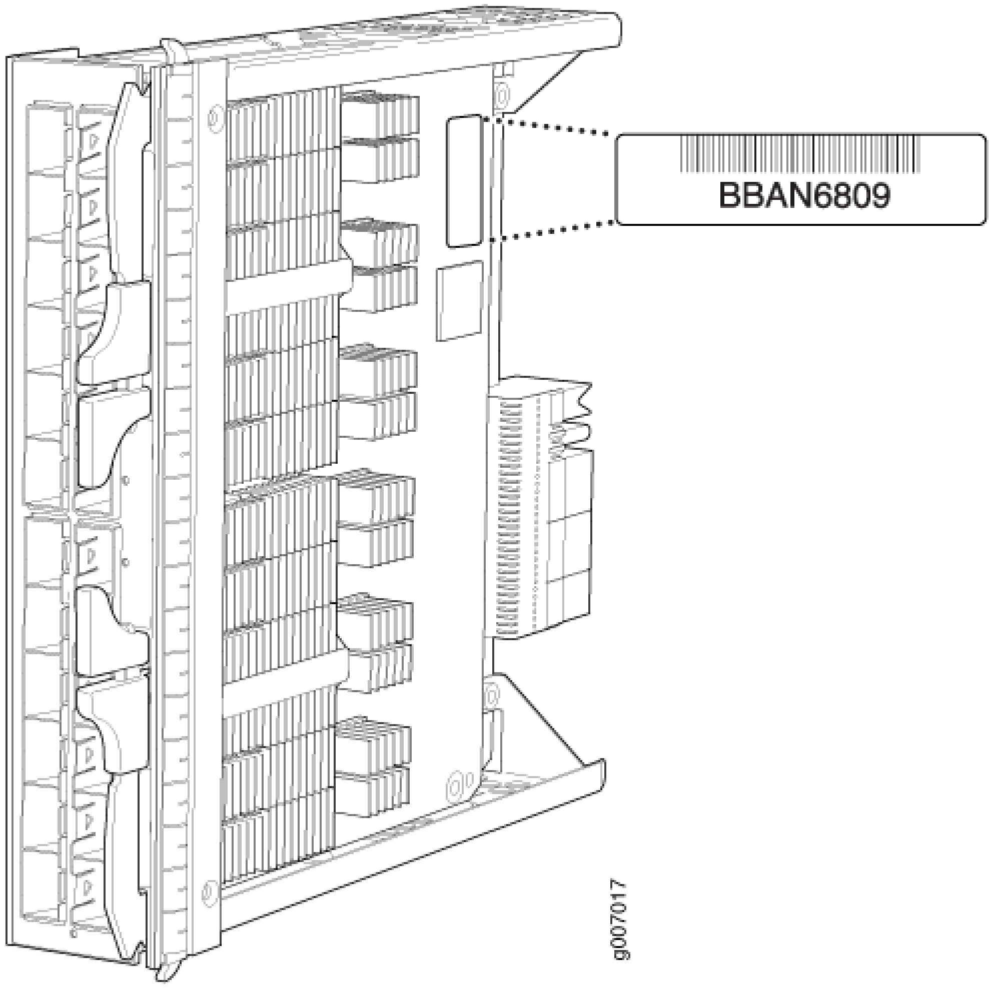
RELATED DOCUMENTATION

Displaying MX2010 Router Components and Serial Numbers | 840
Contact Customer Support | 838
How to Return a Hardware Component to Juniper Networks, Inc. | 810
Guidelines for Packing Hardware Components for Shipment | 808

MX2010 MIC Serial Number Label

The serial number label location varies according to the number of ports on a MIC (see Figure 378 on page 852). The exact location might be slightly different on different MICs, depending on the placement of components on the MIC board.

Figure 378: MIC Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2010 MIC | 613

Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support | 838

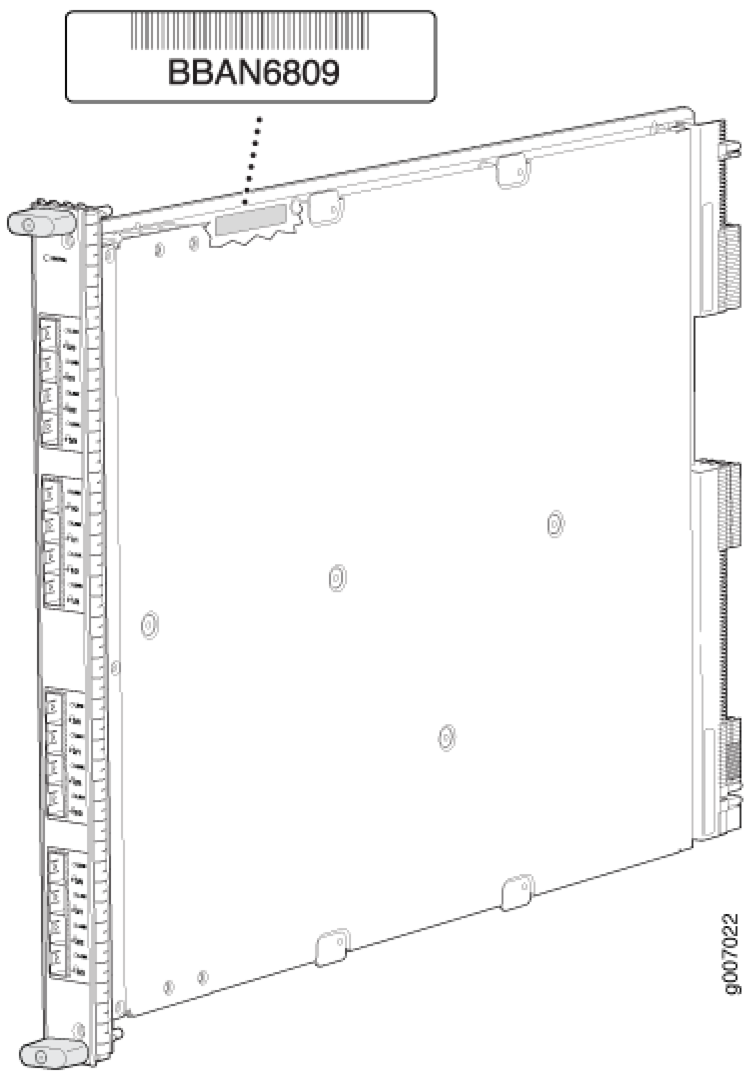
How to Return a Hardware Component to Juniper Networks, Inc. | 810

Guidelines for Packing Hardware Components for Shipment | 808

MX2010 MPC Serial Number Label

The serial number label is near the connectors located on the left side of the MPC when it is oriented vertically (see Figure 379 on page 853).

Figure 379: MPC Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2010 MPC and Adapter Card | 625

Displaying MX2010 Router Components and Serial Numbers | 840
Contact Customer Support | 838
How to Return a Hardware Component to Juniper Networks, Inc. | 810
Guidelines for Packing Hardware Components for Shipment | 808

MX2010 Power Distribution Module Serial Number Label

For the three-phase delta and wye AC PDM, the serial number label is located on the rear (see Figure 380 on page 854).

For the 60/80 A DC PDM, the serial number label is located on the rear (see Figure 381 on page 855).

Figure 380: AC Power Distribution Module Three-Phase Delta and Wye Serial Number Label

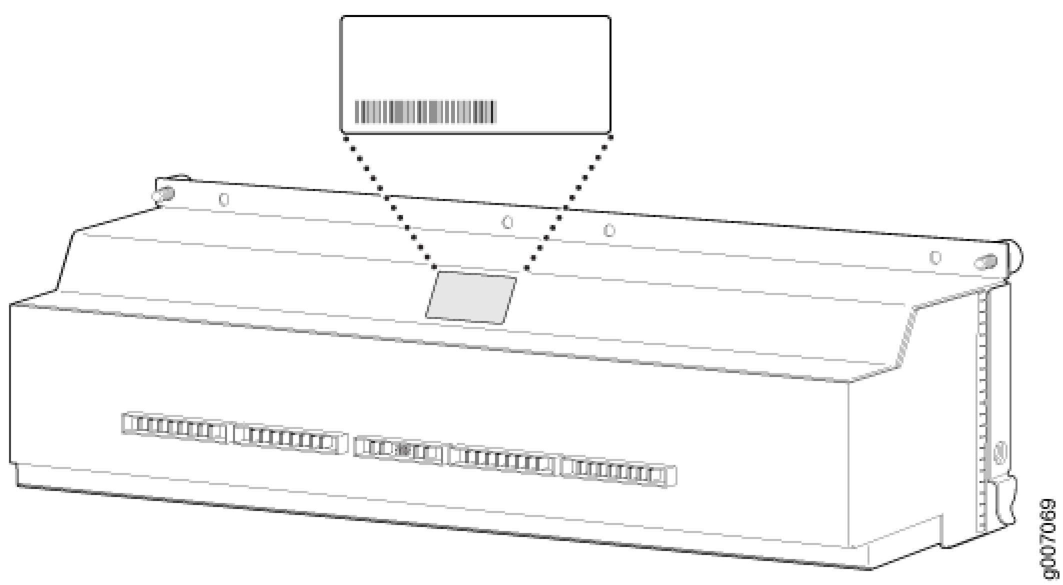


Figure 381: DC Power Distribution Module Serial Number Label

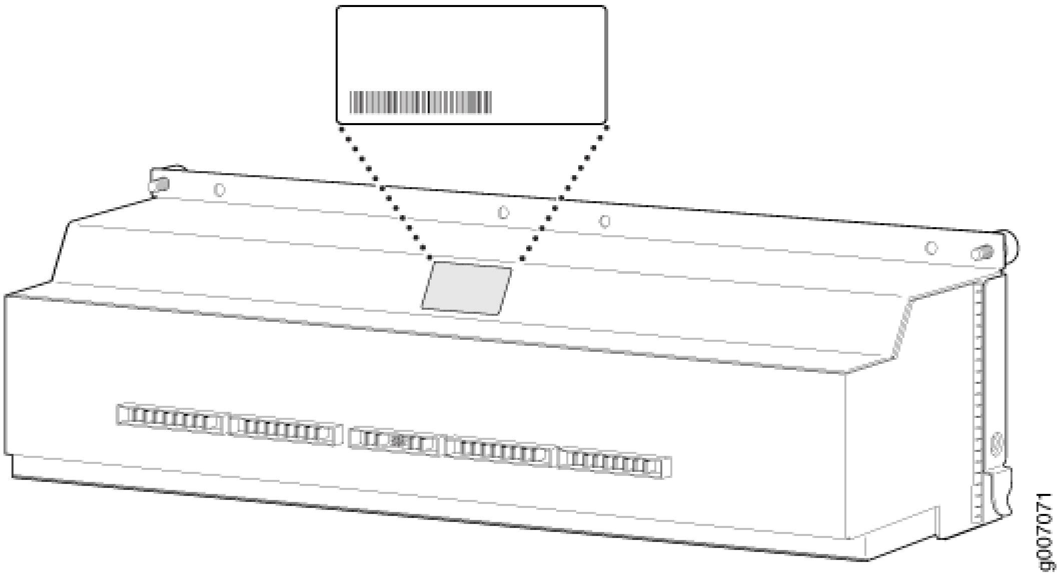
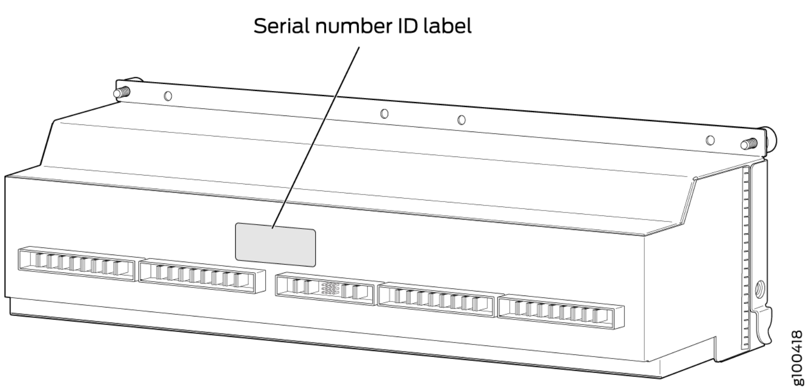


Figure 382: DC Power Distribution Module (240 V China) and Second-Generation Universal Power (HVAC/HVDC) Distribution Module Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2020 Three-Phase Wye AC Power Distribution Module

Replacing an MX2000 Three-Phase Delta AC Power Distribution Module

Replacing an MX2000 DC Power Distribution Module (-48 V) | **571**

Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support

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

Guidelines for Packing Hardware Components for Shipment

MX2010 Power Supply Module Serial Number Label

The serial number label is located on the side of the AC PSM (see Figure 383 on page 856).

The serial number label is located on the side of the DC PSM (see Figure 384 on page 857).

Figure 383: AC Power Supply Module Serial Number Label

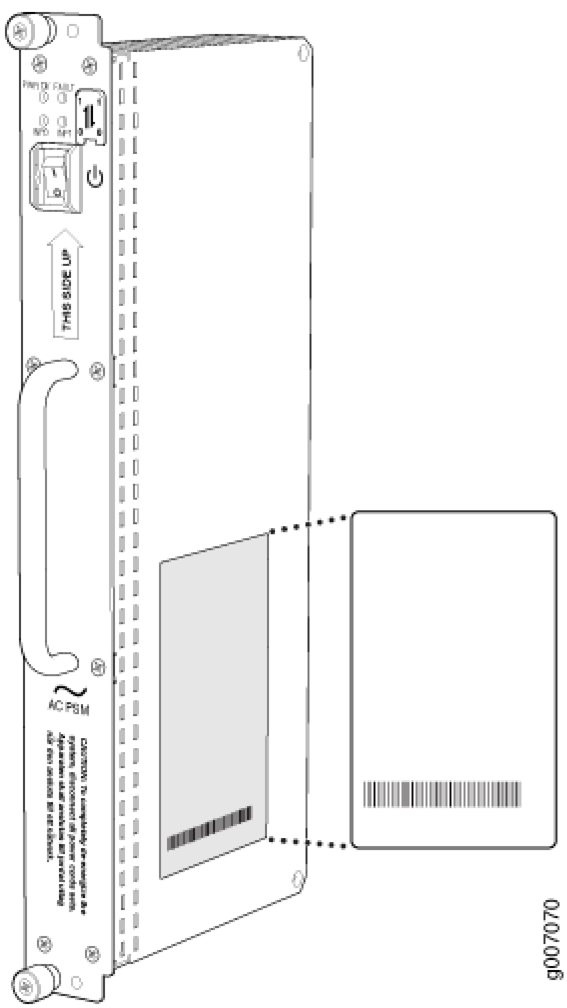


Figure 384: DC Power Supply Module Serial Number Label

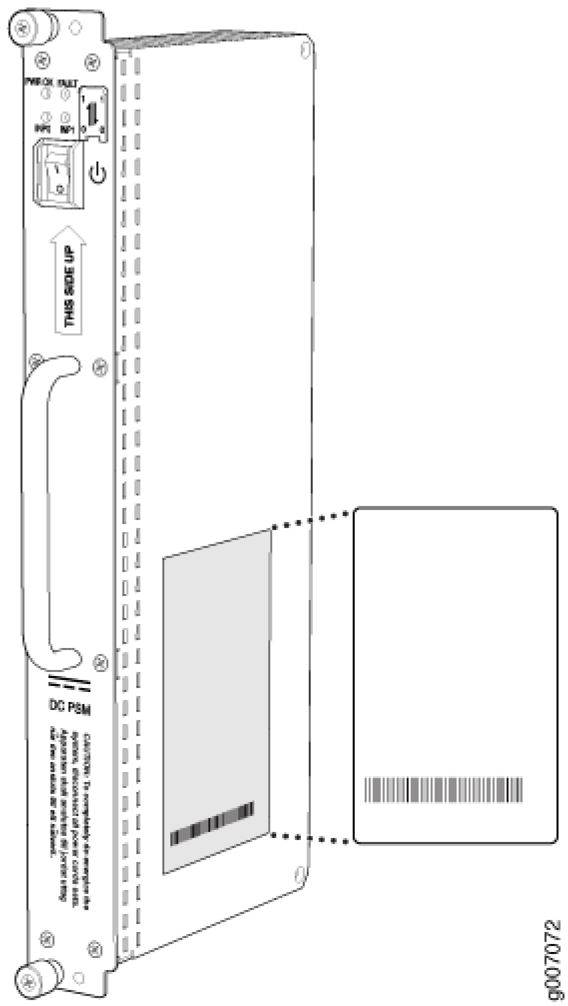
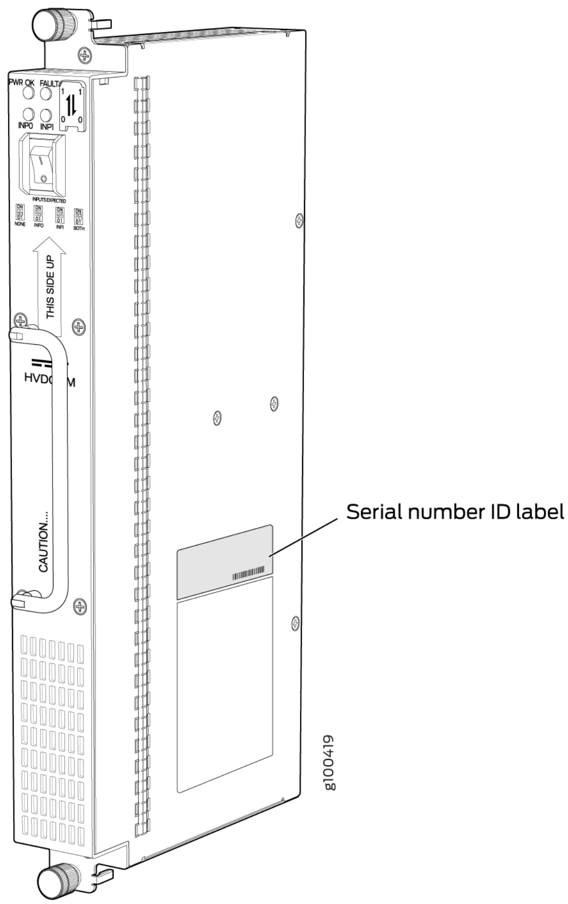


Figure 385: DC Power Supply Module (240 V China) and Second-Generation Universal Power (HVAC/HVDC) Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2010 AC Power Supply Module

Replacing an MX2010 DC Power Supply Module (-48 V) | 555

Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support

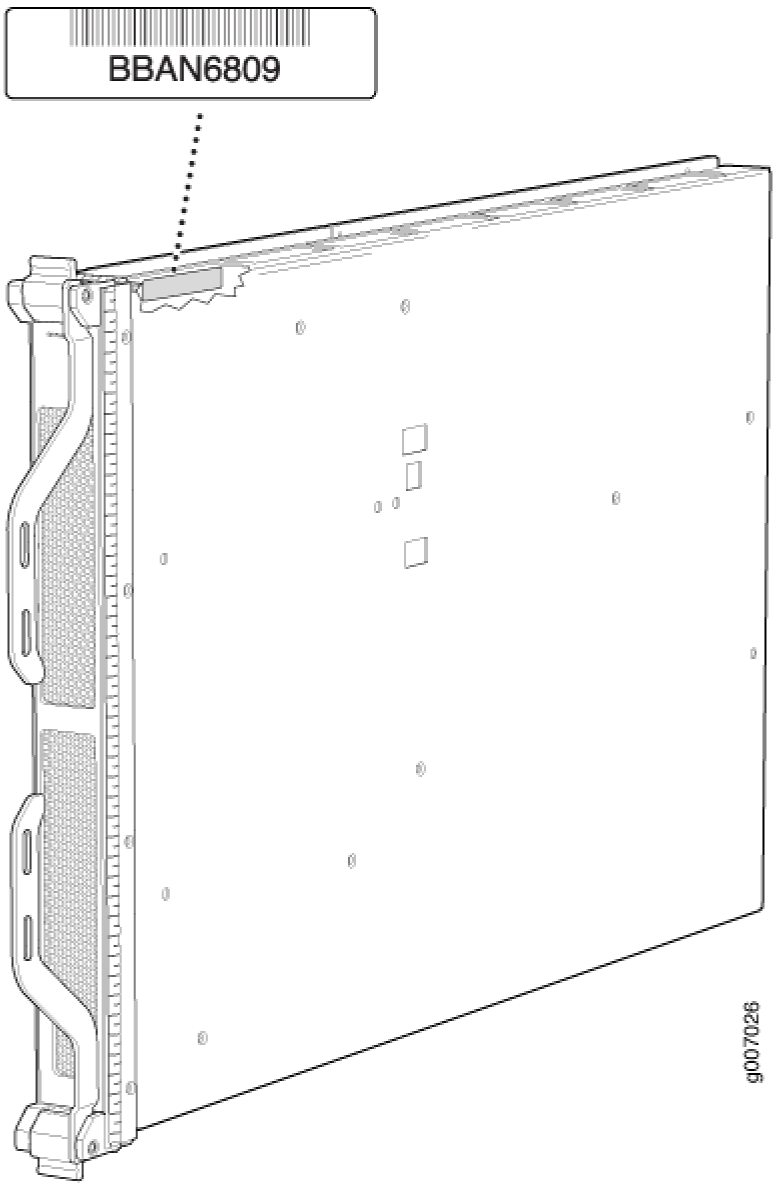
How to Return a Hardware Component to Juniper Networks, Inc.

Guidelines for Packing Hardware Components for Shipment

MX2010 SFB Serial Number Label

The serial number is located on the right side of the top of the SFB (see Figure 386 on page 859).

Figure 386: SFB Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2000 SFB | 637

Displaying MX2010 Router Components and Serial Numbers | 840

Contact Customer Support | 838

How to Return a Hardware Component to Juniper Networks, Inc. | 810

Guidelines for Packing Hardware Components for Shipment | 808

CHAPTER 30

Packing and Returning Components

IN THIS CHAPTER

- Contact Customer Support to Obtain a Return Material Authorization | **861**
- Guidelines for Packing Hardware Components for Shipment | **862**
- Packing the MX2020 Router for Shipment | **862**
- How to Return a Hardware Component to Juniper Networks, Inc. | **865**

Contact Customer Support to Obtain a Return Material Authorization

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

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

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

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

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

- Service Request Manager: https://support.juniper.net/support

- Telephone: +1-888-314-JTAC (+1-888-314-5822), toll free in U.S., Canada, and Mexico

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

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

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

Guidelines for Packing Hardware Components for Shipment

To pack and ship individual components:

- When you return components, make sure that they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: Do not stack any of the hardware components.

Packing the MX2020 Router for Shipment

To pack the router for shipment:

1. Retrieve the shipping crate and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.

2. On the console or other management device connected to the primary CB-RE, enter CLI operational mode and issue the following command to shut down the router software. (If two CB-REs are installed, also issue the command on the backup CB-RE.)

```
user@host> request system halt
```

   Wait until a message appears on the console confirming that the operating system has halted.

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Shut down power to the router by switching the AC or DC circuit breaker for all PDMs to the off (**O**) position.
5. Disconnect power from the router.
6. Remove the cables that connect to all external devices.
7. Remove all field replaceable units (FRUs) from the router.
8. Attach the front and rear shipping covers.

   CAUTION: Apply force to any other parts of chassis other than the shipping covers can damage the chassis.

9. Remove the router from the rack.

   - Using a pallet jack with attachment:

     - Install the pallet jack attachment to a pallet jack. Position the pallet jack in front of the rack, and unscrew and remove the mounting screws from the front mounting flange on the rack.

       NOTE: The pallet jack attachment fits only on a standard pallet jack. The standard pallet jack is approximately 48 in. (121.92 cm) deep x 27 in. (68.58 cm) wide.

     - A minimum of four people can then slide the router onto the pallet jack by using the handles on the shipping covers. Attach the four shipping brackets and hardware to the pallet jack attachment. Secure the brackets to the router chassis.

     - Position the router in front of the shipping crate and raise the pallet jack.

     - Remove the shipping brackets and hardware, and set them aside.

     - Guide the router in the shipping crate.

Using a router transport kit:

- Position the router transport platform in front of the rack, and adjust the four leveling mounts using an 8 mm Allen wrench to align the platform with the bottom of the mounting shelf and the chassis.
- Unscrew and remove the mounting screws from the front mounting flange on the rack.
- A minimum of four people can then slide the router onto the router transport platform by using the handles on the shipping covers.
- Secure the four toggle latches to the router transport platform.
- Using a two person team, adjust the height on the router transport platform to install the router transport mounting plates and wheel assembly.

  WARNING: Do not raise the router more than 1 in. (2.54 cm). Doing so can make the router unstable.

- Attach the router transport mounting plates and wheel assembly to both sides of the chassis using the captive screws, tighten to secure.

  NOTE: You may have to adjust the wheel assembly to installed the router transport mounting plates.

- Using a two person team, crank the handles 4-5 times until the router is lifted approximately 1 in. (2.54 cm).

  WARNING: Do not raise the router transport over the required limit. Doing so can make the router unstable during transport.

- Unlatch the four toggle latches that secure the router transport platform to the router mounting plate and wheel assembly.
- Remove the router transport platform away from the bottom of the router, and set aside
- Position the crate door in front of the shipping crate and secure the two latches.
- Guide the router up the ramp and into the shipping crate.
- Lower the router until the chassis is resting firmly onto the shipping crate platform.

- Remove the router transport mounting plates and wheel assembly from the chassis.

> **WARNING**: We recommend using a pallet jack with attachment or a router transport kit. Not using one of these recommended installation mechanisms can result in personal injury or damage to the equipment.

10. Reattach the shipping brackets to the router chassis and the shipping crate pallet.
11. Cover the router with an ESD bag and place the packing foam on top of and around the router.
12. Replace the accessory box on top of the packing foam.
13. Securely place the crate cover over the router.
14. Close all latches to secure the shipping crate to the pallet.
15. Write the RMA number on the exterior of the box to ensure proper tracking.

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Powering Off the DC-Powered MX2020 Router

Powering Off the AC-Powered MX2020 Router

Replacing an MX2020 Three-Phase Delta AC Power Cord

Replacing an MX2020 Three-Phase Wye AC Power Cord

Disconnecting an MX2020 DC Power Distribution Module Cable

Installing the Router Transport Kit on the MX2020 Router

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

If a hardware component fails, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

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

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

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Service Request Manager link at https://support.juniper.net/support/ or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.
2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.
3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
   - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the component.
5. Pack the component for shipment.

8

PART

Safety and Compliance Information

General Safety Guidelines and Warnings | 868

Installation and Maintenance Safety Guidelines and Warnings | 874

Radiation and Laser Warnings | 882

Maintenance and Operational Safety Guidelines and Warnings | 886

Electrical Safety Guidelines and Warnings | 892

Agency Approvals and Compliance Statements | 905

CHAPTER 31

General Safety Guidelines and Warnings

IN THIS CHAPTER

- General Safety Guidelines and Warnings | 868
- Definitions of Safety Warning Levels | 869
- Qualified Personnel Warning | 871
- Fire Safety Requirements | 872
- Warning Statement for Norway and Sweden | 873

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.

Fire Safety Requirements

IN THIS SECTION

- Fire Suppression | **872**
- Fire Suppression Equipment | **872**

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.

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.

CHAPTER 32

Installation and Maintenance Safety Guidelines and Warnings

IN THIS CHAPTER

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- Rack-Mounting and Cabinet-Mounting Warnings | 876
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Installation Instructions Warning

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

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

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

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

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

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

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

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

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

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

Chassis and Component Lifting Guidelines

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

Ramp Warning

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

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

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

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

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

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

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

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

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

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

Rack-Mounting and Cabinet-Mounting Warnings

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

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

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

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

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

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

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

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

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

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

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

- Der Juniper Networks switch muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
- Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
- Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
- Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

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

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

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

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

- Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

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

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

CHAPTER 33

Radiation and Laser Warnings

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- Radiation from Open Port Apertures Warning | 885

Laser and LED Safety Guidelines and Warnings

IN THIS SECTION

- General Laser Safety Guidelines | 882
- Class 1 Laser Product Warning | 883
- Class 1 LED Product Warning | 883
- Laser Beam Warning | 884

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

Observe the following guidelines and warnings:

General Laser Safety Guidelines

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

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

- Avoid direct exposure to the beam.

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

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

Class 1 Laser Product Warning

LASER WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Avertissement Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

LASER WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Avertissement Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

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

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

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

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

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

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

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

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

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

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

Radiation from Open Port Apertures Warning

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

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

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

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

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

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

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

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

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

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

CHAPTER 34

Maintenance and Operational Safety Guidelines and Warnings

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Maintenance and Operational Safety Guidelines and Warnings

IN THIS SECTION

- Battery Handling Warning | 886
- Jewelry Removal Warning | 887
- Lightning Activity Warning | 889
- Operating Temperature Warning | 889
- Product Disposal Warning | 891

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.

CHAPTER 35

Electrical Safety Guidelines and Warnings

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General Electrical Safety Guidelines and Warnings

WARNING: Certain ports on the device are designed for use as intrabuilding (within-the-building) interfaces only (Type 2 or Type 4 ports as described in *GR-1089-CORE*) and require isolation from the exposed outside plant (OSP) cabling. To comply with NEBS (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.

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 387 on page 895) 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).

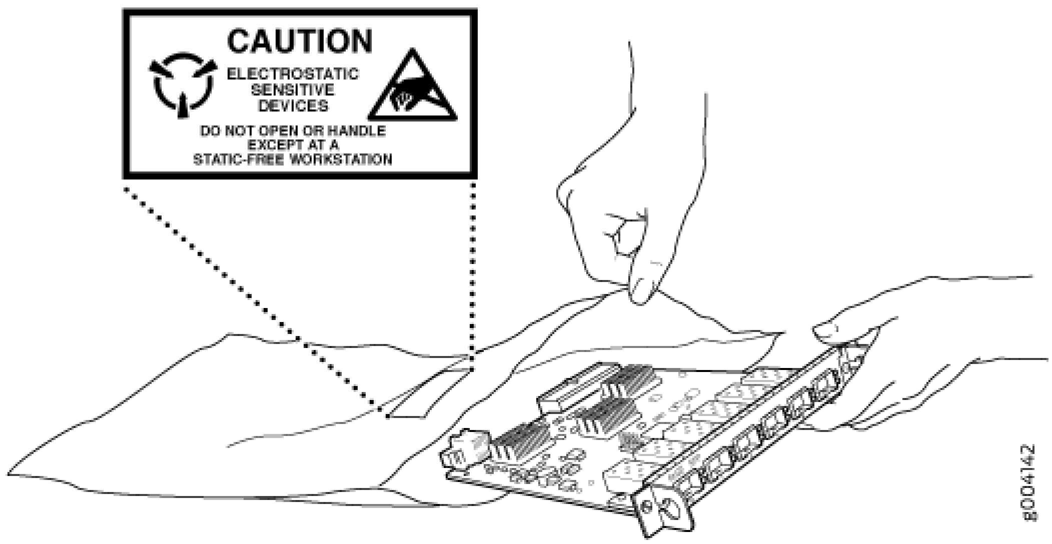
- When handling any component that is subject to ESD damage and that is removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.

  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 387 on page 895). If you are returning a component, place it in an antistatic bag before packing it.

Figure 387: Placing a Component into an Antistatic Bag



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

Attention Les câbles ANSI/TIA/EIA-568, par exemple Cat 5e et Cat 6, peuvent emmagasiner des charges électrostatiques. Pour évacuer ces charges, reliez toujours les câbles à une prise de terre adaptée avant de les raccorder au système.

AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to AC-powered devices:

- Note the following warnings printed on the device:

“**CAUTION:** THIS UNIT HAS MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRIC SHOCK.”

“**ATTENTION:** CET APPAREIL COMPORTE PLUS D'UN CORDON D'ALIMENTATION. AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES, DÉBRANCHER TOUT CORDON D'ALIMENTATION AVANT DE FAIRE LE DÉPANNAGE.”

- AC-powered devices are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- You must provide an external certified circuit breaker (2-pole circuit breaker or 4-pole circuit breaker based on your device) rated minimum 20 A in the building installation.
- The power cord serves as the main disconnecting device for the AC-powered device. The socket outlet must be near the AC-powered device and be easily accessible.
- For devices that have more than one power supply connection, you must ensure that all power connections are fully disconnected so that power to the device is completely removed to prevent electric shock. To disconnect power, unplug all power cords (one for each power supply).

Power Cable Warning (Japanese)

WARNING: The attached power cable is only for this product. Do not use the cable for another product.

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

AC Power Disconnection Warning

WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

Waarschuwing Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Avertissement Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut på vekselstrømsenheter.

Aviso Antes de trabalhar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden.

DC Power 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.

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.

CHAPTER 36

Agency Approvals and Compliance Statements

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Agency Approvals and Compliance Statements for the MX2010 Router

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Agency Approvals for MX2010 Routers

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The routers comply with the following standards:

- Safety

    - CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
    - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
    - EN 60950 Safety of Information Technology Equipment
- EMC
    - AS/NZS CISPR22: (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
    - ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

The router is designed to comply with the following standards:

- 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

NOTE: The Premium 2 Chassis is not NEBs compliant.

Compliance Statement for Argentina

EQUIPO DE USO IDÓNEO.

SEE ALSO

Compliance Statements for NEBS for the MX2010 Router | 907

Compliance Statements for EMC Requirements for the MX2010 Router | 907

Compliance Statements for Environmental Requirements | 911

Compliance Statements for NEBS for the MX2010 Router

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- The MX2010 complies with GR-63-CORE. However, under normal operation, the sound power level produced by the MX2010 is 80dB(A).

SEE ALSO

Agency Approvals for MX2010 Routers | 905

Compliance Statements for EMC Requirements for the MX2010 Router | 907

Compliance Statements for Environmental Requirements | 911

Compliance Statements for EMC Requirements for the MX2010 Router

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Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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

Translation from Japanese—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. VCCI-A

United States

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

Compliance Statements for Environmental Requirements

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

Compliance Statements for EMC Requirements

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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.

Compliance Statements for Data Center

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.