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MX2020 Universal Routing Platform Hardware Guide

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MX2020 Universal Routing Platform Hardware Guide

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

YEAR 2000 NOTICE

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About This Guide

Use this guide to install hardware and perform initial software configuration, routine maintenance, and troubleshooting for the MX2020 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.

RELATED DOCUMENTATION

- MX2020 Quick Start
- Junos OS for MX Series 5G Universal Routing Platforms

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CHAPTER

Fast Track: Initial Installation

Fast Track to Rack Installation and Power

SUMMARY

This procedure guides you through the simplest steps for the most common installation to mount your MX2020 router in a rack and connect it to power.

IN THIS SECTION

Install the MX2020 in a Rack

IN THIS SECTION

You can mount the MX2020 Universal Routing Platform in a four-post rack or cabinet. In this section, we'll walk you through the steps to install an MX2020 router and connect it to power.

A fully configured router can weigh up to 1,515 lb (687.19 kg).

Because of the router's size and weight, you can install the router using a pallet jack with a pallet jack attachment, or the router transport kit. We recommend that you use the router transport kit to install the router.

You must install the router into a rack or cabinet that is secured to the building structure in a restricted-access location. You must also ensure that the chassis is always grounded properly.

Before you install, review the following:

- "MX2020 Site Preparation Checklist" on page 200
- "General Safety Guidelines and Warnings" on page 898
- "Prevention of Electrostatic Discharge Damage" on page 924
- "Overview of Unpacking the MX2020 Router" on page 332
- "Chassis and Component Lifting Guidelines" on page 905

Mount the Router

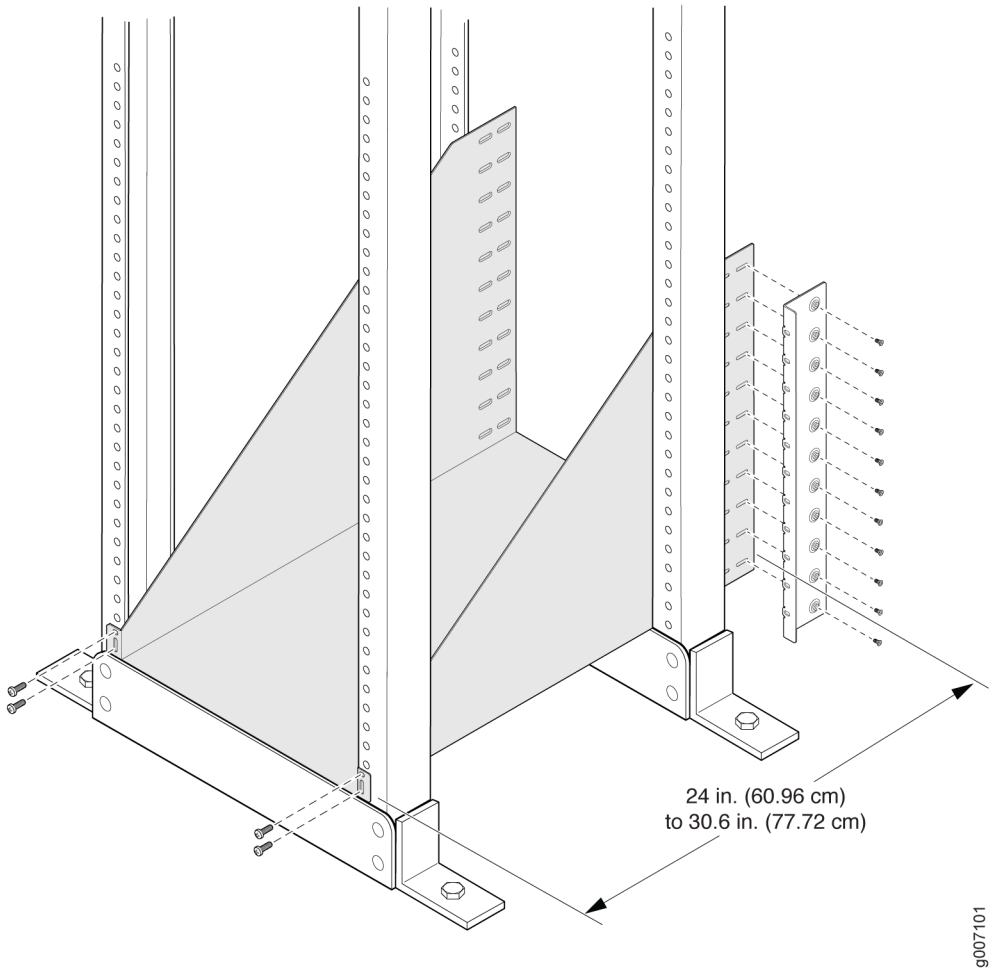
To connect the MX2020 router to a four-post rack using a router transport kit (model number MX2K-TRNSPRT-KIT):

1. Slide the four-post rack mounting shelf between the rack rails, resting the bottom of the shelf on the rack supports. The four-post rack mounting shelf installs on the rear rack rails, extending toward the front of the rack.

   NOTE: There must be a minimum of 45-U unobstructed front-to-back usable rack space when installing the MX2020 router into a four-post rack or cabinet.

2. On the front of the rear rack rails, partially insert screws into the holes in each ear of the four-post rack mounting shelf.

Figure 1: Mounting Hardware for a Four-Post Rack or Cabinet



3. Partially insert screws into the open holes in the front ears of the four-post rack mounting shelf.
4. Tighten all the screws completely.
5. Because of the router's size and weight, you must first remove the components from the chassis before installation.

Figure 2: Components to Remove from the Front of the MX2020 Router

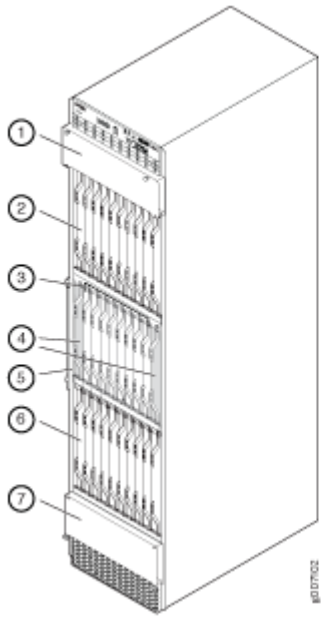


Table 1: Components to Remove from the Front of the MX2020 Router

Component No.	Component Description	Slots	Number of FRUs
1	MPCs with ADCs and MICs (top)	10 through 19 (top)	10
2	Switch Fabric Boards (SFBs)	0 through 7	8
3	Control Board and Routine Engine (CB-RE)	0 and 1	2
4	MPCs with ADCs and MICs (bottom)	0 through 9	10

Figure 3: Components to Remove from the Rear of an AC-Powered MX2020 Router

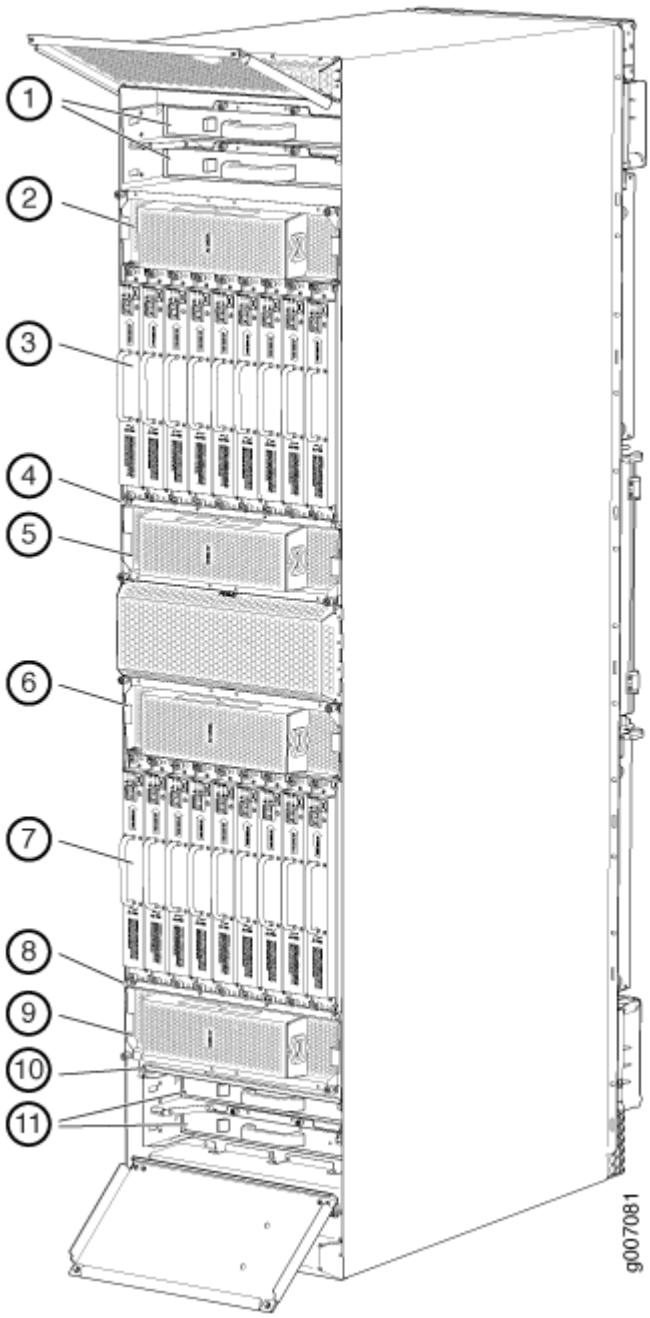


Table 2: Components to Remove from the Rear of an AC-Powered MX2020 Router

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	AC PDM—Three-phase delta or wye	PDM3/Input1	1
3	AC PSM	9 through 17	9
4	PSM air filter	–	1
5	AC PDM—Three-phase delta or wye	PDM2/Input0	1
6	AC PDM—Three-phase delta or wye	PDM1/Input1	1
7	AC PSM	0 through 8	9
8	PSM air filter	–	1
9	AC PDM—Three-phase delta or wye	PDM0/Input0	1
10	Fan tray air filter	–	1
11	Lower fan trays (two)	Fan tray 0 and fan tray 1 (behind access door)	2

To remove the components from the router:

a. Slide each component out of the chassis evenly so that it does not become stuck or damaged.

b. Label each component as you remove it so you can reinstall it in the correct location.

c. Immediately store each removed component in an electrostatic bag.

d. Lay each one on a flat surface. Do not stack removed components.

To remove the upper and lower fan tray:

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

b. Loosen the two captive screws on each side of the fan tray access panel and open.

c. Loosen the two captive screws on the fan tray faceplate.

d. 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.

> **NOTE**: The double latch system is a safety mechanism, so you cannot pull the fan tray out in one motion.

e. Place each component on an antistatic mat resting on a stable, flat surface. Do not stack fan trays on top of another after you remove them.

Figure 4: Removing Upper Fan Trays

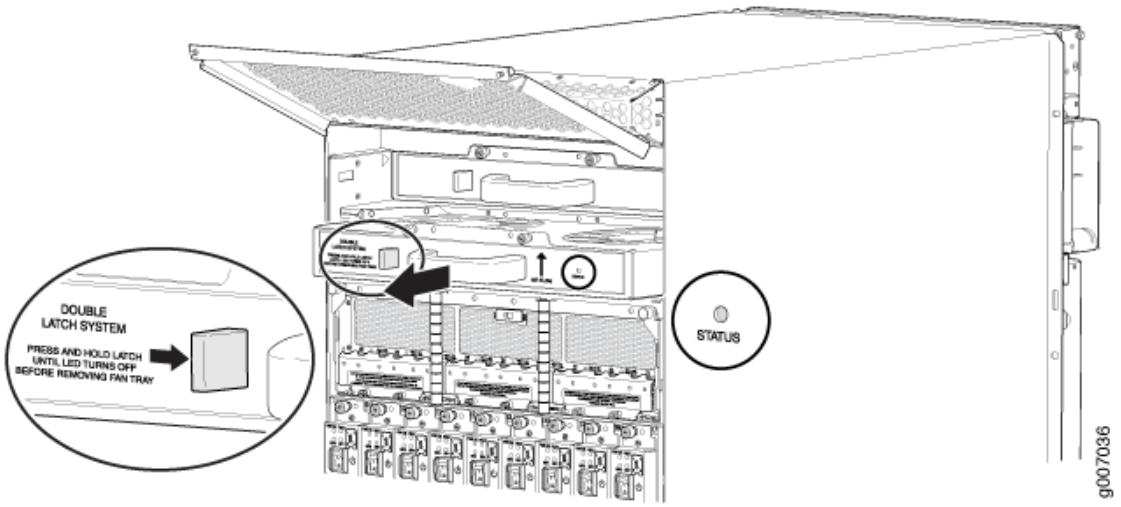
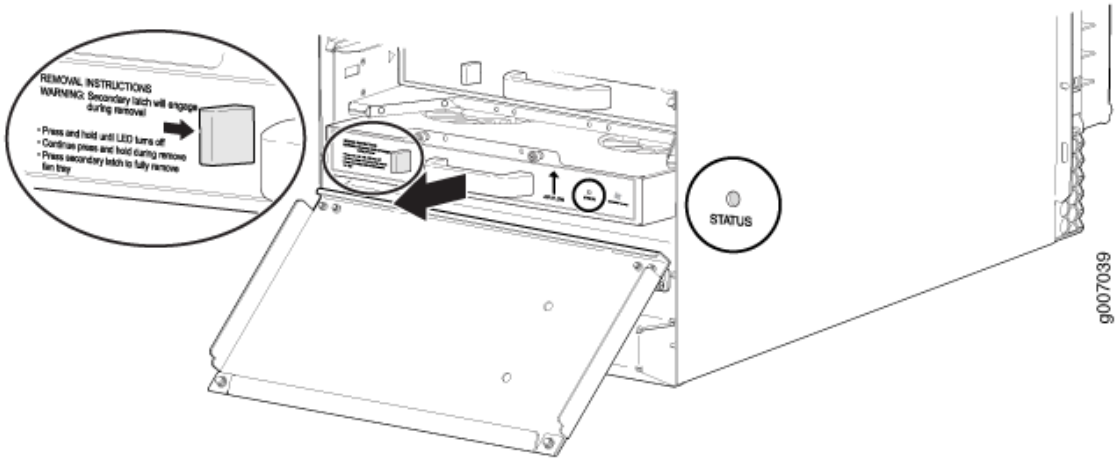


Figure 5: Removing Lower Fan Trays



NOTE: For complete instructions on removing router components, see "Removing Components from the MX2020 Router Chassis Before Installing it in a Rack" on page 349.

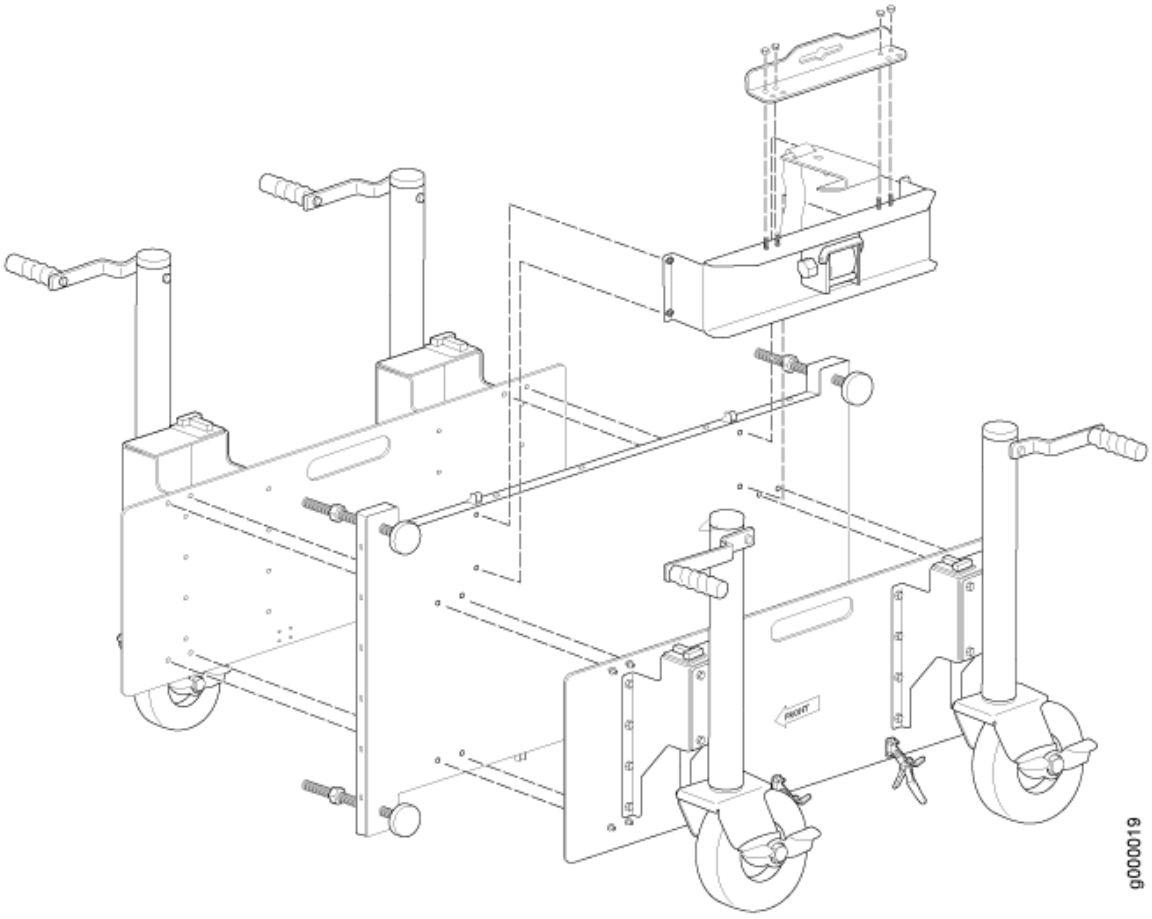
6. Remove the router transport kit from the shipping crate (see "Unpacking the Router Transport Kit" on page 341).

7. 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.

8. 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.

9. 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.

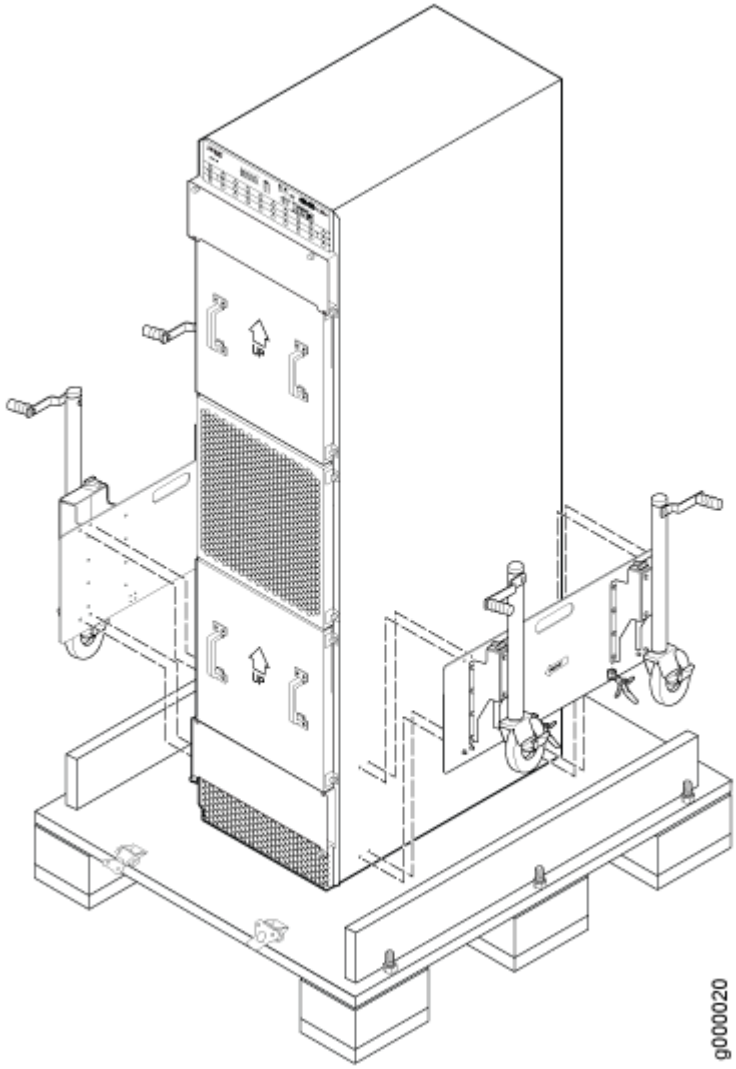
Figure 6: Preparing the Router Transport Kit for Installation



10. Remove the four shipping brackets that secure the router to the shipping crate platform by using a 9/16-in. (14 mm) socket wrench, and a number 2 Phillips screwdriver, and set the brackets aside.

11. Align the left router transport mounting plate and wheel assembly (indicated by left arrow) with the holes on the left side of the chassis.

Figure 7: Installing the Router Transport Kit onto the MX2020 Router



12. Using a number 3 Phillips screwdriver, tighten the captive screws to secure the router transport mounting plate and wheel assembly to the chassis.

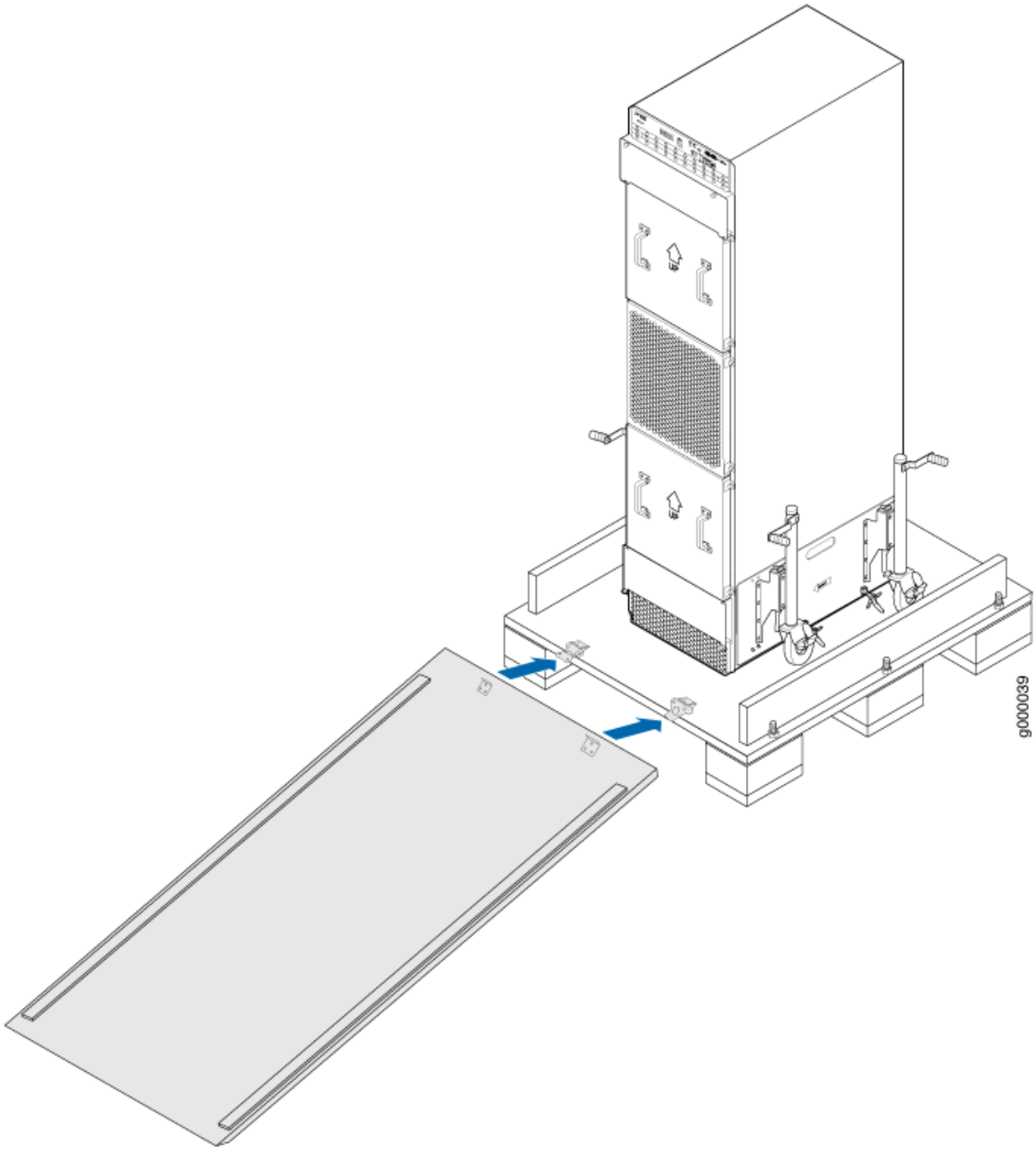
13. Align the right router transport mounting plate and wheel assembly (indicated by right arrow) with the holes on the right side of the chassis (see Figure 7 on page 11).

14. Using a number 3 Phillips screwdriver, tighten the captive screws to secure the router transport mounting plate and wheel assembly to the chassis.

15. Once you have installed the router transport kit onto the router, you can now secure the router to the transport platform. Reinstall the front and rear shipping covers to help guide the chassis during installation.

16. Using the shipping crate door as a ramp, secure the door to the crate platform by using the two metal latches.

Figure 8: Securing the Crate Door to the Shipping Crate Platform



17. Using a two-person team on either side of the chassis, turn the handles on the router transport 4–5 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 that the bubbles within the T-shaped levels are between the lines, indicating that the chassis is level.

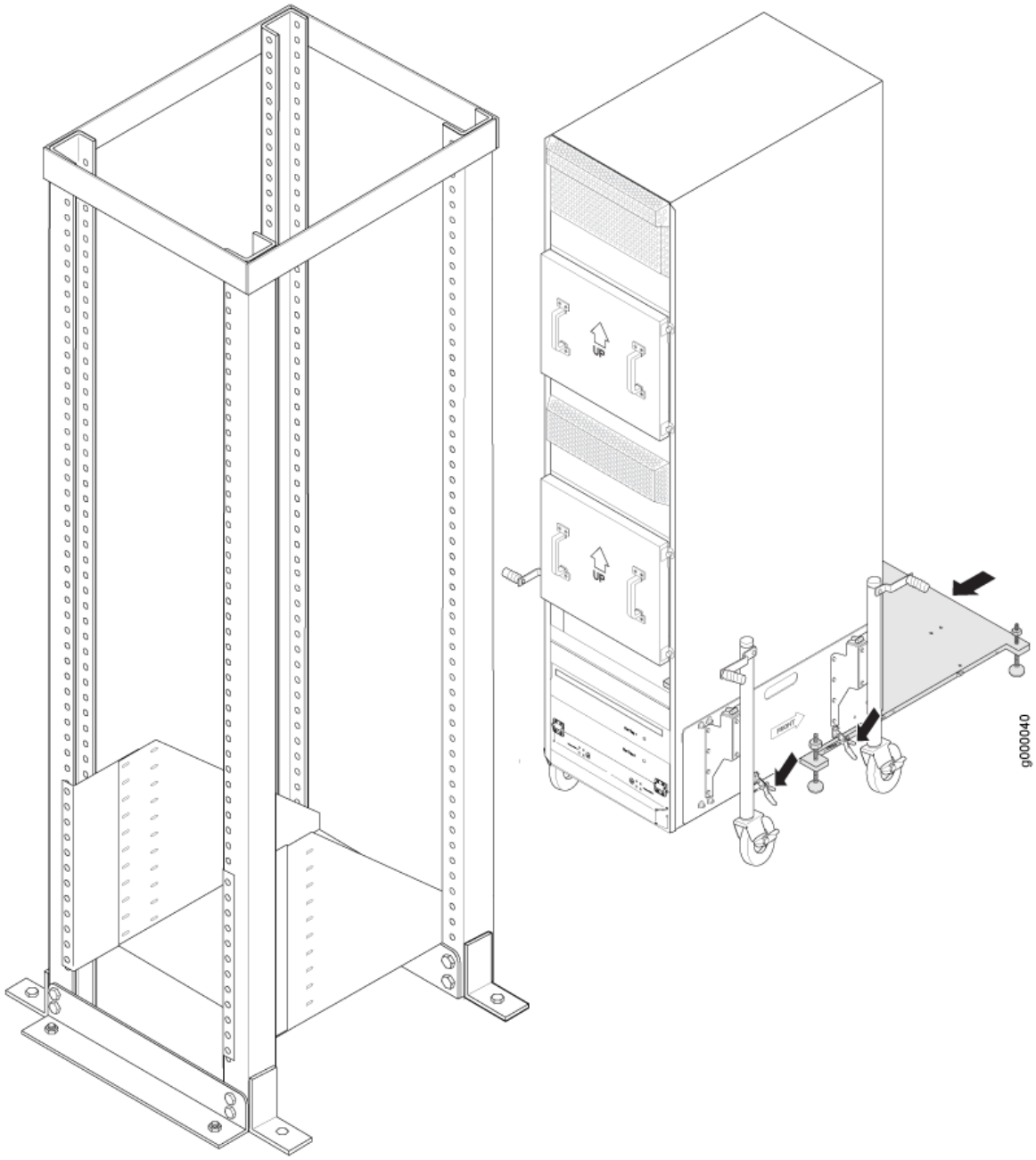
CAUTION: Do not raise the chassis above 1 in. (2.54 cm). This ensures the router will not tilt during transportation, which can result in injury or damage to the router.

18. Turn the four wheels on the router transport kit toward the rear of the chassis.
19. 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. Doing so can cause the wheels to turn abruptly and tilt the router over.

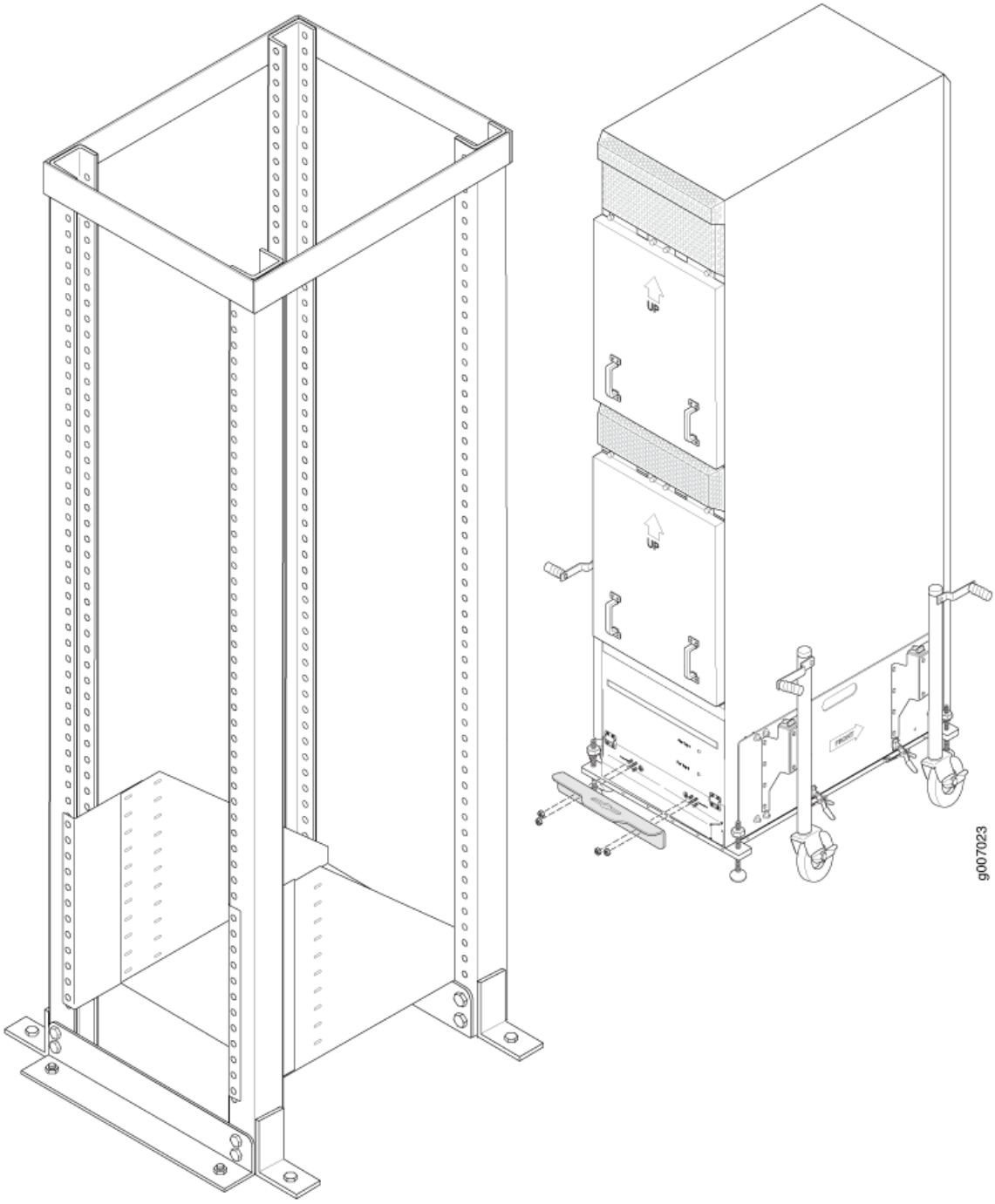
20. Position the router transport platform directly under the router, aligning the router transport platform with the bottom of the chassis by adjusting the four leveling mounts.
21. Secure the router transport platform to the router transport mounting plates by using the four latch locks.

Figure 9: Securing the Router Transport Platform



22. Install the winch strap plate to the rear of the router by using the four captive screws, and tighten the screws.

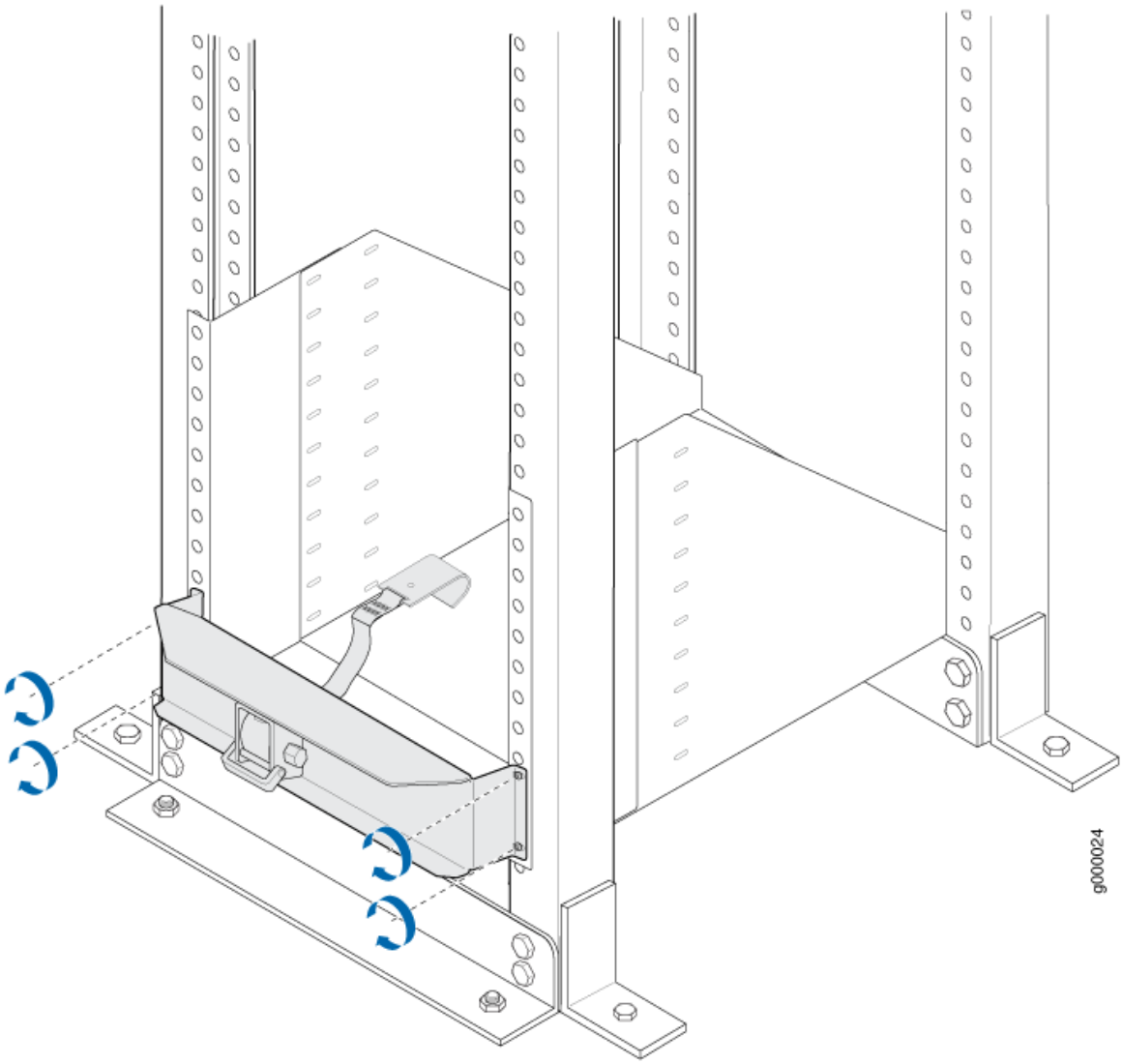
Figure 10: Installing Winch Strap Plate



23. Using a four-person team, transport the router to the rack installation location and center it in front of the mounting shelf.

24. Install the winch mount bracket to the rear rack rails by using the six captive screws, and tighten the screws.

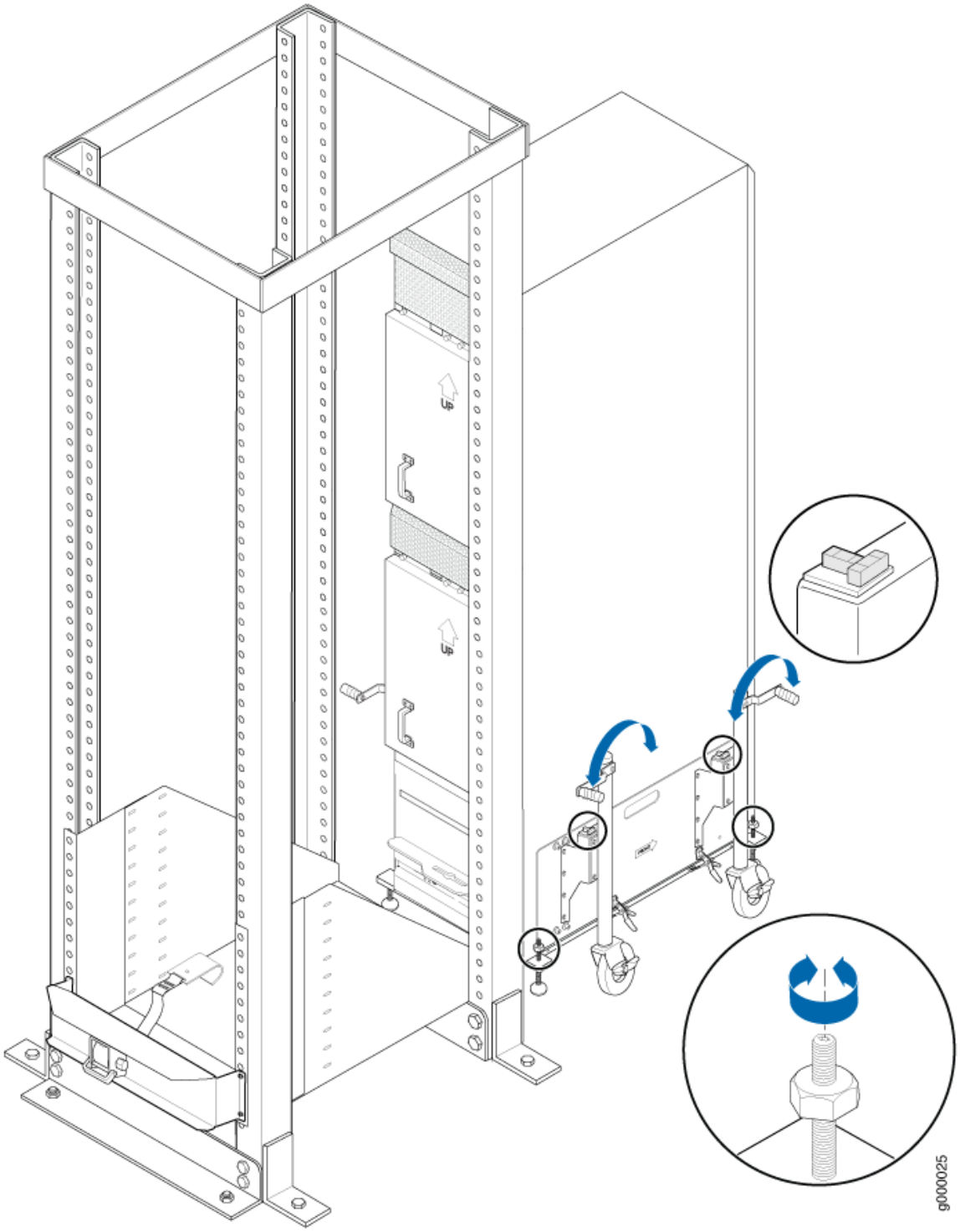
Figure 11: Installing Winch Mount Bracket to Rack Rails



25. 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.

NOTE: Make sure the bubbles within the T-shaped levels are between the lines, indicating the router is level.

Figure 12: Aligning the MX2020 Router with Rack Mounting Shelf



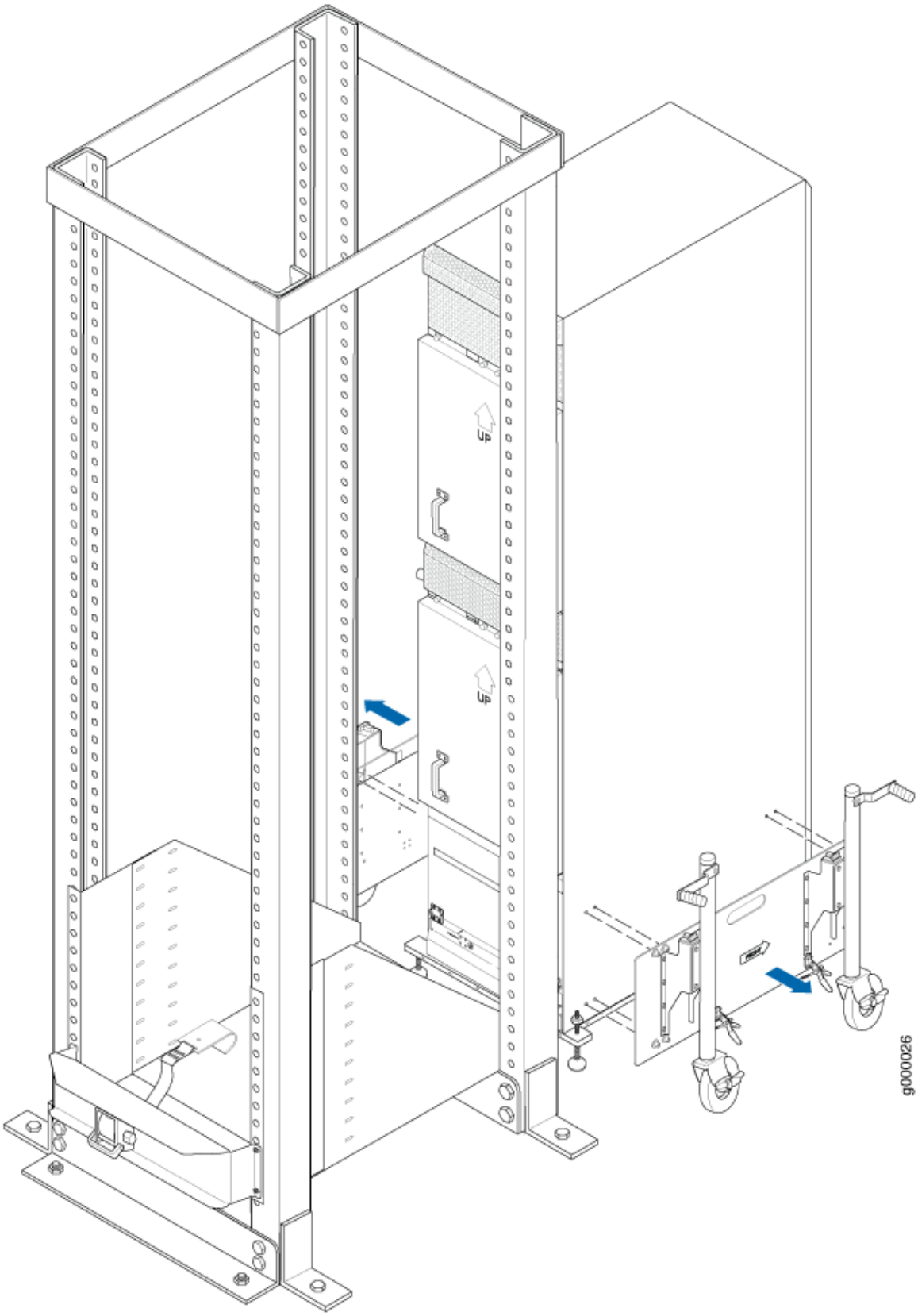
26. Adjust the four leveling mounts on the router transport platform until all four leveling mounts rest firmly on the ground (see Figure 12 on page 19).

27. Unlock the four toggle latches that secure the router transport platform to the router transport mounting plate and wheel assembly.

28. Lift the wheels up by turning the handles counterclockwise so that the weight of the router is on the router transport platform.

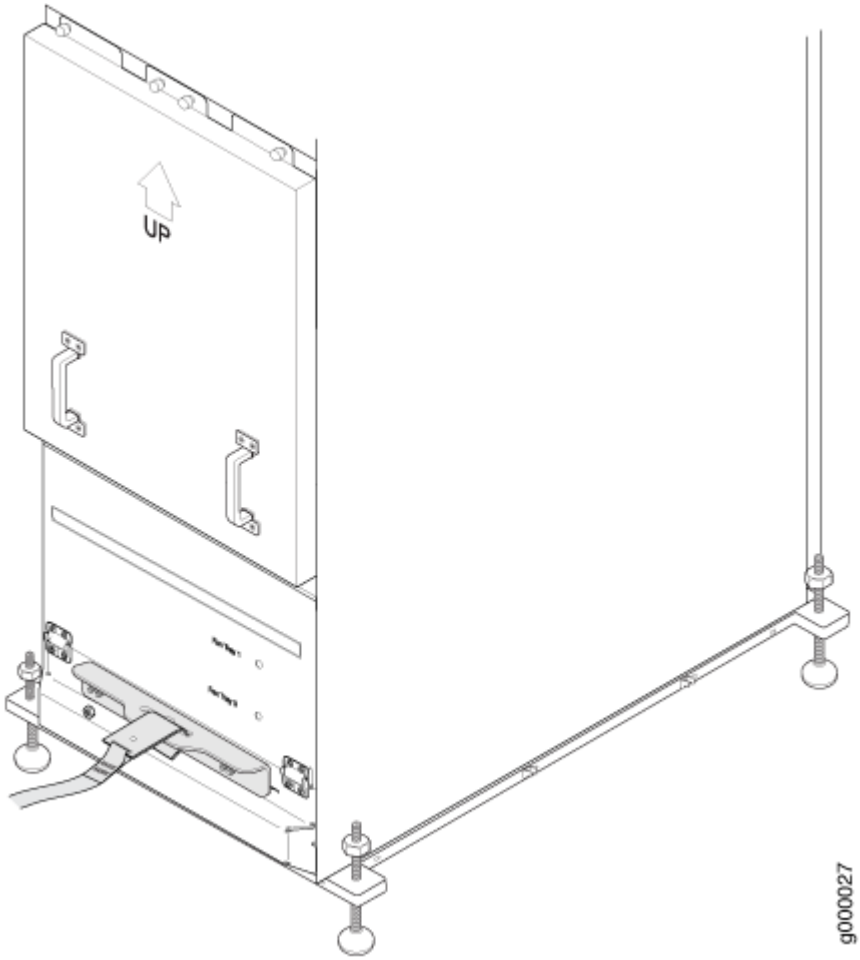
29. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plates and wheel assembly to the chassis, and set them aside.

Figure 13: Removing Router Transport Mounting Plate and Wheel Assembly



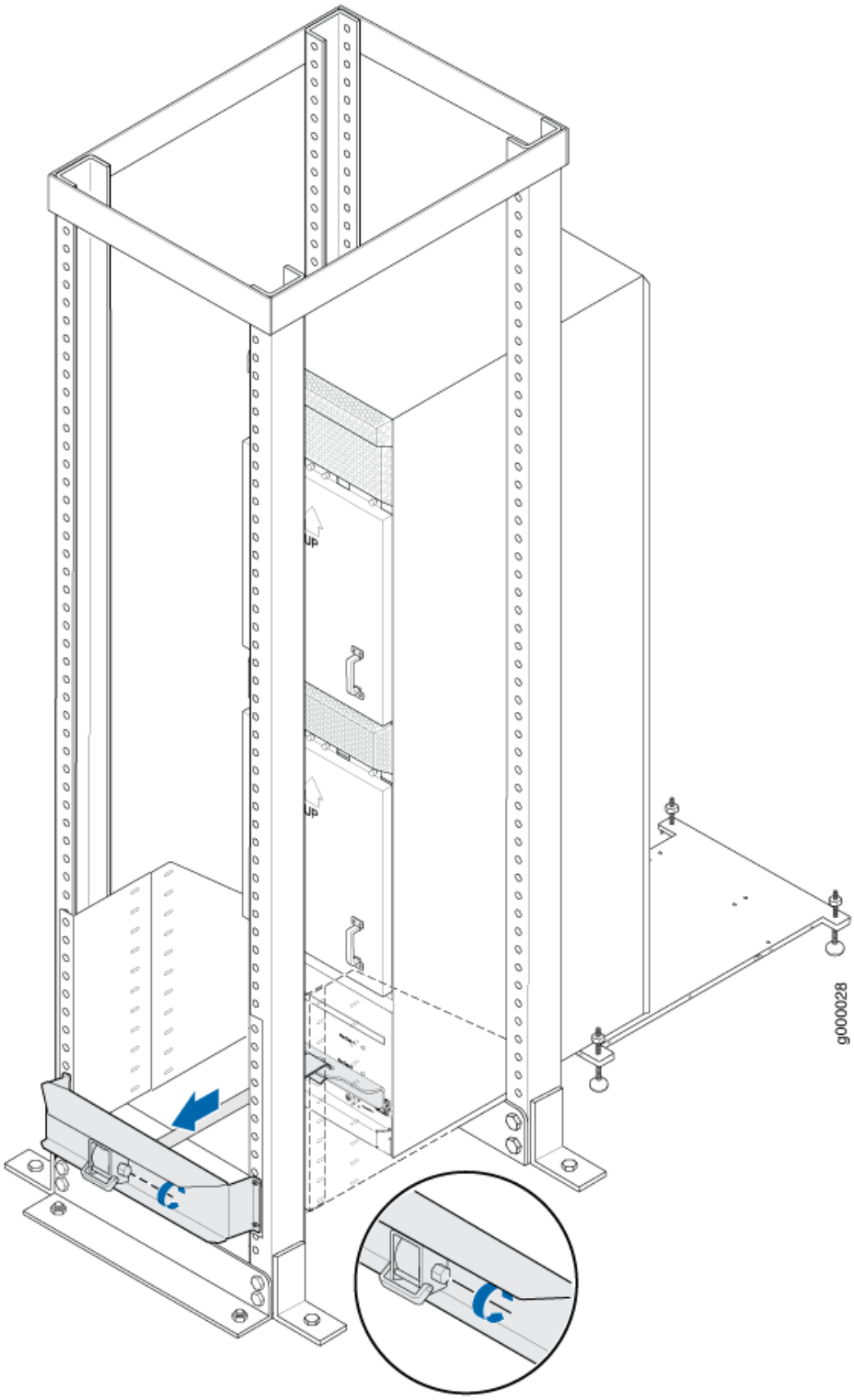
30. Attach the winch strap to the winch strap plate at the rear of the router.

Figure 14: Attaching Winch Strap to Winch Strap Plate



31. 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.

Figure 15: Pulling the MX2020 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 MX2020 into a 45-U rack.

32. Remove the router transport platform, and set the platform aside.
33. Remove the winch mount and winch strap plate, and set them aside.
34. Insert sixteen mounting screws (eight on each side) into the mounting holes to secure the router to the rack.
35. 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.
36. Reassemble the router transport kit, and set aside.
37. Reinstall the components in the router:
    a. Take each component out of its electrostatic bag, and identify the slot on the component where it will be connected.
    b. Slide each component into the chassis evenly so that it does not become stuck or damaged.

NOTE: We recommend that you reinstall the rear components first.

    c. Tighten the captive screws, and secure all levers for each component.

NOTE: Make sure that all empty slots are covered with a blank panel before operating the router.

Connect to Power

IN THIS SECTION

The MX2020 router supports -48 V and 240 V China DC power configurations, three-phase (delta and wye) AC power configurations, single-phase power configuration, and high-voltage AC (HVAC) or high-voltage DC (HVDC) configurations. In this section, we show you how to connect to power using a three-phase delta AC power distribution module.

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.

To connect the MX2020 router to AC power:

Ground the Router

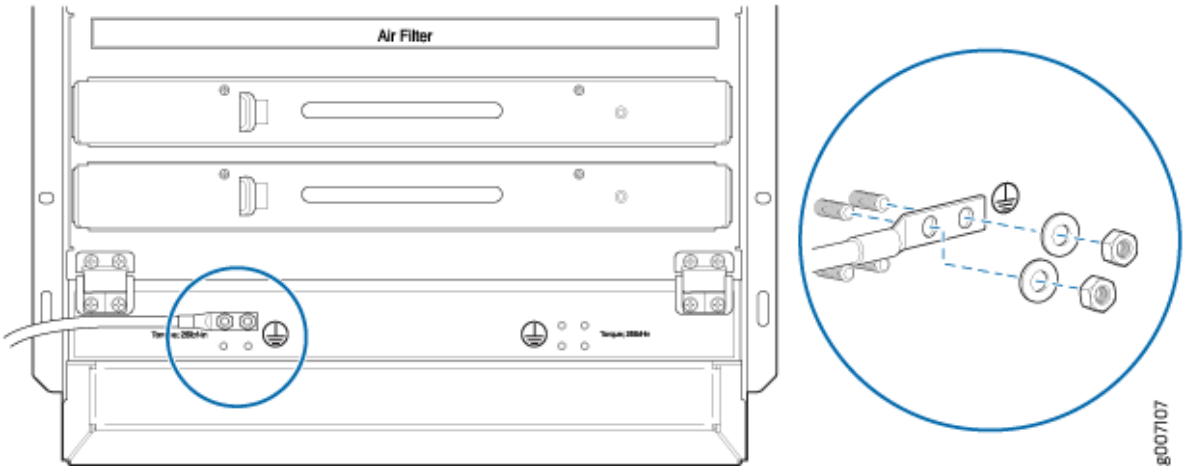
To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, you must connect the chassis to earth ground. Make this connection before you connect the router to power.

To connect the MX2020 router to earth ground:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. Refer the instructions for your site.
2. Connect the grounding cable to a proper earth ground.

3. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
4. Make sure that grounding surfaces are clean and brought to a bright finish before you make grounding connections.
5. Place the grounding cable lug over the grounding points. The upper pair is sized for UNC 1/4-20 bolts, and the lower pair is sized for M6 bolts.
6. Secure the grounding cable lug to the grounding points, first with the washers, and then with the nuts.

Figure 16: Grounding Points on the MX2020 Router



7. 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.

Connect the Power Cable and Power On the Router

To connect power to a three-phase delta AC power distribution module:

1. 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.
2. 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.
3. Switch off (**O**) the AC power supply modules (PSMs) and disengage all AC PSMs.

4. Verify that the correct three-phase delta AC PDMs are installed and secured in the chassis before connecting power cables.

   NOTE: The power cables must be uninstalled and removed from the PDM before the PDM is removed from the chassis.

5. 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 per PDM).
6. Remove the cover of the metal AC wiring compartment.
7. Unscrew the retaining nut from the AC power cord.
8. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
9. Put 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 17 on page 28). Figure 18 on page 28 shows the three-phase delta AC power cord and connector. Loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw (see Table 3 on page 29 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.

    NOTE: 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 MX2020 chassis is not sensitive to phase rotation sequence—either clockwise or counterclockwise will operate correctly.

    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 17: Connecting Power to a Three-Phase Delta AC Power Distribution Module

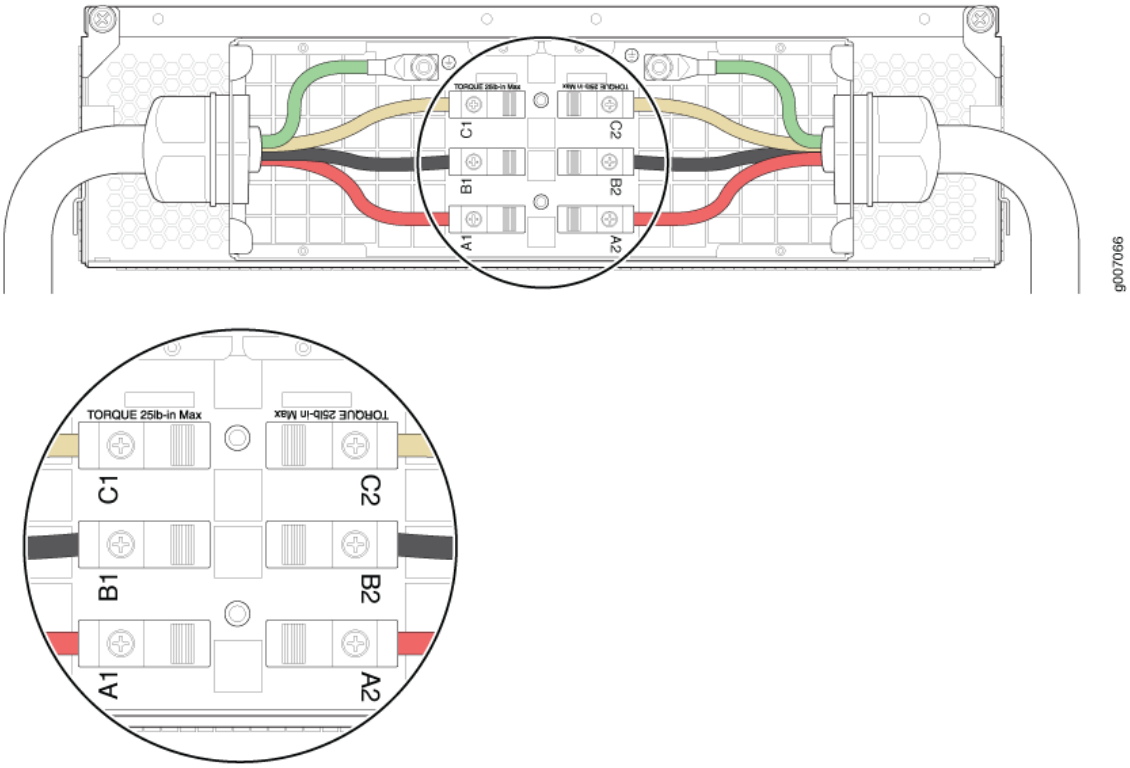
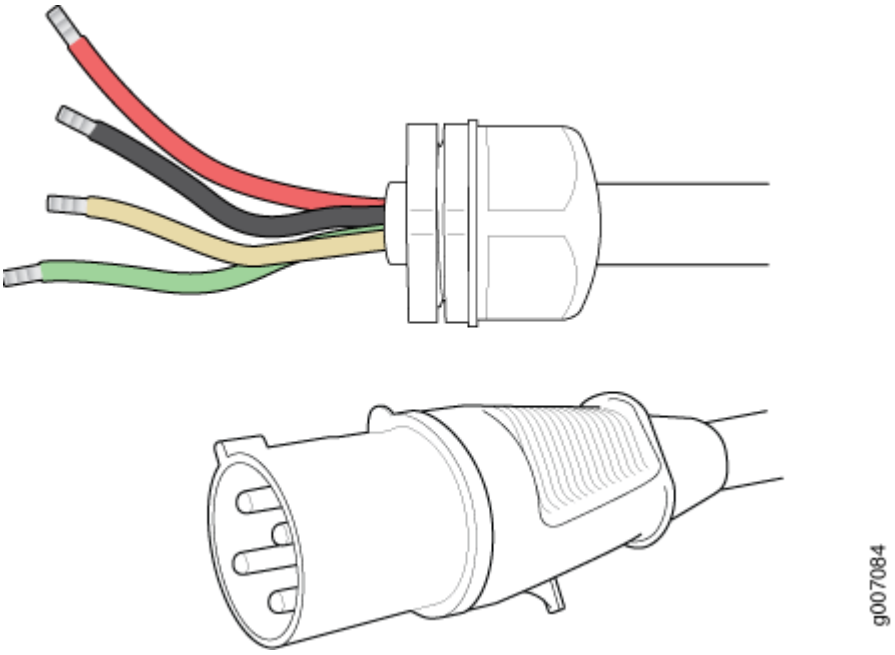


Figure 18: Three-Phase Delta AC Power Cord



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

CAUTION: Wire label configuration is for Juniper Networks supplied cable only. If you are using your own cable, make sure that 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 miswired 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 264VAC 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 color of each AC power wire might vary.

NOTE: Three-phase delta AC wire assembly kits can be purchased from Juniper Networks.

Table 3: 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 cable 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. Use the provided plastic cable tie to fasten the AC power cord to the PDM.
15. 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.
16. Repeat the procedure for the other three-phase delta AC PDMs.
17. Connect the three-phase delta AC power cord mating connector to the AC power cord connector.

Figure 19: Three-Phase Delta AC Power Cord Mating Connector

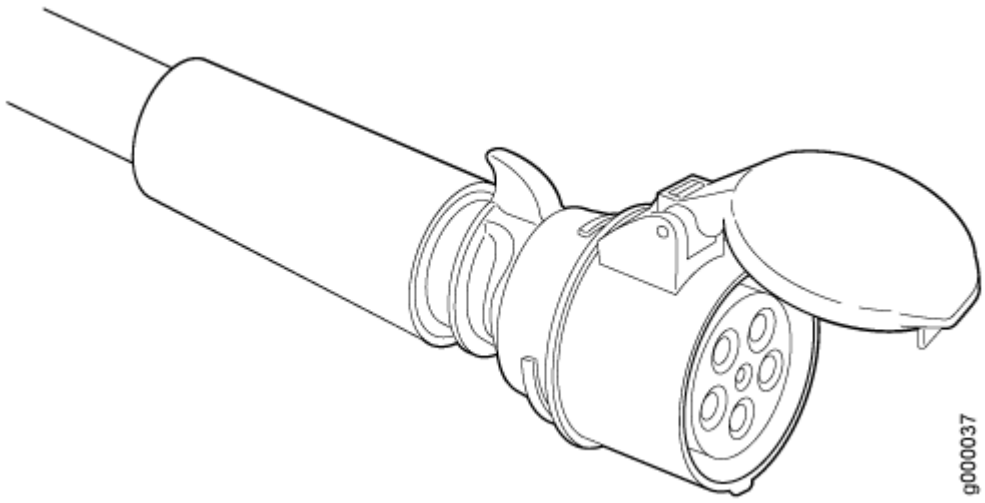


Table 4: Three-Phase Delta AC Power Cord Mating Cable Connector Specifications

Cable	Manufacturer Part Number	Description
Three-phase delta	460C9W	60-amp, 250 volt 3-phase, 3-pole, 4-wire, North American pin and sleeve connector, industrial grade, IP67, watertight (blue)

WARNING: Do not touch the power connectors on the PDM. They can contain dangerous voltages.

Configure and Monitor MX2020

SUMMARY

This topic provides you with pointers to configure, and monitor MX2020 routers using the Junos OS CLI.

IN THIS SECTION

Junos OS CLI

You can configure and monitor MX2020 routers using the Junos OS CLI. See Table 5 on page 31 for more information.

Table 5: Configure MX2020 Using Junos OS CLI

If you want to	Then
Customize basic configuration	See "Initially Configuring the MX2020 Router" on page 475.

Table 5: Configure MX2020 Using Junos OS CLI *(Continued)*

If you want to	Then
Explore the software features supported on the MX2020	See Feature Explorer.
Configure supported software features on the MX2020	See User Guides.

1

PART

Overview

CHAPTER 2

MX2020 System Overview and Architecture

IN THIS CHAPTER

MX2020 Universal Edge Router Overview

The MX2020 Universal Routing Platform is an Ethernet-optimized router that provides both switching and carrier-class Ethernet routing. The MX2020 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 MX2020 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 MX2020 router is 45 rack units (U) tall. One router can be installed in a four-post rack or cabinet. The MX2020 router has 20 dedicated line card slots for a maximum of 20 Modular Port Concentrators (MPCs). Up to two Modular Interface Cards (MICs) can be installed in each MPC for a total of 40 MICs when fully populated. The host subsystem consists of two Control Boards with Routing Engines (CB-REs) and eight Switch Fabric Boards (SFBs).

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

RELATED DOCUMENTATION

MX2020 Component Redundancy | 48

MX2020 Physical Specifications | 202

MX2020 Chassis Description | 36

MX2000 Host Subsystem CB-RE Description

MX2020 Craft Interface Description | 68

MX2020 Power Subsystem Description | 156

MX2020 Cooling System Description | 83

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

MX2020 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components, (see Figure 20 on page 38, Figure 21 on page 40, and Figure 22 on page 43). The chassis installs in a standard 19-in. four-post rack or enclosed cabinet.

NOTE: There must be a minimum of 45-U of usable rack space when installing the MX2020 router into a 45-U rack.

NOTE: If you are installing the MX2020 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 45-U rack space from access during installation.

There are two types of chassis configurations available for the MX2020:

- The chassis with standard cable managers and EMI covers measures 78.75 in. (200 cm) high, 19 in. (48.26 cm) wide, and 35.72 in. (90.7 cm) deep.
- The chassis with extended cable managers and extended EMI covers measures 78.75 in. (200 cm) high, 19 in. (48.26 cm) wide, and 37.46 in. (95.1 cm) deep.

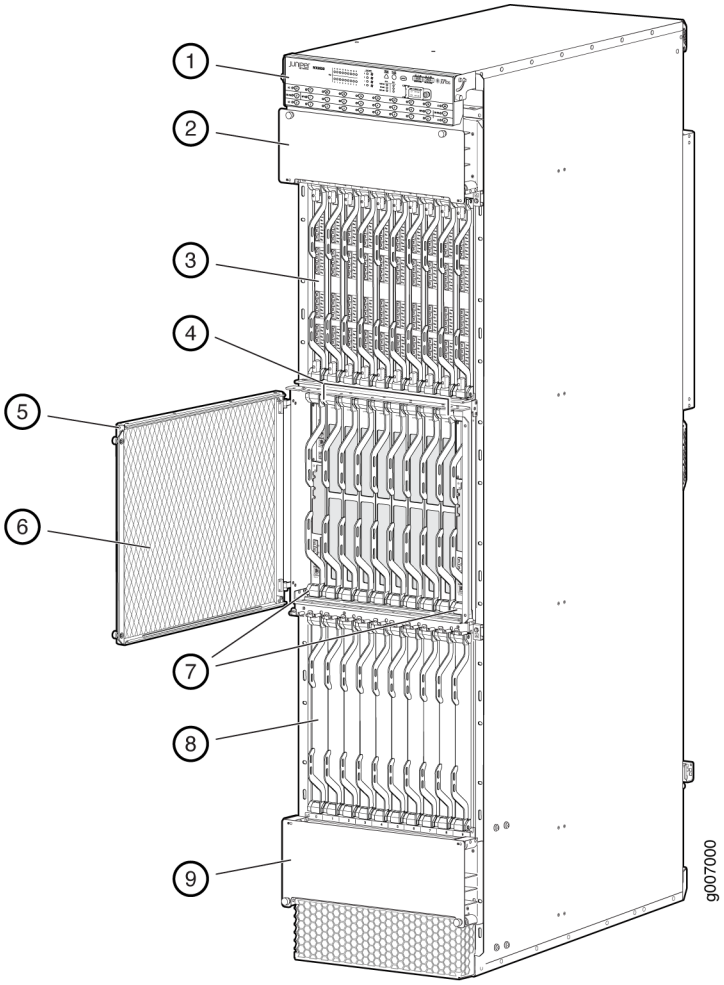
CAUTION: Before removing or installing components, attach an ESD strap to an ESD point, and place the other end of the strap around your bare wrist. Failure to use an ESD strap could result in damage to the hardware components.

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

NOTE: One router can be installed in a 45-U four-post rack if the rack can support the combined weight, which can be greater than 1,500 lb (680.39 kg).

Mounting hardware includes built-in front-mounting flanges on the front of the chassis, and one large shelf attached to a four-post rack or cabinet to support the chassis.

Figure 20: Front View of a Fully Configured MX2020 Router Chassis



Remove field replacement units (FRUs) from the front of the MX2020 router before you install the router. See Table 6 on page 38 for information on MX2020 router components.

Table 6: Front Components in a Fully Configured MX2020 Router

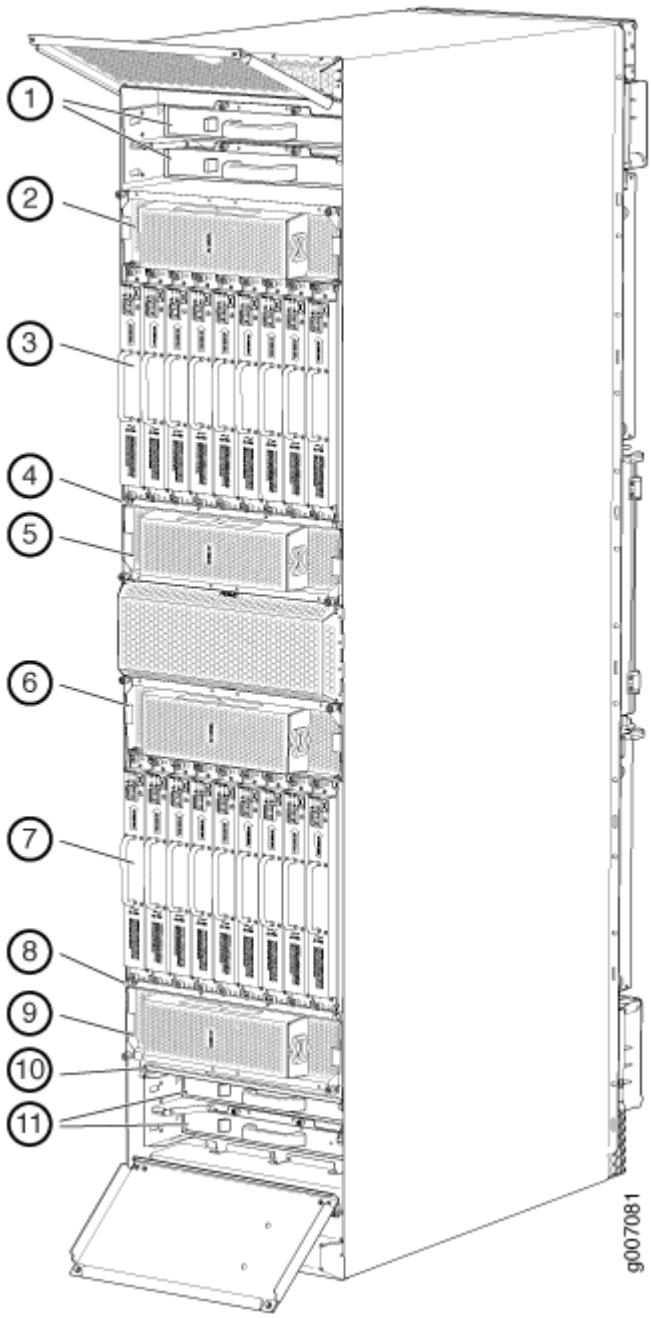
Component No.	Component Description	Slots	Number of FRUs
1	Craft interface	-	1
2	Upper cable manager–(standard or extended)	–	1

Table 6: Front Components in a Fully Configured MX2020 Router *(Continued)*

Component No.	Component Description	Slots	Number of FRUs
3	MPCs with ADCs and MICs (top)	10 through 19 (top)	10
4	Switch Fabric Boards (SFBs)	0 through 7	8
5	Air filter door	-	1
6	Middle card cage air filter	–	1
7	Control Board and Routing Engine (CB-RE)	0 and 1	2
8	MPCs with ADCs and MICs (bottom)	0 through 9	10
9	Lower cable manager–(standard or extended)	–	1

NOTE: A combination middle cable manager and air filter is installed over the middle card cage.

Figure 21: Rear View of a Fully Configured AC-Powered MX2020 Router Chassis



Remove field replacement units (FRUs) from the rear of the MX2020 router before you install the router. See Table 7 on page 41 for information on MX2020 router components.

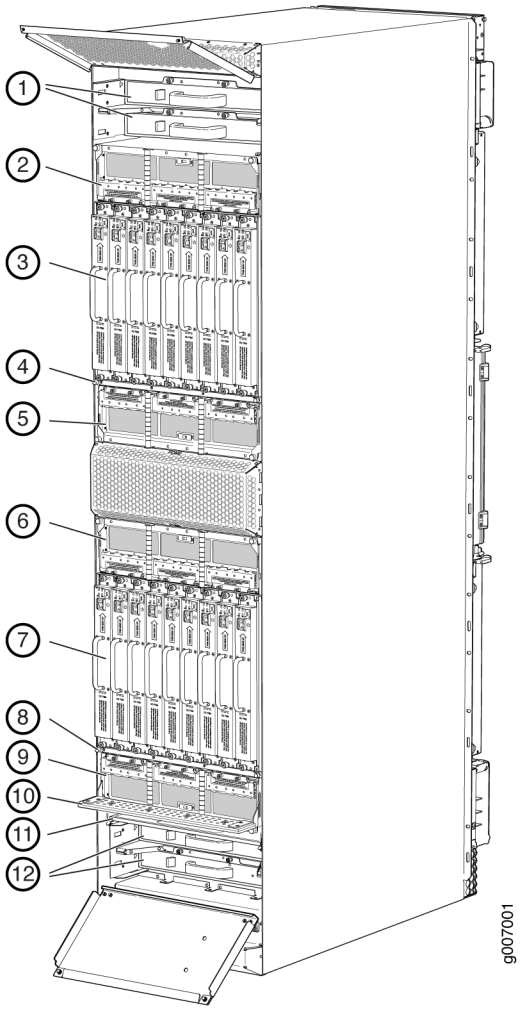
Table 7: Rear Components in a Fully Configured AC-Powered MX2020 Router

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	AC PDM—Three-phase delta or wye, single-phase AC, or high-voltage second-generation universal (HVAC/HVDC) PDM. **NOTE**: The universal PDM accepts either an HVAC/HVDC input.	PDM3/Input1	1
3	AC PSM or high-voltage second-generation universal (HVAC/HVDC) PSM.	9 through 17	9
4	PSM air filter	–	1
5	AC PDM—Three-phase delta or wye, single-phase AC, or universal (HVAC/HVDC) PDM.	PDM2/Input0	1
6	AC PDM—Three-phase delta or wye, single-phase AC, or universal (HVAC/HVDC) PDM	PDM1/Input1	1
7	AC PSM or universal (HVAC/HVDC) PSM	0 through 8	9
8	PSM air filter	–	1

Table 7: Rear Components in a Fully Configured AC-Powered MX2020 Router *(Continued)*

Component No.	Component Description	Slots	Number of FRUs
9	AC PDM)—Three-phase delta or wye, single-phase AC, or universal (HVAC/ HVDC) PDM.	PDM0/Input0	1
10	Fan tray air filter	–	1
11	Lower fan trays (two)	Fan tray 0 and fan tray 1 (behind access door)	2

Figure 22: Rear View of a Fully Configured DC-Powered MX2020 Router Chassis



Remove field replacement units (FRUs) from the rear of the MX2020 router before you install the router. See Table 8 on page 43 for information on MX2020 router components.

Table 8: Rear Components in a Fully Configured DC-Powered MX2020 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 8: Rear Components in a Fully Configured DC-Powered MX2020 Router *(Continued)*

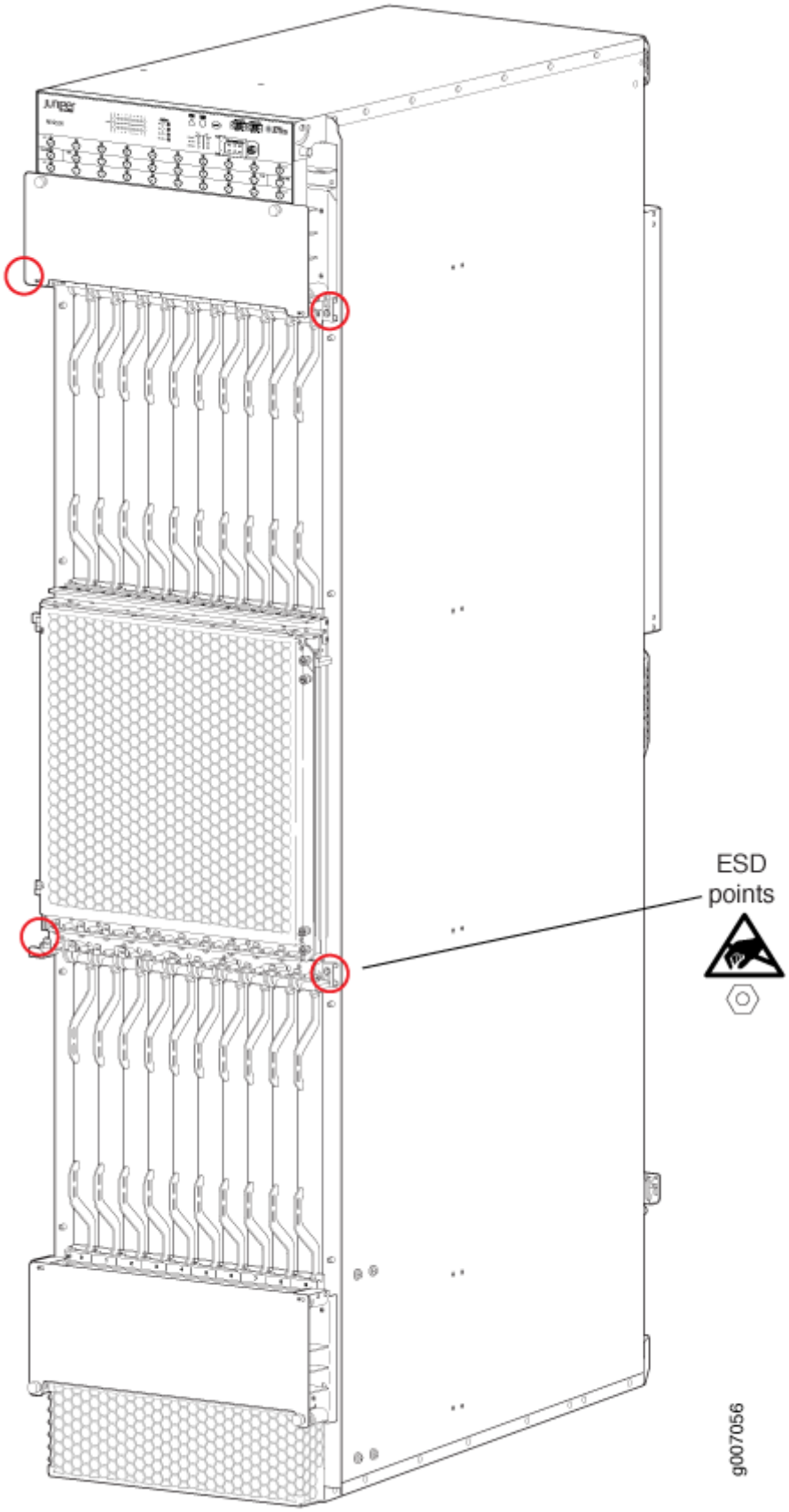
Component No.	Component Description	Slots	Number of FRUs
2	DC PDM, DC PDM (240 V China), or high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM3/Input1	1
3	DC PSMs, DC PSM (240 V Chinas), or high-voltage second-generation universal (HVAC/HVDC) PSMs.	9 through 17	9
4	PSM air filter	–	1
5	DC PDM, DC PDM (240 V China), or high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM2/Input0	1
6	DC PDM, DC PDM (240 V China), or high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM1/Input1	1
7	DC PSM, DC PSM (240 V China), or high-voltage second-generation universal (HVAC/HVDC) PSM.	0 through 8	9
8	PSM air filter	–	1
9	DC PDM, DC PDM (240 V China), or high-voltage second-generation universal (HVAC/HVDC) PDM.	PDM0/Input0	1

Table 8: Rear Components in a Fully Configured DC-Powered MX2020 Router *(Continued)*

Component No.	Component Description	Slots	Number of FRUs
10	DC cable manager–(standard or extended)	–	4
11	Fan tray air filter	–	1
12	Lower fan tray (two)	Fan tray 0 and fan tray 1 (behind access door)	2

The MX2020 router has four electrostatic discharge (ESD) points. Two are located on either side of the upper MPCs on the front of the chassis. A second pair is located on either side of the lower MPCs on the front of the chassis (see Figure 23 on page 46).

Figure 23: MX2020 Router ESD Points



RELATED DOCUMENTATION

- MX2020 Physical Specifications | 202
- Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet | 344
- *MX2000 Router Grounding Specifications*
- MX2020 Chassis Moving Guidelines | 219

MX2020 Backplane Description

Backplanes are located toward the rear of the chassis and form the rear of the card cage. They consist of one upper signal and power backplane located at the top of the chassis, and one lower signal and power backplane located at the bottom of the chassis. The Switch Fabric Boards (SFBs) connect both upper and lower backplanes. The adapter cards (ADCs) are carrier cards used to house the MPCs. The MPCs install into the top and bottom card cage backplanes from the front of the chassis and mate to the signal backplanes. The SFBs and CB-REs install into the middle from the front of the chassis. The PSMs and PDMs install into the top and bottom power backplanes from the rear of the chassis. The cooling system components also connect to the top and bottom backplanes.

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.

RELATED DOCUMENTATION

- MX2020 Universal Edge Router Overview | 34
- MX2020 Modular Port Concentrator (MPC) Description | 138
- *MX2000 Switch Fabric Board (SFB) Overview*
- *MX2000 Host Subsystem CB-RE Description*
- MX2000 Modular Interface Card (MIC) Description | 123
- MX2020 Power Subsystem Description | 156
- MX2020 Power Midplane Description | 163

MX2020 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 Routing Engine functioning together with a Control Board. The MX router can have one or two host subsystems. Each host subsystem functions as a unit—the Control Board and Routing Engine (CB-RE). To operate, each host subsystem requires one or two Routing Engines installed into the front of the chassis in vertical slots labeled **0** and **1**. If two CB-REs are installed, one functions as the primary and the other functions as the backup. If the primary host subsystem (or either of its components) fails, the backup can take over as the primary. See *MX2000 Host Subsystem CB-RE Description*.

  If the Routing Engines are configured for *nonstop active routing*, the backup Routing Engine automatically synchronizes its configuration and state with the primary Routing Engine. Any update to the primary Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes primary role, packet forwarding continues through the packet transport router without interruption.

- Power system—The MX2020 router has up to four power distribution modules (PDMs) that share the load evenly. If one PDM fails in a fully redundant power system that includes two PDMs and nine power supply modules (PSMs), the other PDM can provide full power to the MX router indefinitely. PSM redundancy varies depending on the number of PSMs and number of Field Replaceable Units (FRUs). See the "MX2020 Power Subsystem Description" on page 156 for more information about power system redundancy.

- PSMs—All PSMs in the power subsystem share the load (the nine PSMs in the upper card cage share the load, and the nine PSMs in the lower card cage share the load). If one PSM fails in a redundant configuration, the remaining PSMs provide power to FRUs. In the AC, DC, 240 V China, or universal high voltage AC (HVAC), or high voltage DC (HVDC) configuration, up to eighteen PSMs may be required to supply power to a fully configured router.

  In a fully configured MX2020 router with 18 PSMs, the nine PSMs in the upper card cage and the nine PSMs in the lower card cage supply power to:

  - 10 line-card slots
  - Four Power Distribution Modules (PDMs)
  - 20 Modular Port Concentrators (MPCs) (10 MPCs per zone)
  - Two fan trays
  - Eight Switch Fabric Boards (SFBs)

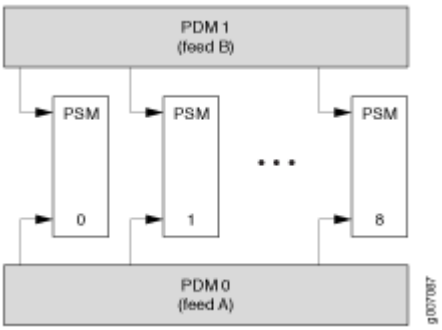
- Two Control Board and Routing Engines (CB-REs)

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.

- DC power subsystem—The MX2020 DC power system (-48 V and 240 V China) is comprised of two subsystems. Each DC power subsystem provides power to 10 line-card slots, three fan trays, two CB-REs, and eight SFBs. There are nine DC PSMs and two DC PDMs in each power subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning; the router will continue to function.

  Figure 24 on page 49 illustrates feed redundancy for the MX2020 DC power subsystem.

Figure 24: MX2020 Router DC Power Subsystem Feed Redundancy



Each DC power subsystem has two power zones: zone 0 and zone 1. 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. Some FRUs draw power only from zone 0, some FRUs draw power only from zone 1, and some FRUs draw power from both zone 0 and zone 1.

There are two types of DC power subsystems available for the MX2020: a “base” DC power subsystem (MX2020-BASE-DC) and an “optimized” or premium DC power subsystem (MX2020-PREMIUM2-DC). The fan trays in an optimized DC power subsystem draw power from the power zones differently than the fan trays in a base DC power subsystem. In a base DC power subsystem, two of the four fan trays draw power from both zones. In the optimized DC power subsystem, two of the fan trays draw power from only one zone. Because of this, the optimized power subsystem requires less power. See "Determining DC Power Requirements for Your MX2020 Router" on page 297 for more information about MX 2020 power distribution.

Figure 25 on page 50 illustrates how the power zones in the MX2020 base DC power subsystem distribute power to FRUs

Figure 25: Power Distribution in a DC Base Power Subsystem

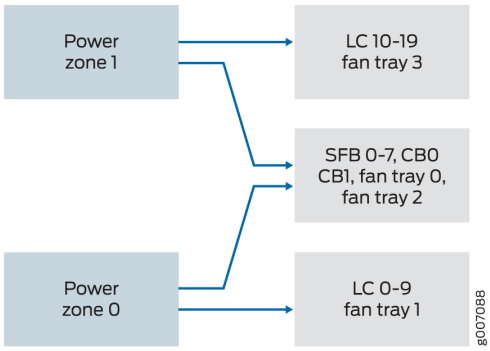
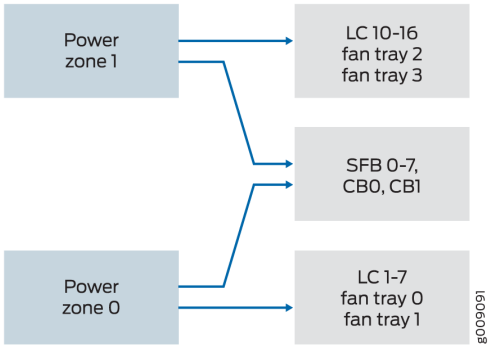


Figure 26 on page 50 illustrates how the power zones in the MX2020 optimized DC power subsystem distribute power to FRUs

Figure 26: Power Distribution in an Optimized DC Power Subsystem



- DC PSMs—The MX2020 DC PSMs (-48 V) and DC PSMs (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 "MX2020 DC Power Supply Module (-48 V) Description" on page 181).

- DC PDMs (-48 VDC or 240 V China) There are two PDMs per power subsystem capable of carrying seven feeds or nine feeds each. You can install a total of four PDMs into a router. Each DC PDM 240 V China) or DC PDM (-48 V) operates with seven feeds or nine feeds of either a 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. In a redundant configuration, the seven-feed DC PDMs support a total of fourteen 60-A or 80-A feeds, and the nine-feed DC PDMs support a total of eighteen 60-A or 80-A feeds. Each DC PSM is capable of delivering 2500 W of power if 80-A feeds are connected. In the DC

configuration, each subsystem 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 will provide full power.

> **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.

> **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.

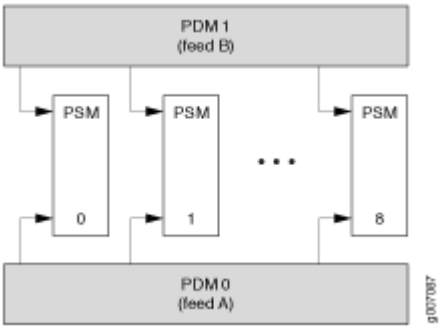
- DC PDMs (240 V China)—There are two PDMs per power subsystem capable of carrying nine feeds each. You can install a total of four PDMs (240 V China) into a router. Each DC PSM is capable of delivering 2500 W of power. In the DC configuration, each subsystem provides *N+1* PSM redundancy along with *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 will provide full power.

  > **NOTE**: Depending on the voltage of the DC feeds, 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.

- High-Voltage Second-Generation Universal (HVAC/HVDC) PDMs—There are two PDMs per power subsystem capable of carrying nine feeds each. The universal PDM accepts either an HVAC or HVDC input. You can install a total of four 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 will provide full power. Both input power feeds are active, and share the load when they are present.

  Figure 27 on page 52 and illustrate the power distribution from the universal (HVAC/HVDC) PDMs to the universal (HVAC/HVDC) PSMs.

Figure 27: MX2020 Router Universal (HVAC/HVDC) Power Subsystem Feed Redundancy



- AC power subsystem—The AC power subsystem 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. 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.

- AC PSM—The MX2020 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 MX2020 AC Power Supply Module Description). 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.

- AC PDM—Up to nine PSMs can be connected through the AC PDM. The MX2020 supports connection of a single-phase or three-phase (delta or wye) AC PDM. The three-phase AC PDMs require 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. Each AC input is independent and feeds one PSM.

  Figure 28 on page 53 and Figure 29 on page 53 illustrate the power distribution from the three-phase delta and wye PDMs to the AC PSMs.

Figure 28: Power Distribution from Three-Phase Feed Delta PDM to the AC PSMs

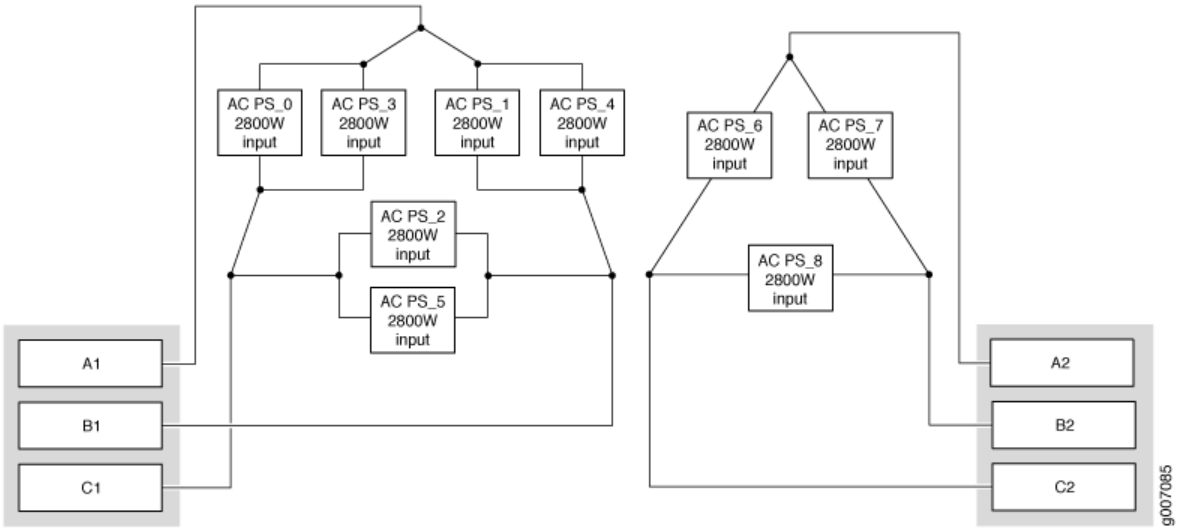
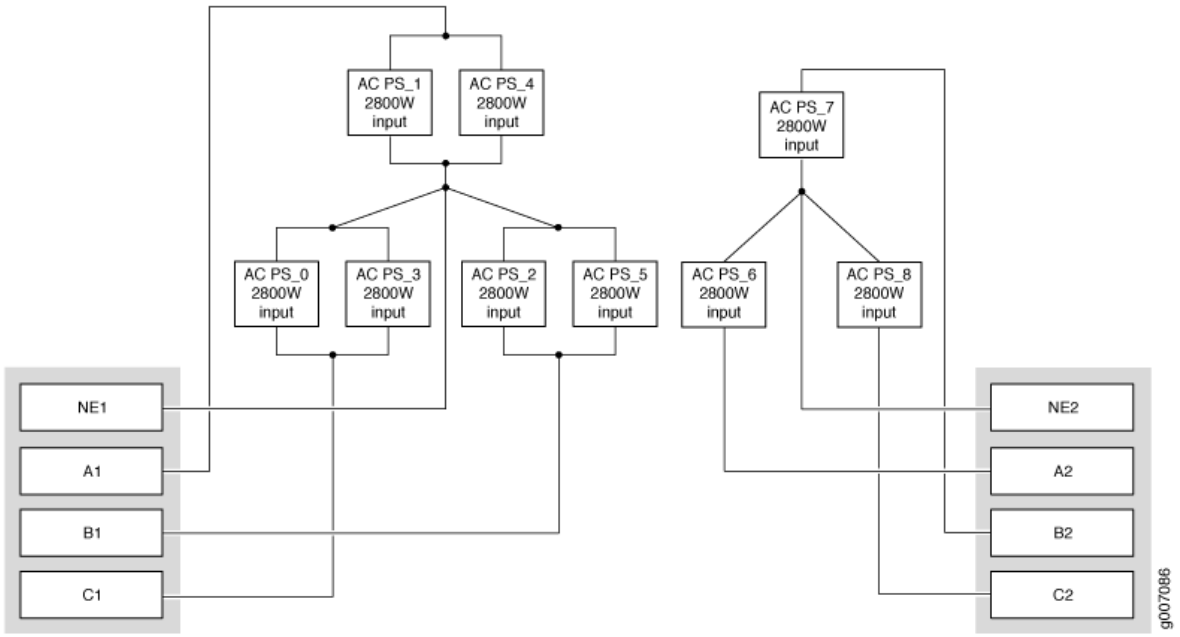


Figure 29: Power Distribution from Three-Phase Feed Wye PDM to the AC PSMs



- AC power requirements—Table 9 on page 54 shows the MX2020 current requirements for the three-phase delta, three-phase wye, and single-phase power feeds.

Table 9: AC PDM Current Requirements

Three–Phase Voltage	Input Feed	Current Delta per Three-Phase PDM	Current Wye per Three-Phase PDM	Current per Single 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	
200 V (minimum–nominal)	1	–	–	14 A

NOTE: This is the minimum required to provide 2.5KW per PSM. Based on facilities guidelines, you should over-provision the MX2020 router. The two numbers listed in the three-phase delta and three-phase wye current columns reflect the distribution of phases from the feed to the PSM. For example, from one feed, each phase goes to two PSMs, and from the other feed, each phase goes to only one PSM.

- Cooling system—The cooling system in a fully-configured MX2020 router has a total of four fan trays, which are controlled by the host subsystem. If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient cooling for the router. See "MX2020 Cooling System Description" on page 83).The fan trays are powered by two power subsystems that are divided into zones. The fan trays draw power from each zone depending upon whether you have a base DC power subsystem (MX2020-BASE-DC) or an optimized DC power subsystem (MX2020-PREMIUM2-DC). In the base DC power subsystem, two of the four fan trays draw power from both zones. In the optimized DC power subsystem, two of the fan trays draw power from only one zone. See "Determining DC Power Requirements for Your MX2020 Router" on page 297 for more information about MX 2020 power distribution.

RELATED DOCUMENTATION

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

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

MX2000 Three-Phase Wye AC Power Distribution Module Description

MX2000 Three-Phase Delta AC Power Distribution Module Description

MX2020 DC Power Distribution Module (-48 V) Description | **176**

MX2000 DC Power Distribution Module (240 V China) Description | **178**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | **188**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description | **190**

MX2000 AC Power Supply Module Description

MX2020 DC Power Supply Module (-48 V) Description | **181**

MX2000 DC Power Supply Module (240 V China) Description | **185**

Displaying MX2020 Router Components and Serial Numbers | **872**

MX2020 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site (see Table 10 on page 56). 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 10 on page 56 lists the FRUs for the MX2020 router.

Table 10: Field-Replaceable Units

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• PSM air filters • Air filter (lower) • Standard upper cable manager • Standard lower cable manager • Standard DC cable manager • Extended upper cable manager (optional) • Extended lower cable manager (optional) • Extended DC cable manager (optional) • 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 (ADCs) • Modular Interface Cards (MICs) • AC power supply modules (if redundant) • DC (-48 V) power supply modules (if redundant) • DC (240 VDC China) power supply modules (if redundant) • Universal (HVAC/HVDC) power supply modules (if redundant) • Fan trays • AC power distribution modules (if redundant)	• Control Board and Routing Engine (CB-RE) (nonredundant) • Switch Fabric Board (SFB) (nonredundant)

Table 10: Field-Replaceable Units *(Continued)*

Hot-Removable and Hot-Insertable FRUs	Hot-Pluggable FRUs
• Universal (HVAC/HVDC) power distribution modules (if redundant) • DC (-48 V) power distribution modules (if redundant) DC (240 VDC China) 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.	

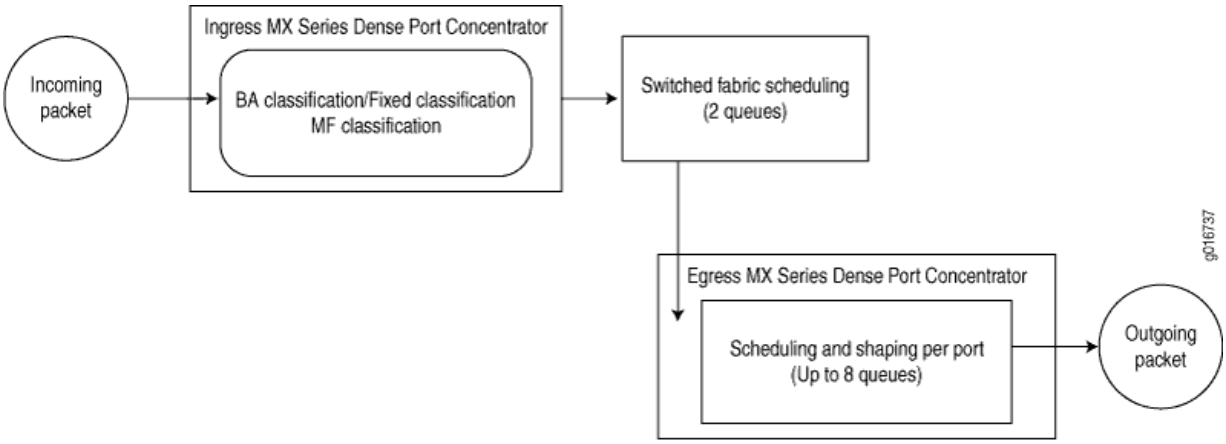
RELATED DOCUMENTATION

- *Replacing an MX2000 DC Power Distribution Module (-48 V)*
- *Replacing an MX2000 DC Power Distribution Module (240 V China)*
- *Replacing an MX2020 Three-Phase Wye AC Power Distribution Module*
- *Replacing an MX2000 Three-Phase Delta AC Power Distribution Module*
- *Taking an MX2000 Host Subsystem Offline*
- Replacing the MX2020 Cable Managers | **787**
- Tools and Parts Required for Replacing MX2020 Hardware Components | **483**
- Replacing the MX2020 Craft Interface
- Replacing an MX2020 Fan Tray | **588**
- Replacing the MX2020 Air Filters

MX Series Router Packet Forwarding Engine (PFE) Architecture

The general architecture for the MX Series router is shown in Figure 30 on page 58.

Figure 30: MX Series Router Packet Forwarding and Data Flow



Line Cards Supported on MX Series Routers

IN THIS SECTION

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

MX2020 Router Hardware Components and CLI Terminology

The MX2020 router supports the components in Table 11 on page 64.

Table 11: MX2020 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	CHAS-BP-MX2020	**MX2020**	"MX2020 Physical Specifications" on page 202 "MX2020 Chassis Description" on page 36
AC Optimized Power Chassis	MX2020-PREMIUM2-AC		
DC Optimized Power Chassis	MX2020-PREMIUM2-DC		
Craft interface panel	MX2020-CRAFT	**Front Panel Display**	"MX2020 Craft Interface Description" on page 68
Extended craft interface panel	MX2K-FPD-KIT-S		"MX2020 Craft Interface Description" on page 68
Cooling system, including air baffle, fan trays, and air filters			"MX2020 Cooling System Description" on page 83
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	MX2020-FLTR-KIT-S	N/A	
Power System Components			"MX2020 Power Subsystem Description" on page 156

Table 11: MX2020 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
PDM blank cover	MX2000-PDM-BLANK	N/A	"MX2020 DC Power Distribution Module (-48 V) Description" on page 176
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" on page 178
	MX2K-PDM-HV	**MX2K UNIVERSAL HV PDM**	"MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description" on page 188
	MX2000-PDM-AC-DELTA	**AC Delta Power Dist Module**	MX2020 Three-Phase Delta AC Power Distribution Module Description
	MX2000-PDM-AC-WYE	**AC Y Power Dist Module**	MX2020 Three-Phase Wye AC Power Distribution Module Description
	MX-PDM-AC-1PH-BB	**AC 9-feed Power Distribution Module**	*MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description*
PSM blank cover	MX2000-PSM-BLANK	N/A	
Power supply module (PSM)	MX2000-PSM-AC	**AC 52V Power Supply Module**	*MX2000 AC Power Supply Module Description*
	MX2000-PSM-DC	**DC 52V Power Supply Module**	"MX2020 DC Power Supply Module (-48 V) Description" on page 181

Table 11: MX2020 Router Hardware Components and CLI Terminology *(Continued)*

Component	Hardware Model Number	CLI Name	Description
	MX2K-PSM-DC240V	**MX2K 240V HVDC PSM**	"MX2000 DC Power Supply Module (240 V China) Description" on page 185
	MX2K-PSM-HV	**MX2K UNIVERSAL HV PSM**	"MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description" on page 190
MIC	See *MX Series Interface Module Reference*		"MX2000 Modular Interface Card (MIC) Description" on page 123
MPC blank cover	MX2000-LC-BLANK	N/A	"MX2020 Modular Port Concentrator (MPC) Description" on page 138
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*
SFB	MX2000-SFB	**Switch Fabric Board**	
CB-RE blank cover	MX2000-RE-SFB-BLANK	N/A	*RE-MX2000-1800x4 CB-RE Description*
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**Control Board** **RE-S-1800x4**	
Transceiver	See *MX Series Interface Module Reference*	**Xcvr**	"Installing an SFP or XFP Transceiver into an MX2020 MPC or MIC" on page 736

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 12 on page 67.

Table 12: 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

CHAPTER 3

Alarm and Display Components

IN THIS CHAPTER

MX2020 Craft Interface Description

The craft interface allows 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.

An extended craft interface is also available for use with the extended cable manager. The extended craft interface functions the same as the standard craft interface but provides additional clearance for maintenance on the extended cable manager.

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.

Refer to Figure 31 on page 69, Figure 32 on page 69 and Table 13 on page 69 for a description of the LEDs, buttons, and connectors for the craft interface.

Figure 31: Craft Interface Components

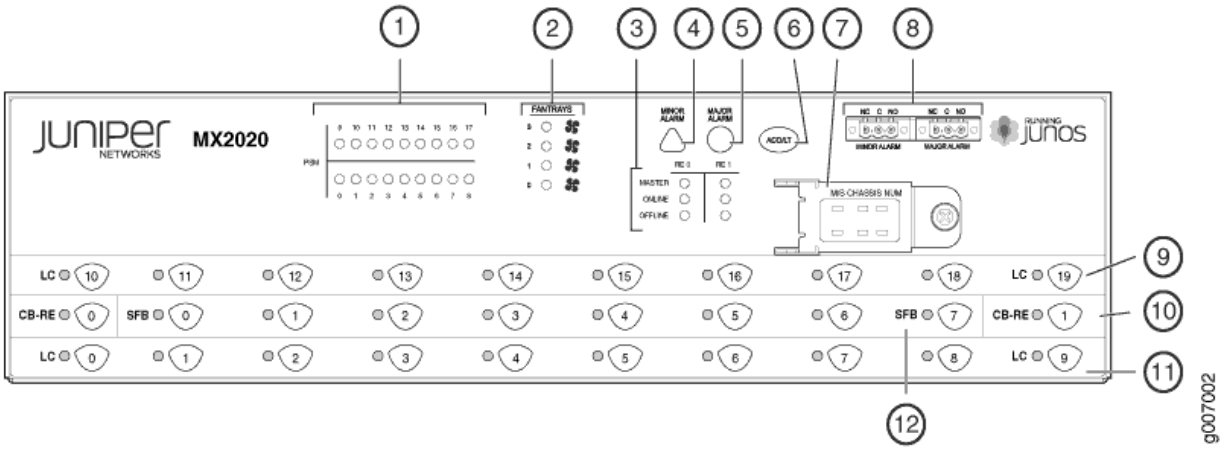


Figure 32: Extended Craft Interface

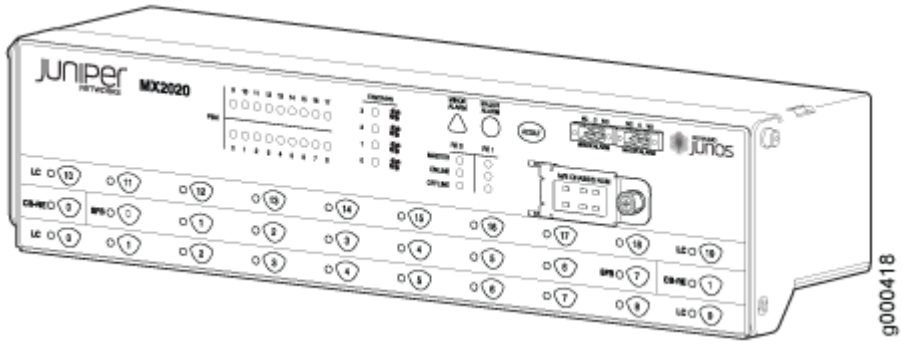


Table 13: Craft Interface LEDs, Buttons, and Connectors

Function No.	Label	Description
1	**PSM**	Status LEDs for PSMs **0** through **8** and **9** through **17**
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.

Table 13: Craft Interface LEDs, Buttons, and Connectors *(Continued)*

Function No.	Label	Description
4	**MINOR ALARM**	Minor Alarm LED for monitoring or maintaining the MX2020
5	**MAJOR ALARM**	Major Alarm LED for critical conditions, that 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 and Standalone Dial. These two dials are used. 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 multi-chassis 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.
9	**LC 10** through **LC 19**	Online and Offline buttons located next to each line card allows you to take individual line cards offline or online. Status LEDs for the upper ten line cards.
10	**CB-RE 0** and **CB-RE 1**	Online and Offline buttons located next to each Control Board and Routing Engine (CB-RE) allows you to take individual CB-REs offline or online. Status LEDs for the two CB-REs cards.

Table 13: Craft Interface LEDs, Buttons, and Connectors *(Continued)*

Function No.	Label	Description
11	**LC 0** through **LC 9**	Online and Offline buttons located next to each line card allows you to take individual line cards offline or online. Status LEDs for the lower ten line cards.
12	**SFB 0** through **SFB 7**	Online and Offline buttons located next to each SFB allows you to take individual SFBs offline or online. Status LEDs for eight SFBs.

RELATED DOCUMENTATION

- Replacing the MX2020 Craft Interface
- MX2020 Craft Interface Serial Number Label | **879**

MX2020 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 33 on page 72) 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 72).

Figure 33: Alarm Relay Contacts

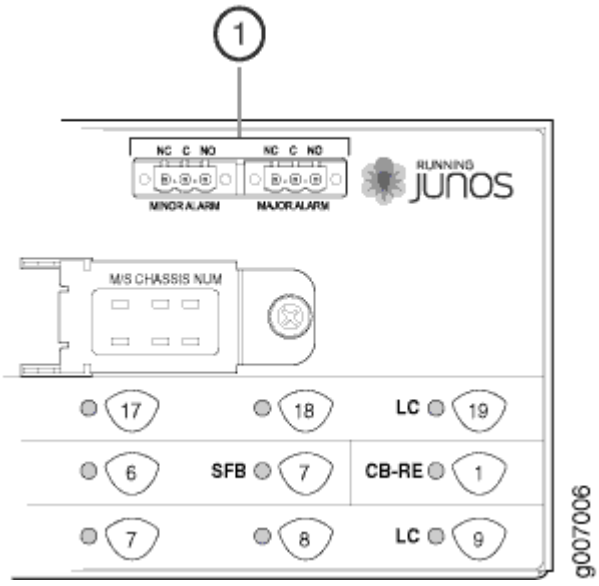


Table 14: Alarm Relay Contacts

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 MX2020 Craft Interface | **470**
- Connecting the Alarm Relay Wires to the MX2020 Craft Interface | **469**

MX2020 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 73 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

MX2020 Craft Interface Description | 68

MX2020 Alarm Relay Contacts on the Craft Interface | 71

MX2020 Universal Edge Router Overview | 34

CHAPTER 4

Cable and Rack Management

IN THIS CHAPTER

MX2020 Cable Management Description

IN THIS SECTION

The MX2020 consists of a standard or extended cable management system.

Standard Cable Management System

The standard cable management system consists of the following components:

- Upper cable manager—MX2000-CBL-TOP-S
- Middle cable manager and air filter—MX2000-CBL-MID-S
- Lower cable manager—MX2000-CBL-BTM-S
- DC cable manager—MX2020-DC-CBL-MGR-S
- Extended cable manager for the DC PDM (240 V China) and the Universal (HVAC/HVDC) PDM—MX2K-HV-CBL-MGR

The upper cable manager, (see Figure 34 on page 76) is located just below the craft interface, 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). The lower cable manager (see Figure 34 on page 76) 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 MPCs, and MICs, (see Figure 35 on page 77).

You can use cable strips or other ties to gently secure the cables in the upper and 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 34 on page 76).

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 34: MX2020 Standard Cable Managers

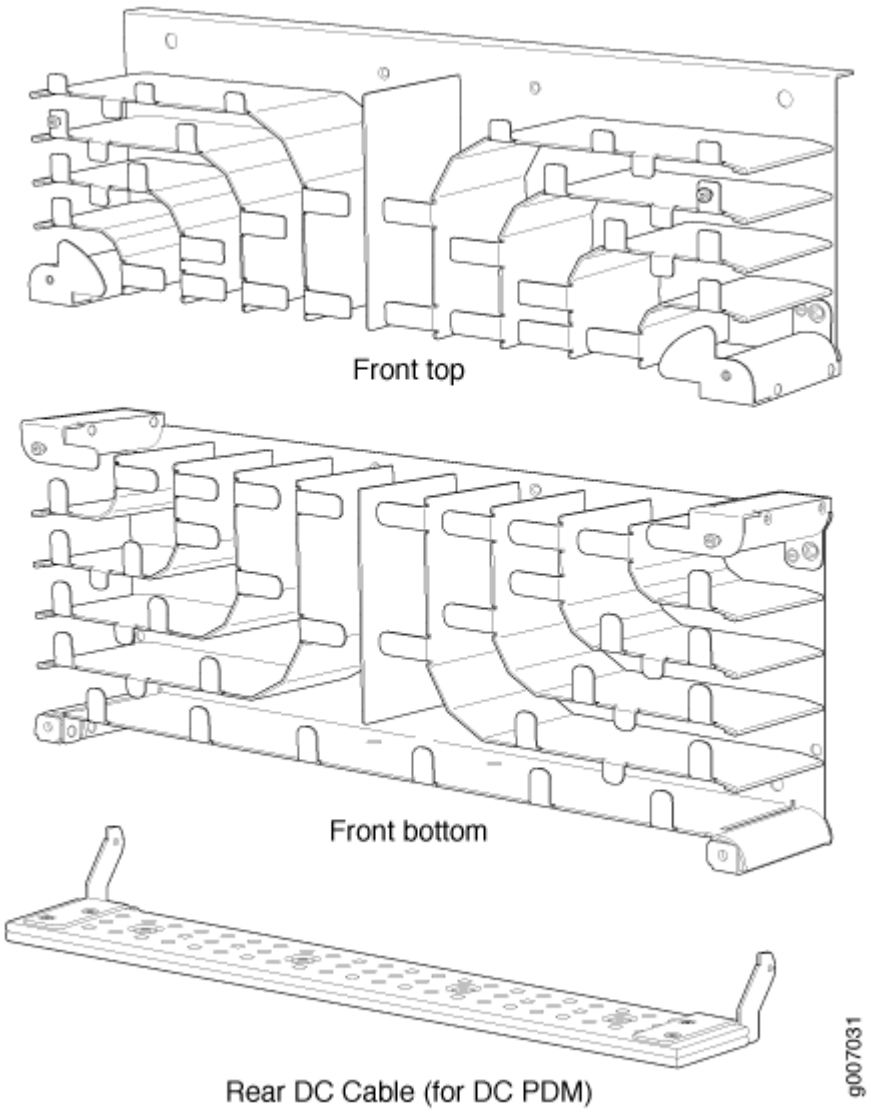
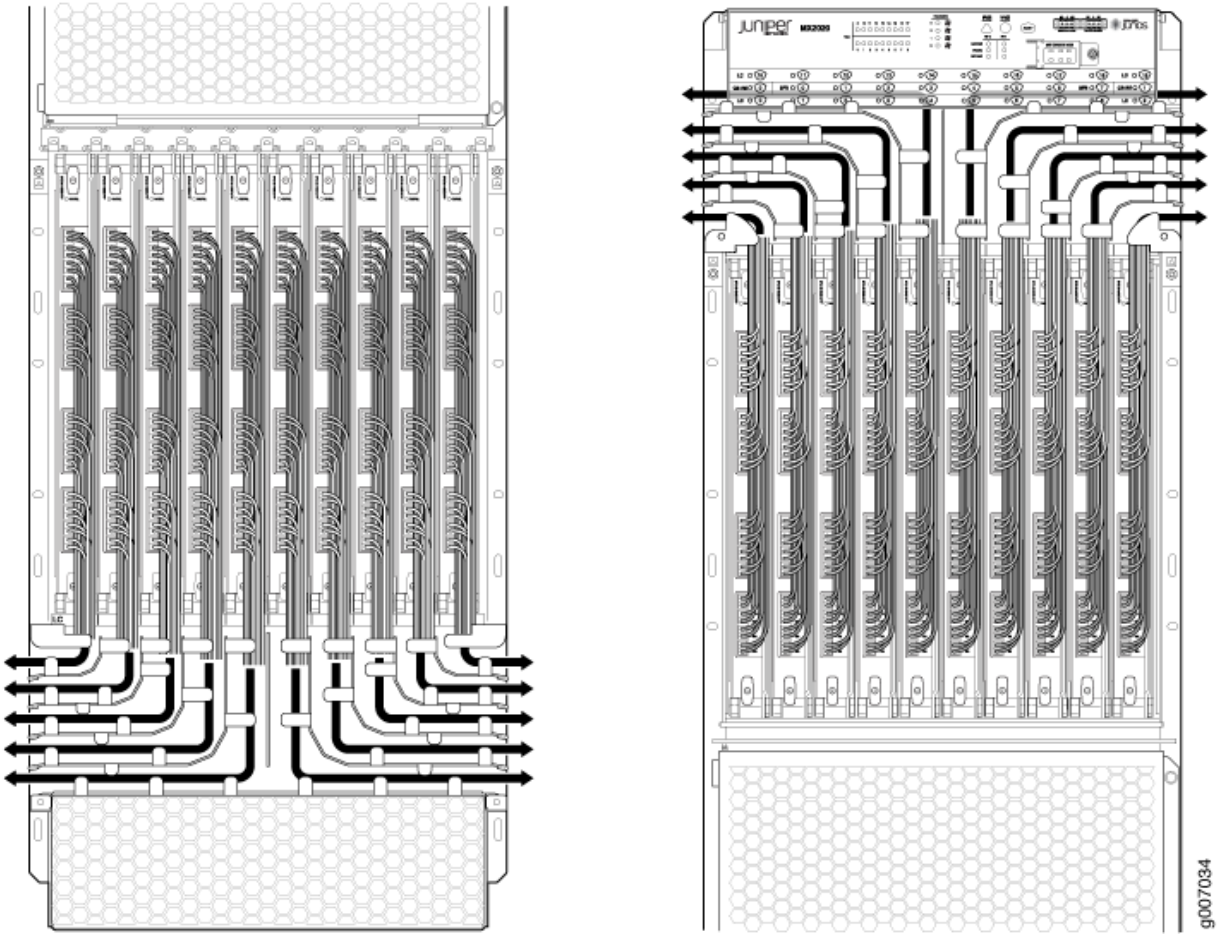


Figure 35: Upper and Lower Cable Management



The middle card-cage cable manager, (see Figure 36 on page 78 and Figure 37 on page 79) is a combination cable tray and air filter located in the middle 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 middle 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 36: Middle Card-Cage Cable Manager

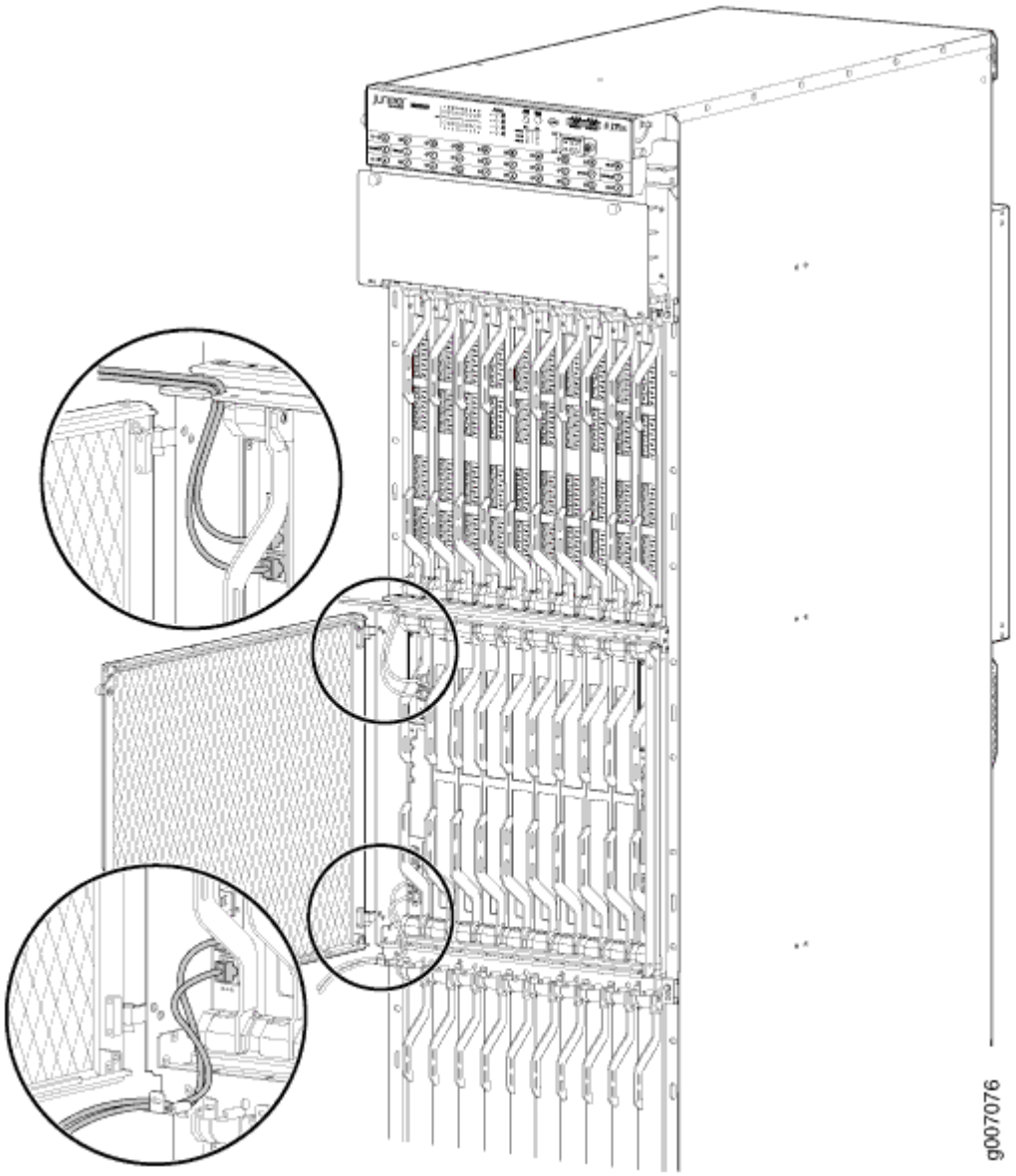
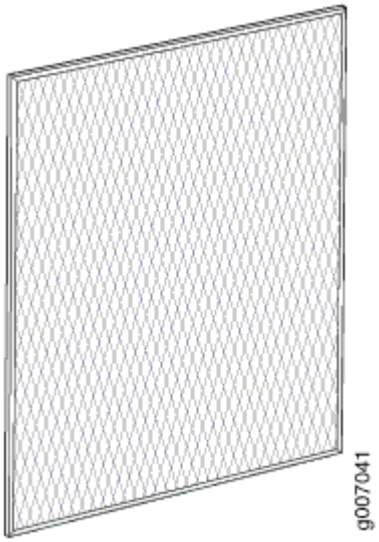


Figure 37: Middle Card-Cage Air Filter



Extended Cable Management System

The extended cable management system consists of the following components:

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

The extended cable management system provides additional support to route and secure a large number of cables away from the front of the MPCs, and MICs (see Figure 38 on page 80).

The extended DC cable management system provides additional support to route and secure a large number of cables away from the rear of the PDMs (see Figure 38 on page 80 and Figure 39 on page 81).

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.

Figure 38: MX2020 Extended Cable Managers

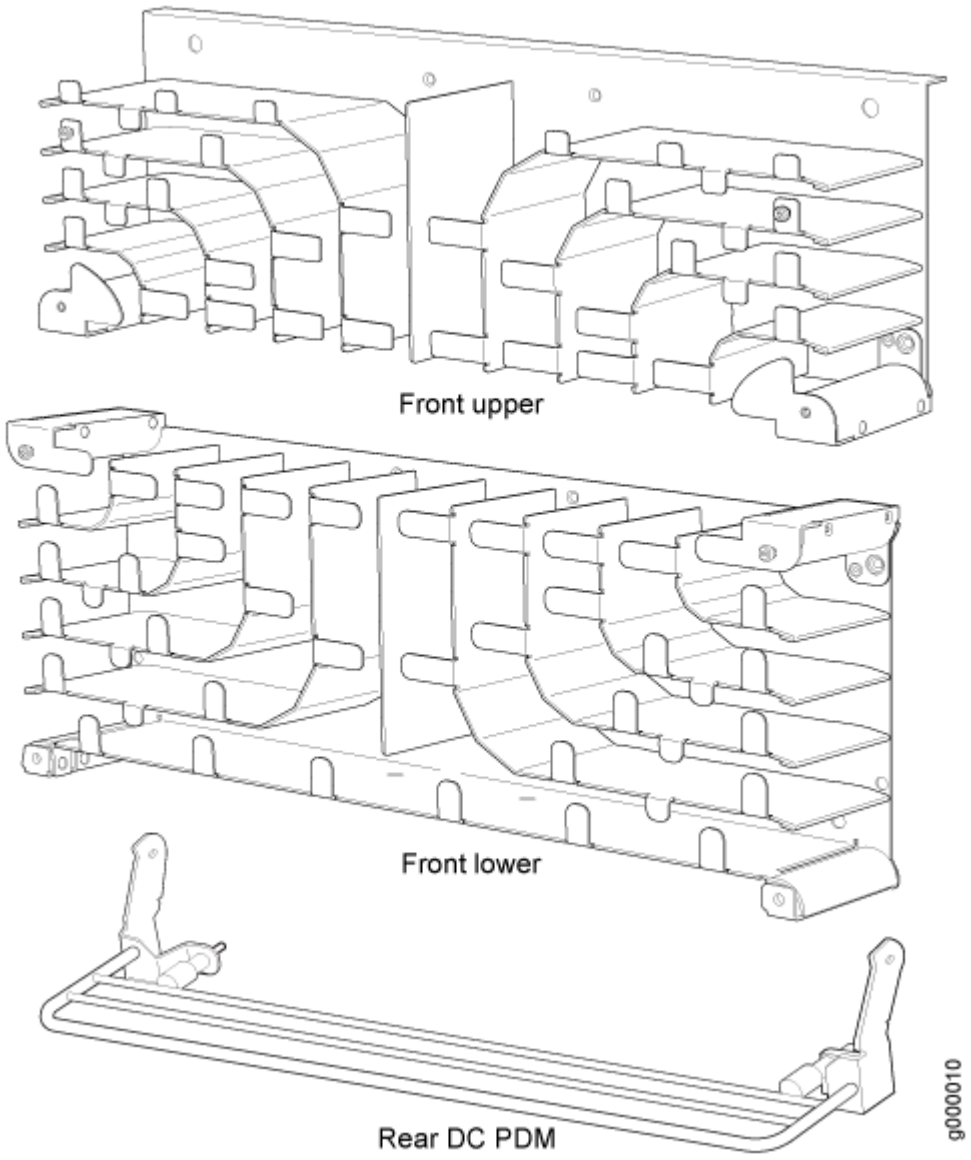


Figure 39: MX2020 Extended Cable Manager for the DC PDM (240 V China) and the Universal (HVAC/ HVDC) PDM

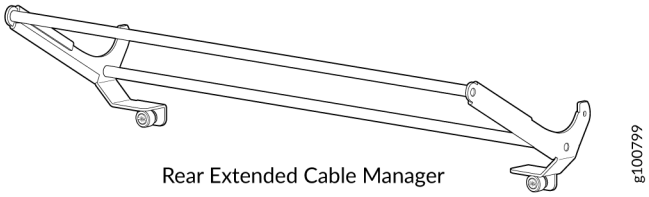
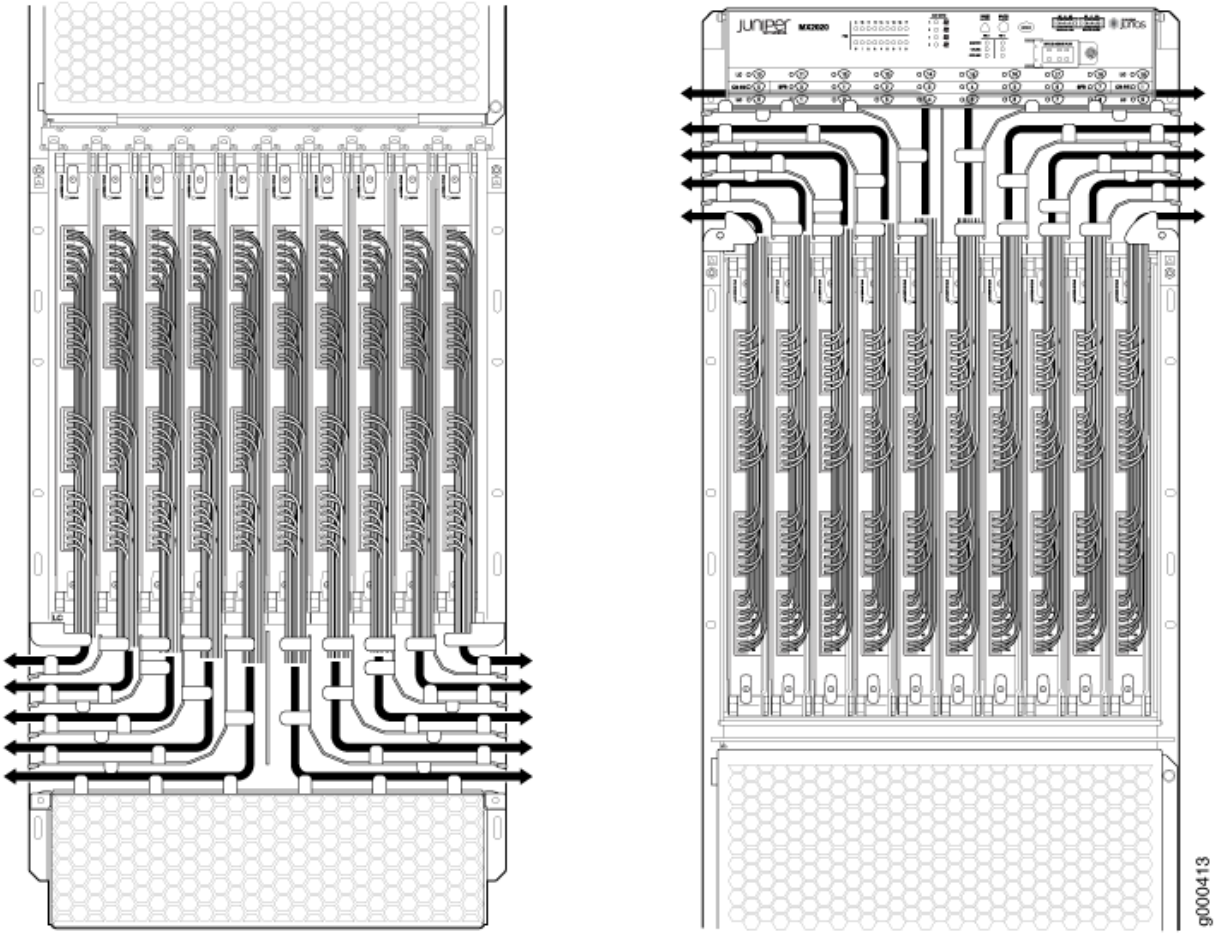


Figure 40: Upper and Lower Extended Cable Management



RELATED DOCUMENTATION

Installing the MX2020 Upper Cable Manager | 807

Installing the MX2020 Lower Cable Manager | 804

Installing the MX2020 DC Cable Manager | 785

Replacing the MX2020 Cable Managers | 787

MX2020 Rack-Mounting Hardware

The rack-mounting hardware for the MX2020 router includes:

- The large adjustable mounting shelf for mounting in four-post racks or cabinets
- Front-mounting flanges on the front of the chassis for front-mounting in a four-post rack or cabinet
- Mounting screws

NOTE: There must be a minimum of 45 U of usable rack space when installing the MX2020 router into a 45-U rack.

RELATED DOCUMENTATION

MX2020 Chassis Description | 36

MX2020 Backplane Description | 47

Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet | 344

CHAPTER 5

Cooling System Components and Descriptions

IN THIS CHAPTER

MX2020 Cooling System Description

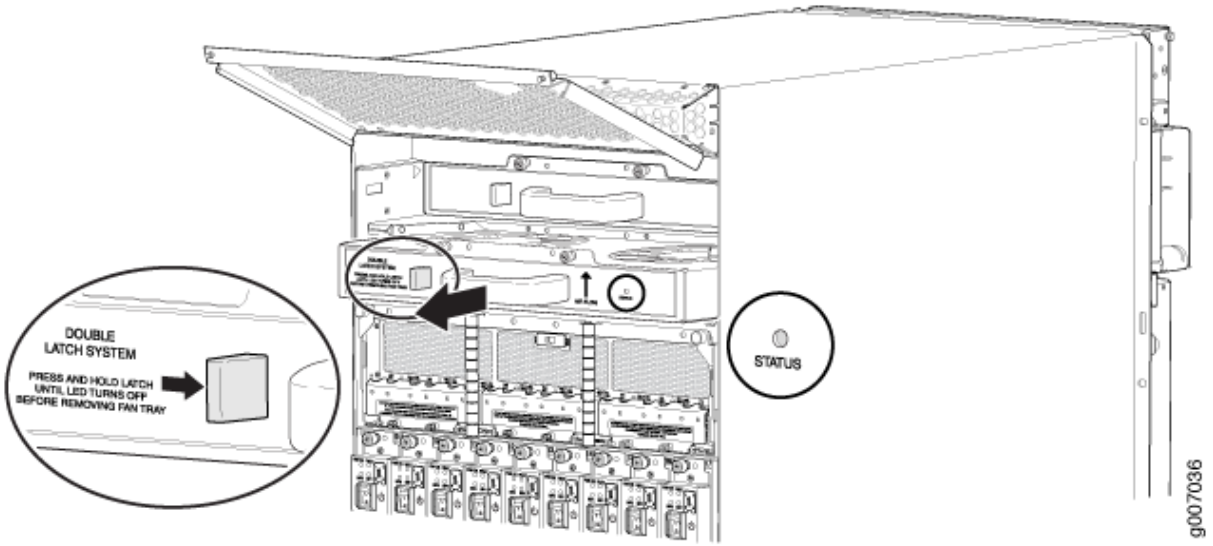
The cooling system consists of the following components:

- Base Fan Tray (MX2000-FANTRAY) or Optimized Power Fan tray (MX2K-FANTRAY-OP-S)
- Lower Fan Tray Air filter—MX2020-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 41 on page 84).

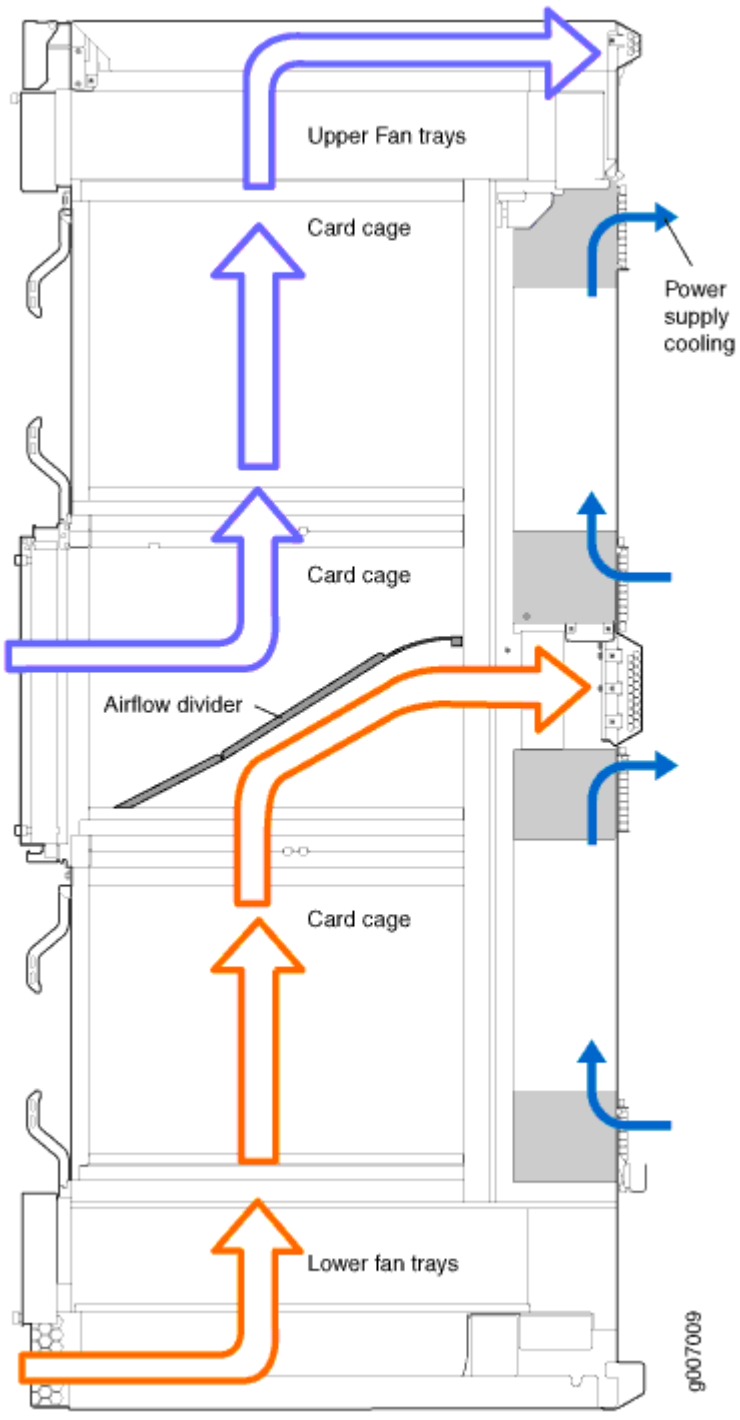
Figure 41: Removing Fan Tray



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 42 on page 85).

Figure 42: Airflow Through the Chassis

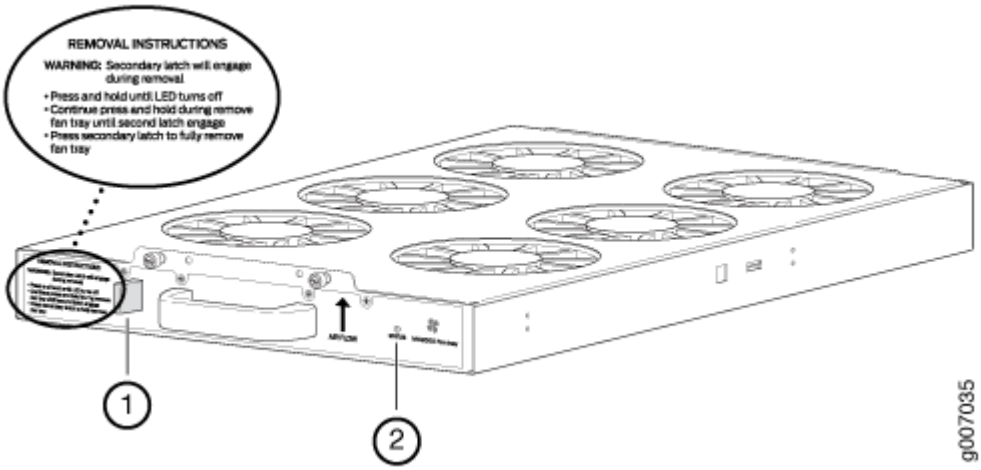


The MX2020 router provides a two-stage front-to-back cooling system. Air is pushed into the bottom inlet and up through the lower fan tray, and exits through the opening between the backplanes in the center of the chassis. This cools the bottom MPCs, half of the SFBs and CB-REs. Air is pulled through

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 from the bottom half of the system out and direct the air to the top half MPCs.

Figure 43: Upper/Lower Fan Tray

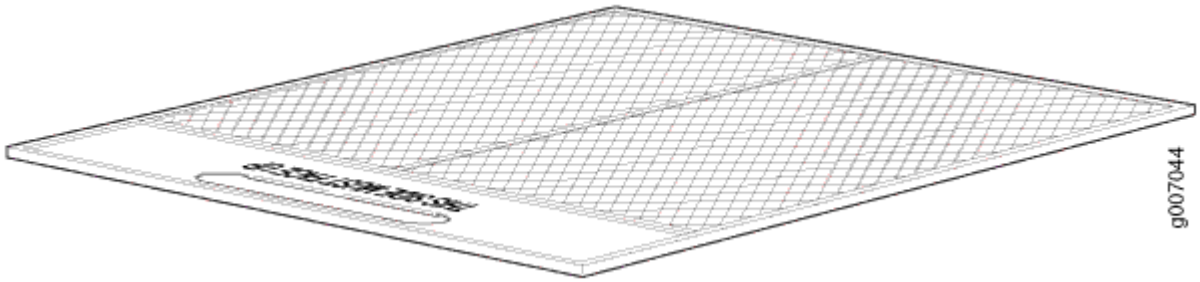


1– Safety double latch system	2– **STATUS** LED

WARNING: Before removing a fan tray, make sure 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 44: 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 MX2020 Cooling System | **851**
- Maintaining the MX2020 Air Filter | **621**
- Maintaining the MX2020 Fan Trays | **593**
- Maintaining the MX2020 Air Baffle | **627**

MX2020 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 87). A set of four bicolor fan tray LEDs is located on the top middle of the craft interface. For more information, see MX2020 Component LEDs on the Craft Interface.

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

Maintaining the MX2020 Fan Trays | **593**

Troubleshooting the MX2020 Cooling System | **851**

MX2020 Component LEDs on the Craft Interface

CHAPTER 6

Host Subsystem Components

IN THIS CHAPTER

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 | **645**

RE-MX2000-1800x4 CB-RE Description

IN THIS SECTION

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 45 on page 91 shows the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4.

Table 17 on page 91 describes the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4 ports.

Figure 45: RE-MX2000-1800x4 CB-RE Front View

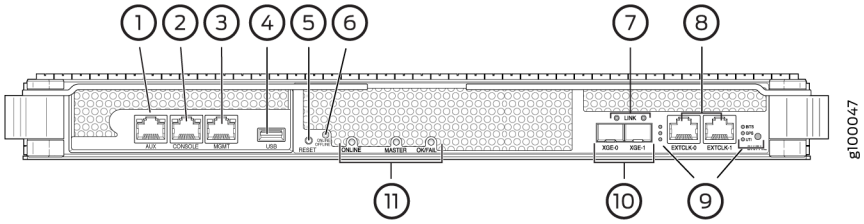


Table 17: Components on the RE-MX2000-1800x4

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 | 234

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

Removing a CB-RE from an MX2000 Router

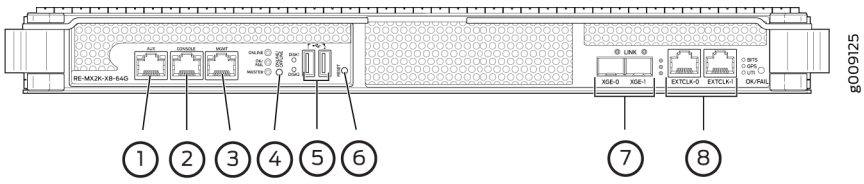
MX2000 Host Subsystem CB-RE Description

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

IN THIS SECTION

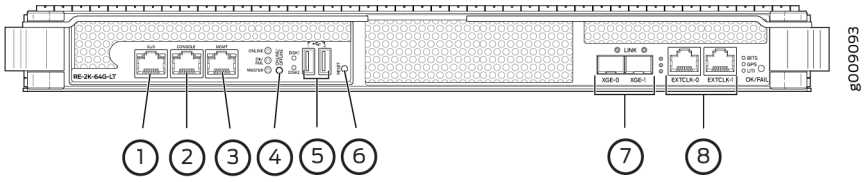
REMX2K-X8-64G CB-RE Components

Figure 46: 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 47: 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

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 18 on page 97 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 18 on page 97 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*.

Table 18: 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.

Table 18: CB-RE LEDs *(Continued)*

Label	Color	State	Description
LINK	Green	On steadily	SFP+ ports (XGE-0 and XGE-1) link connection.
		Blinking steadily	Activity on SFP+ ports (XGE-0 and XGE-1).
	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 48: REMX2K-X8-64G CB-RE LEDs

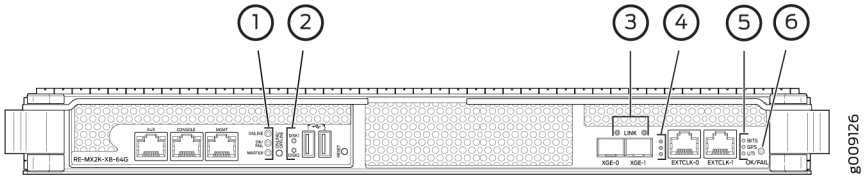


Table 19: REMX2K-X8-64G CB-RE LEDs

Callout from Figure 48 on page 98	Label	Color	State	Description
1	**ONLINE**	Green	Blinking	CB-RE is transitioning online.
			On steadily	CB-RE is functioning normally.
		—	Off	CB-RE is offline.
1	**MASTER**	Blue	On steadily	CB-RE is the primary.
1	**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.
4	Unlabeled (top LED)	Green	On steadily	BITS external clocking interface (on EXTCLK-0 port) is active.

Table 19: REMX2K-X8-64G CB-RE LEDs *(Continued)*

Callout from Figure 48 on page 98	Label	Color	State	Description
		Yellow	On steadily	BITS external clocking interface (on EXTCLK-0 port) has failed.
		–	Off	BITS external clocking interface (on EXTCLK-0 port) is offline.
4	Unlabeled (center LED)	Green	On steadily	GPS external clocking interface (on EXTCLK-0 port) is active.
		Yellow	On steadily	GPS external clocking interface (on EXTCLK-0 port) has failed.
		–	Off	GPS external clocking interface (on EXTCLK-0 port) is offline.
4	Unlabeled (bottom LED)	Green	On steadily	UTI external clocking interface (on EXTCLK-0 port) is active.
		Yellow	On steadily	UTI external clocking interface (on EXTCLK-0 port) has failed.
		–	Off	UTI external clocking interface (on EXTCLK-0 port) is offline.
5	**BITS**	Green	On steadily	BITS external clocking interface (on EXTCLK-1 port) is active.
		Yellow	On steadily	BITS external clocking interface (on EXTCLK-1 port) has failed.

Table 19: REMX2K-X8-64G CB-RE LEDs *(Continued)*

Callout from Figure 48 on page 98	Label	Color	State	Description
		–	Off	BITS external clocking interface (on EXTCLK-1 port) is offline.
5	**GPS**	Green	On steadily	GPS external clocking interface (on EXTCLK-1 port) is active.
		Yellow	On steadily	GPS external clocking interface (on EXTCLK-1 port) has failed.
		–	Off	GPS external clocking interface (on EXTCLK-1 port) is offline.
5	**UTI**	Green	On steadily	UTI external clocking interface (on EXTCLK-1 port) is active.
		Yellow	On steadily	UTI external clocking interface (on EXTCLK-1 port) has failed.
		–	Off	UTI external clocking interface (on EXTCLK-1 port) is offline.
6	**OK/FAIL**	Red	On steadily	CB has failed.

RELATED DOCUMENTATION

Maintaining the MX2020 Host Subsystem | 645

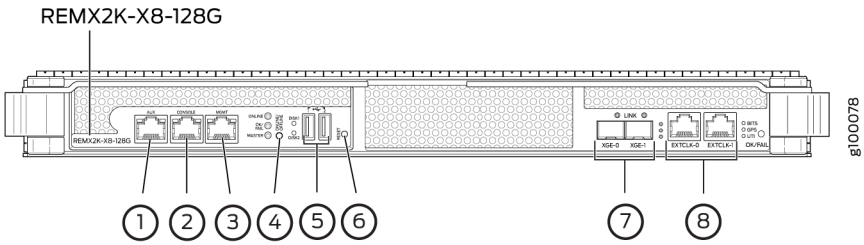
REMX2K-X8-128G CB-RE Description

IN THIS SECTION

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 49: 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.

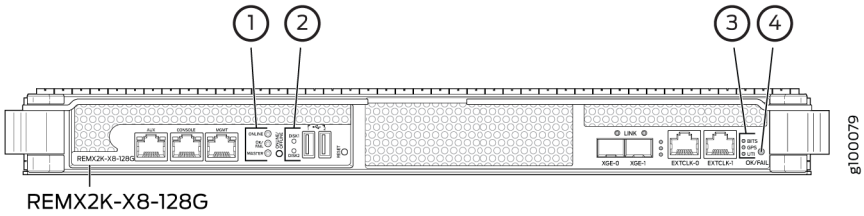
- EEPROM in RE—Stores the field replacement unit (FRU) details of the RE.
- EEPROM in CB—Stores the field replacement unit (FRU) details of the CB.
- **RESET** button—Reboots the Routing Engine on the CB-RE when pressed.
- **ONLINE/OFFLINE** button—Makes the Routing Engine on the CB-RE online or offline 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 50: 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 20: 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.
		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.

Table 20: REMX2K-X8-128G CB-RE LEDs *(Continued)*

Label	Color	State	Description
	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

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

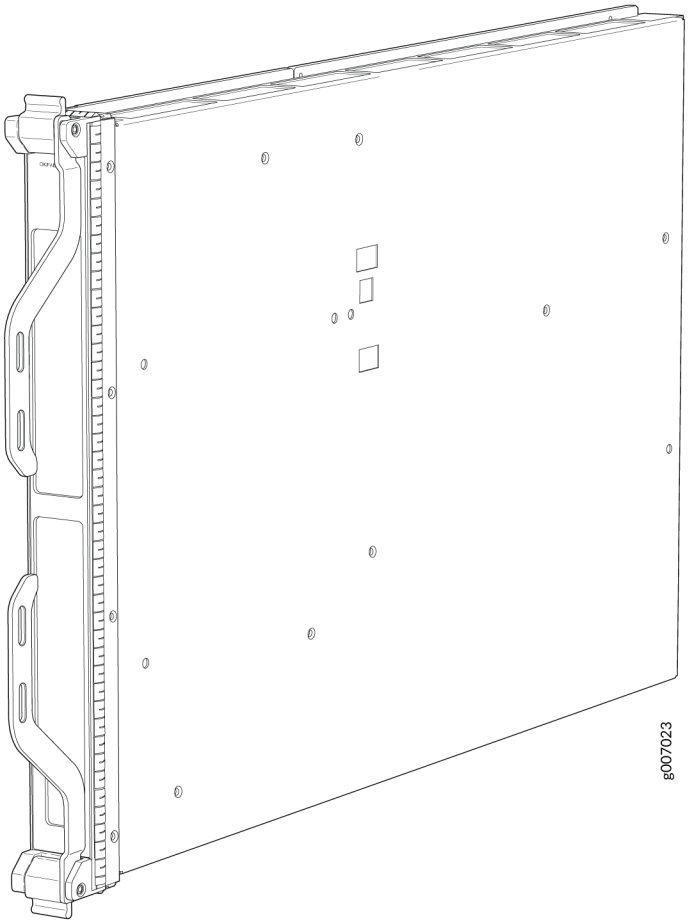
MX2000-SFB-S Switch Fabric Board Description

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 51 on page 107 shows the MX2000 Switch Fabric Board (SFB).

Figure 51: 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*
- *Replacing an MX2000 SFB*
- *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.

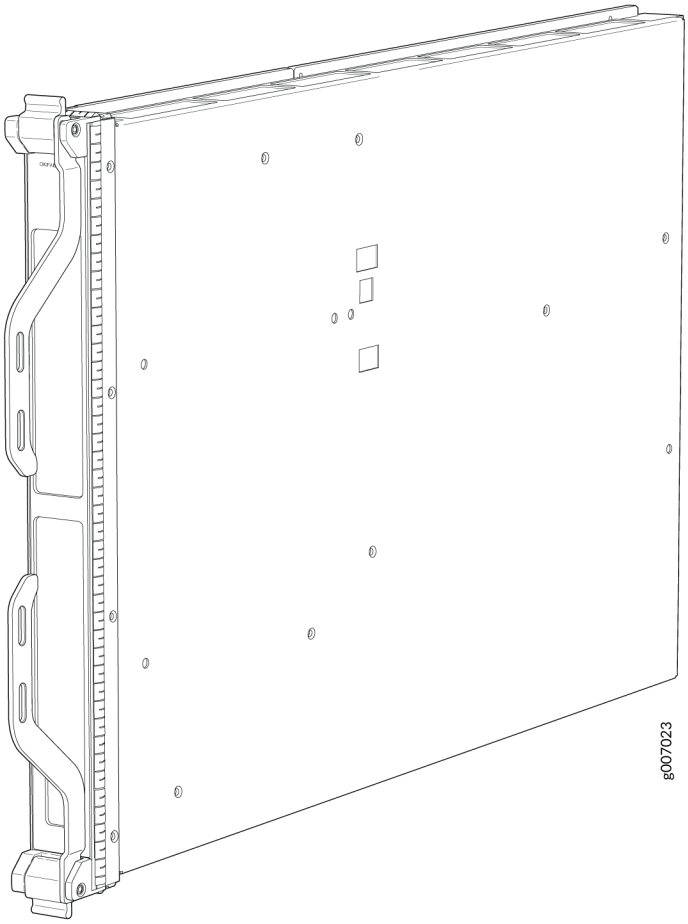
Note that you can’t mix switch fabric board models (SFB, SFB2, SFB3) in a single MX2000 series router chassis. If you upgrade from an SFB to an SFB2, the MX2000 routers will support both the SFB and SFB2 at the same time but only for the duration of the upgrade.

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 52 on page 111 shows the MX2000 Enhanced Switch Fabric Board (SFB).

Figure 52: 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

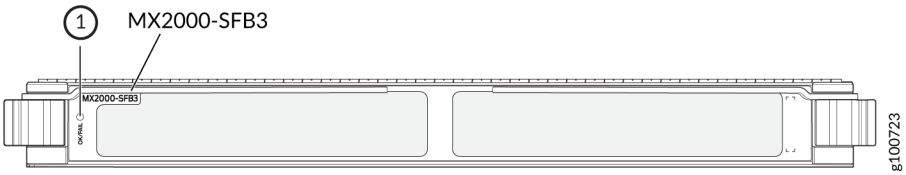
- MX2000 Switch Fabric Board LED
- MX2000 Host Subsystem CB-RE Description
- Replacing an MX2000 SFB
- Understanding Fabric Fault Handling on Enhanced Switch Fabric Board (SFB2)
- Performing a Smooth Upgrade to Enhanced Switch Fabric Board (SFB2) with Minimal Impact on Traffic

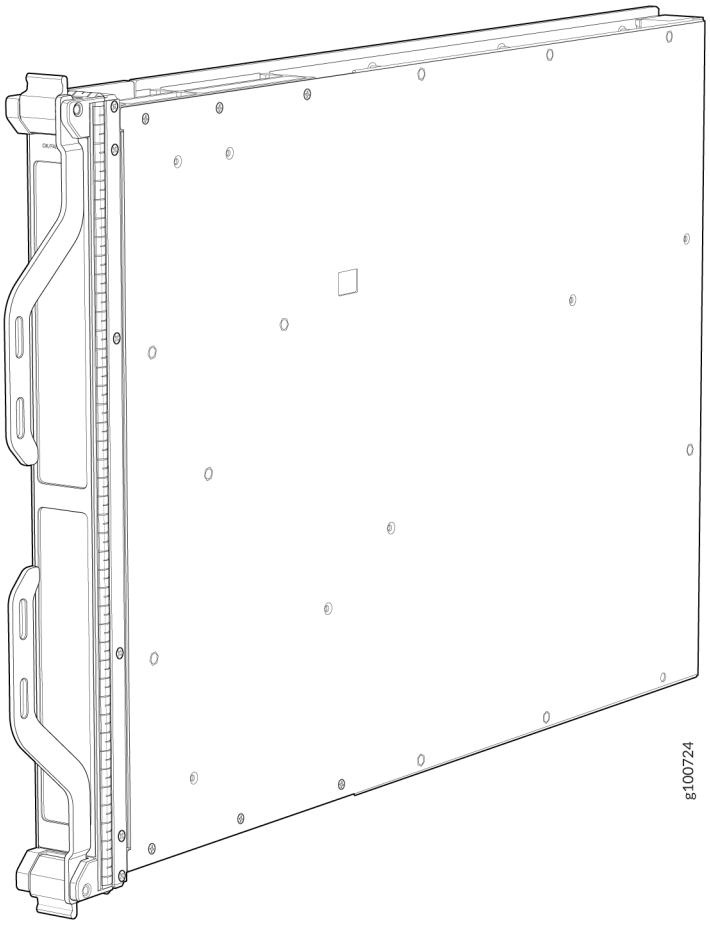
MX2000-SFB3 Switch Fabric Board Description

IN THIS SECTION

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 53 on page 115 shows the MX2000-SFB3.

Figure 53: 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. **NOTE**: MX2020 routers do not support power redundancy mode for the MX2000-SFB3 fabric card in both the power zones. 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 120 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 120 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 121 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*
- *MX2000 Host Subsystem CB-RE Description*
- *Replacing an MX2000 SFB*

CHAPTER 7

Interface Modules— ADCs, MPCs, and MICs

IN THIS CHAPTER

MX2000 Modular Interface Card (MIC) 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. You can install MICs of different media types on the same router as long as the router 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. The MPCs encapsulate the packets received before transmitting outgoing data packets through the MIC interfaces.

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

RELATED DOCUMENTATION

MX2020 Modular Interface Card LEDs | 138

Maintaining MX2020 MICs | 732

Troubleshooting the MX2020 MICs | 854

Replacing an MX2020 MIC | 720

MICs Supported by MX Series Routers

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

- Table 24 on page 124 lists the first supported Junos OS release for MICs on MX240, MX480, MX960, and MX2008 routers.
- Table 25 on page 128 lists the first supported Junos OS release for MICs on MX2010 and MX2020 routers.
- Table 26 on page 131 list the first supported Junos OS release for MICs on MX5, MX10, and MX40 routers.
- Table 27 on page 134 lists the first supported Junos OS release for MICs on MX80 and MX104 routers.
- Table 28 on page 137 lists the first supported Junos OS release for MICs on MX10003 router.

Table 24: 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				
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	15.1F7
Circuit Emulation				

Table 24: MICs Supported by MX240, MX480, MX960, and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
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
No Link Title	MIC-3D-10GE-SFP-E	10	24.2	—
10-Gigabit Ethernet MIC with SFP+ (10 Ports)	MIC3-3D-10XGE-SFPP	10	12.3	15.1F7
10-Gigabit Ethernet MIC with SFP+ (24 Ports)	MIC6-10G	24	—	15.1F7

Table 24: 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 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				
100-Gigabit DWDM OTN MIC with CFP2-ACO	MIC3-100G-DWDM	1	15.1F5 15.1F6 17.1R1	15.1F7
Multi-Rate				

Table 24: MICs Supported by MX240, MX480, MX960, and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
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
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

Table 24: MICs Supported by MX240, MX480, MX960, and MX2008 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2008 Routers
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 25: MICs Supported by MX2010 and MX2020 Routers

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
ATM				
ATM MIC with SFP	MIC-3D-8OC3-2OC12-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
Circuit Emulation				
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	—	—
Gigabit Ethernet				

Table 25: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
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
No Link Title	MIC-3D-10GE-SFP-E	10	24.2	24.2
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				
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	2	12.3	12.3
100-Gigabit Ethernet				

Table 25: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
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	15.1F515.1F617.1R1	15.1F515.1F617.1R1
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
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	12.3	12.3

Table 25: MICs Supported by MX2010 and MX2020 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX2010 Routers	MX2020 Routers
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 26: MICs Supported by MX5, MX10, and MX40 Routers

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
ATM					

Table 26: MICs Supported by MX5, MX10, and MX40 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
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
Gigabit Ethernet MIC with SFP (EH)	MIC-3D-20GE-SFP-EH	20	—	—	—

Table 26: MICs Supported by MX5, MX10, and MX40 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40
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
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3 -1COC12-CE	4	12.2	12.2	12.2

Table 26: 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 (H)	MIC-4COC3-1COC12-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-1OC192-XFP	1	12.2	12.2	12.2

Table 27: MICs Supported by MX80 and MX104 Routers

MIC Name	MIC Model Number	Ports	MX80	MX104
ATM				
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	8	12.1	13.3
DS3/E3				

Table 27: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
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
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	10.2	13.2R2
Multi-Rate				

Table 27: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
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				
Tri-Rate MIC	MIC-3D-40GE-TX	40	10.2	13.2R2
Services				

Table 27: MICs Supported by MX80 and MX104 Routers *(Continued)*

MIC Name	MIC Model Number	Ports	MX80	MX104
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 28: 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*

MX2020 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

- MX2000 Modular Interface Card (MIC) Description | **123**
- Maintaining MX2020 MICs | **732**
- Troubleshooting the MX2020 MICs | **854**
- Replacing an MX2020 MIC | **720**

MX2020 Modular Port Concentrator (MPC) Description

IN THIS SECTION

Designed for flexibility, MX2000 Modular Port Concentrators (MPCs) leverage the Junos Trio chipset to deliver the industry’s highest Gigabit Ethernet density, as well as the flexibility of modular interfaces across the MX Series portfolio. These advanced capabilities allow mix and match interfaces to create service-specific and “pay as you grow” configurations. The MPCs house the packet forwarding engines to deliver up to 120-Gigabit Ethernet of comprehensive Layer 3 routing (IPv4 and IPv6), and Layer 2 switching. The MPCs also support inline services and advanced Hierarchical QoS (H-QoS) per MX Series slot.

Modular Interface Cards (MICs) install into the MPCs to provide the physical interfaces. You can install up to two MICs of different media types on the same MPC as long as the MPC supports those MICs.

NOTE: The MX2020 router also supports fixed port MPCs.

Each MPC is equipped with up to four Junos Trio chipsets, which perform control functions tailored to the MPC’s media type.

The MX2020 router supports up to 20 MPCs. For power requirements, see Calculating DC Power Requirements for MX2020 Routers and "Calculating AC Power Requirements for MX2020 Routers" on page 270.

The router has 20 dedicated line card slots for MPCs. MPCs install vertically in the front of the router. The dedicated slots are numbered **0** though **9** (bottom), and **10** though **19** (top), left to right. An MPC can be installed in any line card slot.

When an MPC slot is not occupied, you need to install a blank MPC panel.

MPCs are hot-removable and hot-insertable. When you install 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 54 on page 139 shows an example of an MPC. Figure 55 on page 140 shows an MPC installed vertically in the MX2020 router. For more information about MPCs, see the *MX Series Interface Module Reference*.

Figure 54: Modular Port Concentrator (MPC)

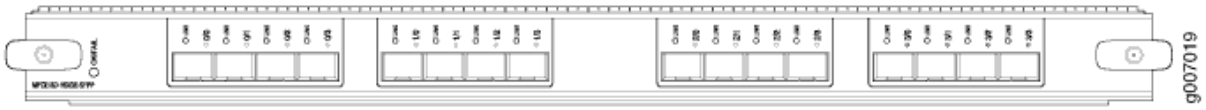
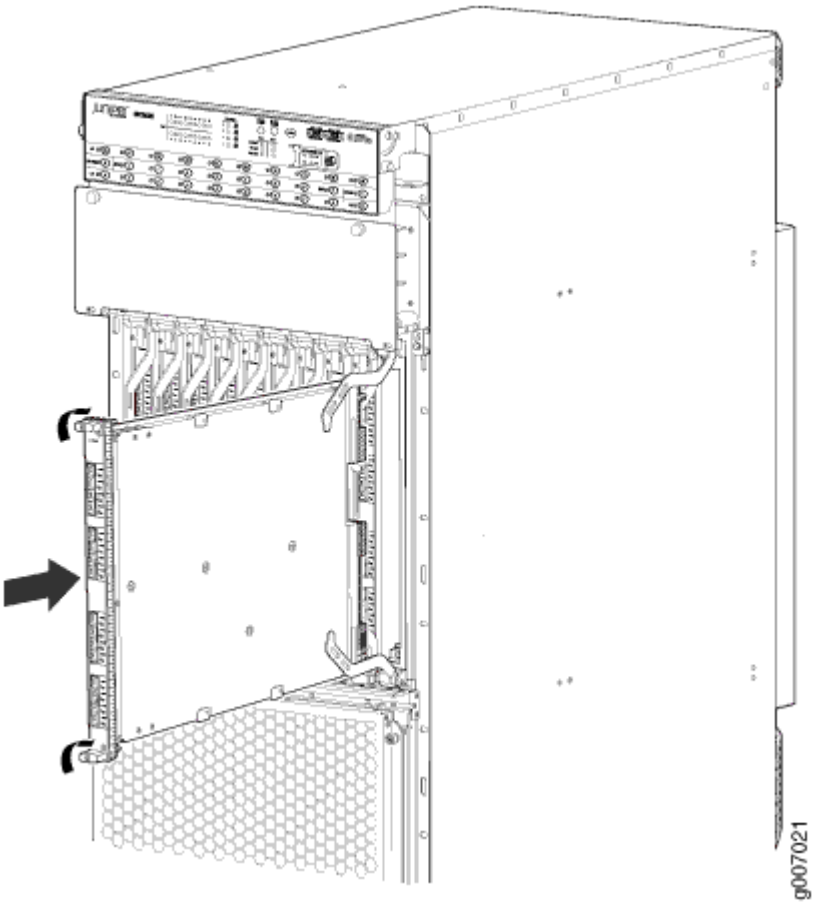


Figure 55: MPC Installed in the MX2020 Router



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 the LEDs for your MPC, refer to the MX Series 5G Universal Routing Platform Interface Module Reference.

RELATED DOCUMENTATION

- MX2020 Field-Replaceable Units | 55
- Maintaining MX2020 MPCs | 714
- Troubleshooting a Modular Port Concentrator (MPC) | 856
- Replacing an MX2020 MPC and Adapter Card (ADC) | 701

MPCs Supported by MX Series Routers

Table 29 on page 141 lists the MPCs and their first supported Junos OS release on MX240, MX480, MX960, MX2008, MX2010, MX2020, and MX10003 routers.

Table 29: 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							
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	–	–

Table 29: 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
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	–	–
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	–	–

Table 29: 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-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 29: 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 29: 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 29: 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 29: 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

MX2020 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 MX2020 Component LEDs on the Craft Interface.

Each MPC also has LEDs located on the faceplate. For more information about LEDs on the MPC faceplate, see the LEDs topic for your MPC.

RELATED DOCUMENTATION

- MX2020 Modular Port Concentrator (MPC) Description | **138**
- Maintaining MX2020 MPCs | **714**
- Troubleshooting a Modular Port Concentrator (MPC) | **856**
- Replacing an MX2020 MPC and Adapter Card (ADC) | **701**
- MICs Supported by MX Series Routers | **124**

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:

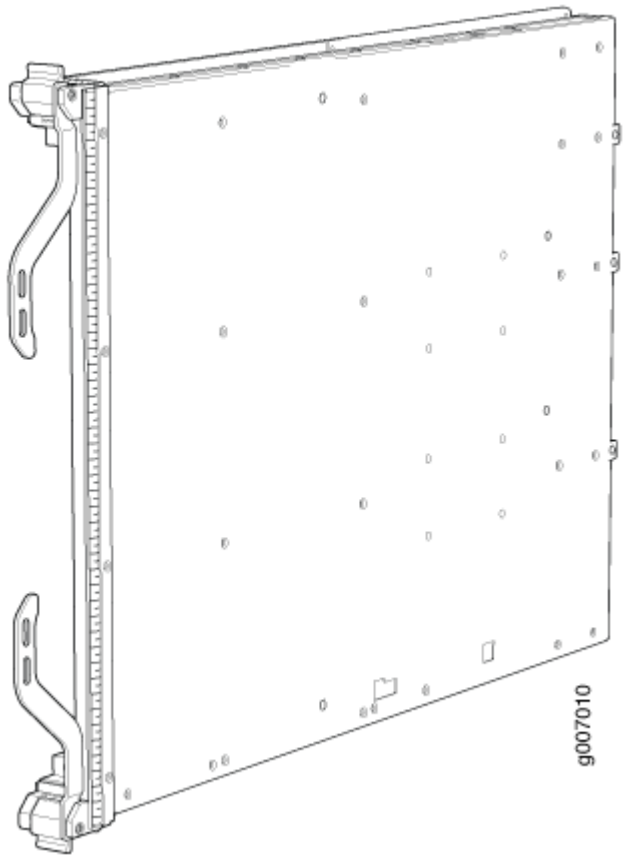
- MPC1E

- 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 56 on page 149 shows the ADC supported on MX2000 routers.

Figure 56: ADC for the MX2000 Routers



RELATED DOCUMENTATION

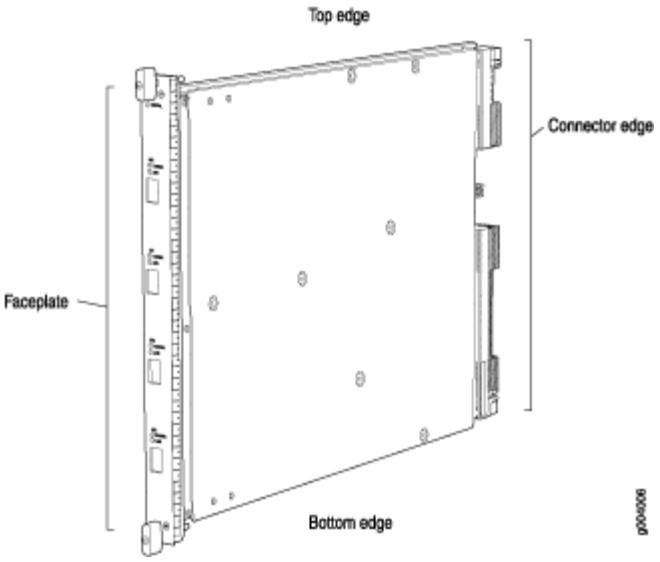
- Maintaining MX2020 Adapter Cards | 718

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 57 on page 150):

- 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 57: MPC Edges



RELATED DOCUMENTATION

- MX2020 Modular Port Concentrator (MPC) Description | 138
- MX2020 Component LEDs on the Craft Interface
- Holding an MPC | 697

Troubleshooting a Modular Port Concentrator (MPC) | 856

Replacing an MX2020 MPC and Adapter Card (ADC) | 701

MX2020 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 MX2020 router, the MPCs are represented in the CLI as FPC 0 through FPC 19.
- *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 MX2020 supports up to twenty MPCs that install vertically and are numbered from left to right.

The following sample CLI output displays an MPC (**MPC Type 2 3D EQ**) installed in MPC slot 19.

```
user@host> show chassis hardware

...
FPC 19           REV 34   750-031090   ZT9647           MPC Type 2 3D EQ
  CPU            REV 06   711-030884   ZS1148           MPC PMB 2G
  MIC 0          REV 07   750-028387   JZ8700           3D 4x 10GE  XFP
    PIC 0                 BUILTIN      BUILTIN          2x 10GE  XFP
      Xcvr 0     REV 01   740-014289   C701XU069        XFP-10G-SR
      Xcvr 1     REV 02   740-014289   C810XU09M        XFP-10G-SR
```

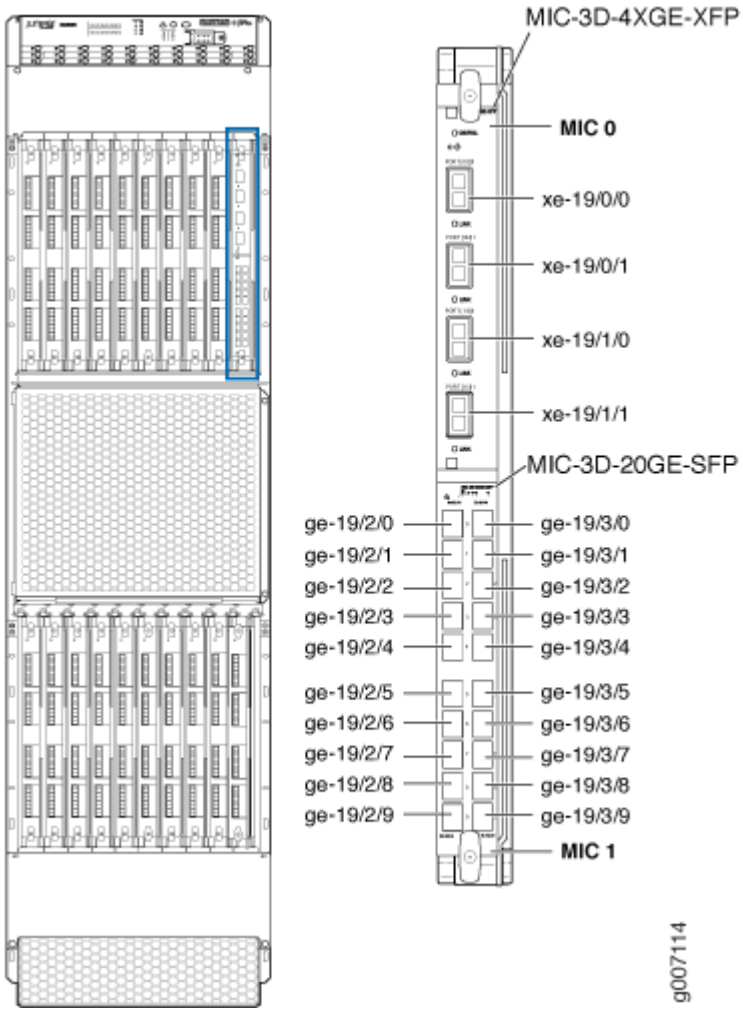
```
    PIC 1                 BUILTIN      BUILTIN          2x 10GE  XFP
      Xcvr 0      REV 03  740-011571   C939BK04B        XFP-10G-SR
      Xcvr 1              NON-JNPR     CA49BK02B        XFP-10G-SR
  MIC 1           REV 26  750-028392   ZT3624           3D 20x 1GE(LAN) SFP
    PIC 2                 BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0      REV 01  740-011613   PAM3CCK          SFP-SX
      Xcvr 1      REV 01  740-011782   PAR1L27          SFP-SX
      Xcvr 2      REV 01  740-011613   PDQ4XH4          SFP-SX
      Xcvr 4      REV 02  740-011613   AM1113SK1K7      SFP-SX
      Xcvr 5      REV 01  740-011782   P9P0XXH          SFP-SX
      Xcvr 6      REV 02  740-011613   PJT1CSS          SFP-SX
      Xcvr 7      REV 01  740-011782   PAR1YHC          SFP-SX
      Xcvr 8      REV 02  740-011613   AM0925SBG0L      SFP-SX
    PIC 3                 BUILTIN      BUILTIN          10x 1GE(LAN) SFP
      Xcvr 0      REV 01  740-011613   P9F13CH          SFP-SX
      Xcvr 1      REV 01  740-011782   PAR1L2E          SFP-SX
      Xcvr 2      REV 01  740-011782   P9M0TLC          SFP-SX
      Xcvr 3      REV 01  740-011613   PAM6KBK          SFP-SX
      Xcvr 4      REV 01  740-011613   PAM3WLY          SFP-SX
      Xcvr 5      REV 02  740-011613   PFQ4NUW          SFP-SX
      Xcvr 6      REV 02  740-011613   AM1003SFUZH      SFP-SX
      Xcvr 8      REV 02  740-011613   AM1033SH2MQ      SFP-SX
      Xcvr 9      REV 01  740-031851   AM1041SU1WW      SFP-SX
...
```

There is one 10-Gigabit Ethernet MIC (**MIC-3D-4XGE-XFP**) installed into the MPC, **MIC 0** (top slot), and one Gigabit Ethernet MIC (**MIC-3D-20GE-SFP**) 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 on specific MICs.

Figure 58 on page 153 shows how the interfaces correspond to the ports on the MIC.

Figure 58: MX2020 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 four 10-Gigabit Ethernet interfaces, `xe-19/0/0`, `xe-19/0/1`, `xe-19/1/0`, and `xe-19/1/1` that correspond to the four ports on the MIC card that is installed in slot **0** of the MPC, and twenty Gigabit Ethernet interfaces, `ge-19/2/0`, `ge-19/2/1`, `ge-19/2/2`, `ge-19/2/3`, `ge-19/2/4`, `ge-19/2/5`, `ge-19/2/6`, `ge-19/2/7`, `ge-19/2/8`, `ge-19/2/9` (left side), and `ge-19/3/0`, `ge-19/3/1`, `ge-19/3/2`, `ge-19/3/3`, `ge-19/3/4`, `ge-19/3/5`, `ge-19/3/6`, `ge-19/3/7`, `ge-19/3/8`, `ge-19/3/9` (right side) that correspond to the twenty ports on the MIC card that is installed in slot **1** of the MPC.

```
user@host>show interfaces terse

...
```

```
lc-19/0/0               up    up
lc-19/0/0.32769         up    up   vpls
pfe-19/0/0              up    up
pfe-19/0/0.16383        up    up   inet
                                   inet6
pfh-19/0/0              up    up
pfh-19/0/0.16383        up    up   inet
xe-19/0/0               up    down
xe-19/0/1               up    up
xe-19/1/0               up    up
xe-19/1/1               up    up
ge-19/2/0               up    down
lc-19/2/0               up    up
lc-19/2/0.32769         up    up   vpls
pfe-19/2/0              up    up
pfe-19/2/0.16383        up    up   inet
                                   inet6
ge-19/2/1               up    down
ge-19/2/2               up    down
ge-19/2/3               up    down
ge-19/2/4               up    down
ge-19/2/5               up    up
ge-19/2/6               up    up
ge-19/2/7               up    up
ge-19/2/8               up    up
ge-19/2/9               up    down
ge-19/3/0               up    up
ge-19/3/1               up    up
ge-19/3/2               up    up
ge-19/3/3               up    down
ge-19/3/4               up    down
ge-19/3/5               up    down
ge-19/3/6               up    down
ge-19/3/7               up    down
ge-19/3/8               up    up
ge-19/3/9               up    up

...
```

RELATED DOCUMENTATION

MX2020 Router Hardware Components and CLI Terminology | 63

CHAPTER 8

Power Subsystem

IN THIS CHAPTER

MX2020 Power Subsystem Description

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

(HVAC), or high voltage DC (HVDC) configurations. You can add additional power to the rack as needed. The MX2020 router is configurable with up to four AC, DC, 240 V China, or high-voltage second-generation universal (HVAC/HVDC) power distribution modules (PDMs) (two per subsystem), and up to eighteen AC, DC, 240 V China, or high-voltage 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 30 on page 157 describes the MX2020 DC power components and Table 32 on page 160 describes the MX2020 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 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 MX2020 systems configured for three-phase wye AC input power must use only three-phase wye AC PDMs and AC PSMs. The systems configured for three-phase delta AC input power must use three-phase delta AC PDMs and AC PSMs. The systems configured for single-phase AC input power must use single phase AC PDMs and AC PSMs. The systems configured for universal (HVAC/HVDC) input power must use universal (HVAC/HVDC) PDMs and universal PSMs.

Table 30: MX2020 DC Power Components

Component	Description
DC power subsystem	The MX2020 DC power system comprises two subsystems. Each power subsystem provides power to 10 line-card slots, three fan trays, two CB-REs, and eight SFBs. There are nine DC PSMs and two DC PDMs in each subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning; the router will continue to function. There are two types of DC power subsystems available for the MX2020: a “base” DC power subsystem (MX2020-BASE-DC) and an “optimized” or premium DC power subsystem (MX2020-PREMIUM2-DC). See"Determining DC Power Requirements for Your MX2020 Router" on page 297 for more information.

Table 30: MX2020 DC Power Components *(Continued)*

Component	Description
DC Power Distribution Modules (-48 V)	In the DC PDM (-48 V) configuration, each subsystem 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 will provide full power. You can install a total of four PDMs into a router. Each DC PDM operates with seven feeds or nine feeds of either a 60-A or 80-A 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) configuration, each subsystem 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 will provide full power. You can install a total of four PDMs into a router. Each DC PDM (240 V China) operates with nine feeds.
DC Power Supply Modules (PSMs)	The MX2020 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 "MX2020 DC Power Supply Module (-48 V) Description" on page 181). There are two PDMs per power subsystem 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 31: MX2020 High-Voltage Universal (HVAC/HVDC) Power Components

Component	Description
HVAC/HVDC power subsystem	The MX2020 HVAC/HVDC power system comprises two subsystems. Each power subsystem provides power to 10 line-card slots, three fan trays, two CB-REs, and eight SFBs. There are nine universal PSMs and two universal PDMs in each subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning; the router will continue to function.
Universal HVAC/HVDC Power Distribution Modules	The universal PDM accepts either an HVAC/HVDC input. In the universal HVAC/HVDC PDM configuration, each subsystem 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 provides full power. You can install a total of four PDMs into a router. Each universal PDM (190-410 V) operates with nine feeds.
Universal HVAC/HVDC Power Supply Modules (PSMs)	The MX2020 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. The DIP switch sets which feeds that are expected to connected. 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" on page 190). There are two PDMs per power subsystem capable of carrying nine feeds each. Each HVAC/HVDC PSM is capable of delivering 3400 W if both feeds are present, 3000 W if one feed is present.

Table 32: MX2020 AC Power Components

Component	Description
AC power subsystem	The MX2020 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.

AC Power Distribution Modules (PDMs)	The MX2020 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.

Table 32: MX2020 AC Power Components *(Continued)*

Component	Description
AC Power Supply Modules (PSMs)	The MX2020 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 MX2020 AC Power Supply Module Description). 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 MX2020 router supports the power system models and Junos OS releases in Table 33 on page 161.

Table 33: Supported MX2020 Power System Components

Name	Model Number	Junos Release
DC PSM (-48 V)	MX2000-PSM-DC	12.3R2 and later
DC PSM (240 V China)	MX2K-PSM-DC-240V	18.2R1 and later
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 (-48 V)	MX2000-PDM-DC	12.3R2 and later
Seven-feed DC PDM (-48 V)	MX2K-PDM-OP-DC	15.1R1 and later
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

Table 33: Supported MX2020 Power System Components *(Continued)*

Name	Model Number	Junos Release
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 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 MX2020 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

MX2020 AC Power Supply Module Description

MX2020 AC Power Requirements | **248**

MX2000 DC Power Distribution Module (240 V China) Description | **178**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | **188**

MX2020 DC Power Distribution Module (-48 V) Description | **176**

MX2020 DC Power Supply Module (-48 V) Description | **181**

MX2000 DC Power Supply Module (240 V China) Description | **185**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description | **190**

MX2020 DC Power Requirements | **278**

MX2020 Power Midplane Description

The MX2020 power subsystem 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

- MX2020 Universal Edge Router Overview | 34
- MX2020 Chassis Description | 36
- MX2020 Modular Port Concentrator (MPC) Description | 138
- MX2020 Backplane Description | 47

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 59 on page 164 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 59: Three-Phase Delta AC Power Distribution Module

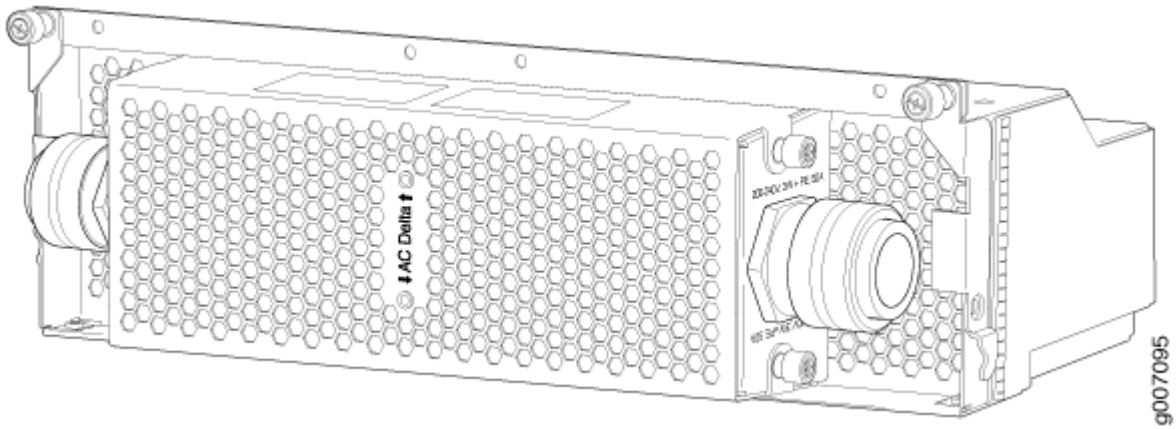


Figure 60 on page 165 shows the three-phase delta AC PDM connections.

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 60: Three-Phase Delta AC Power Distribution Module Connections

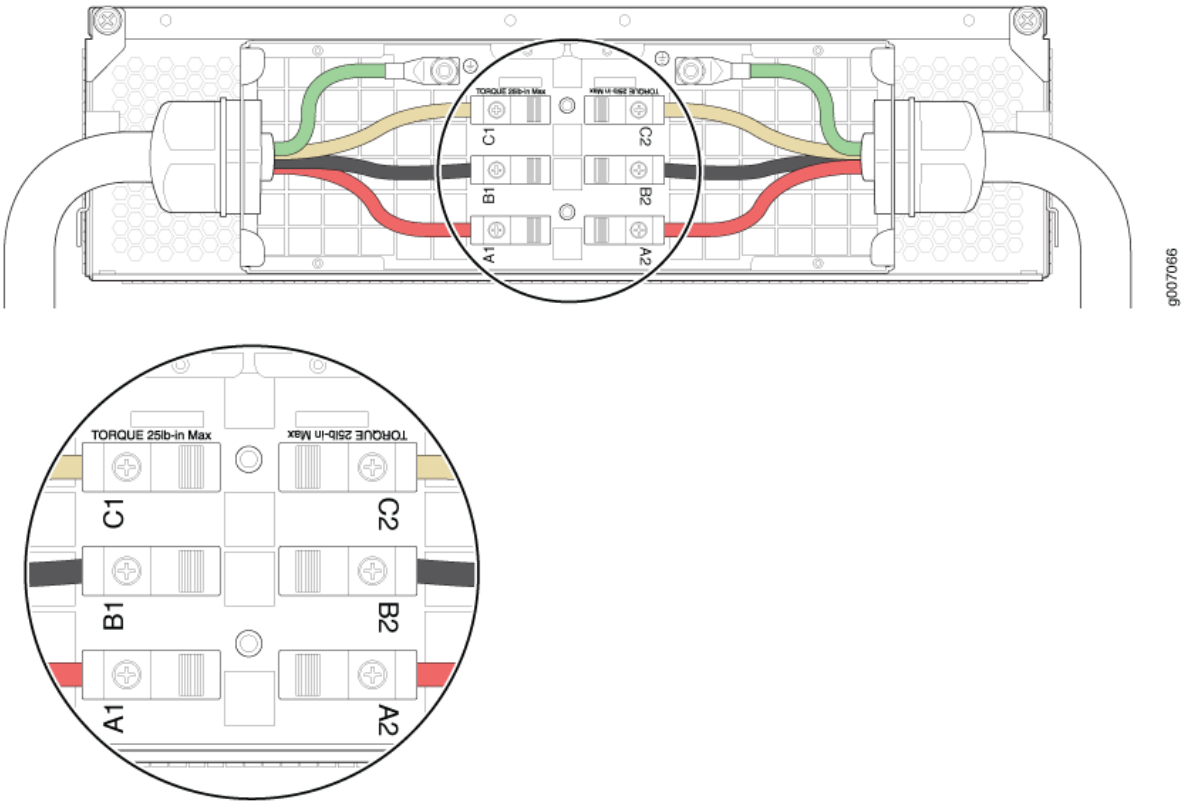
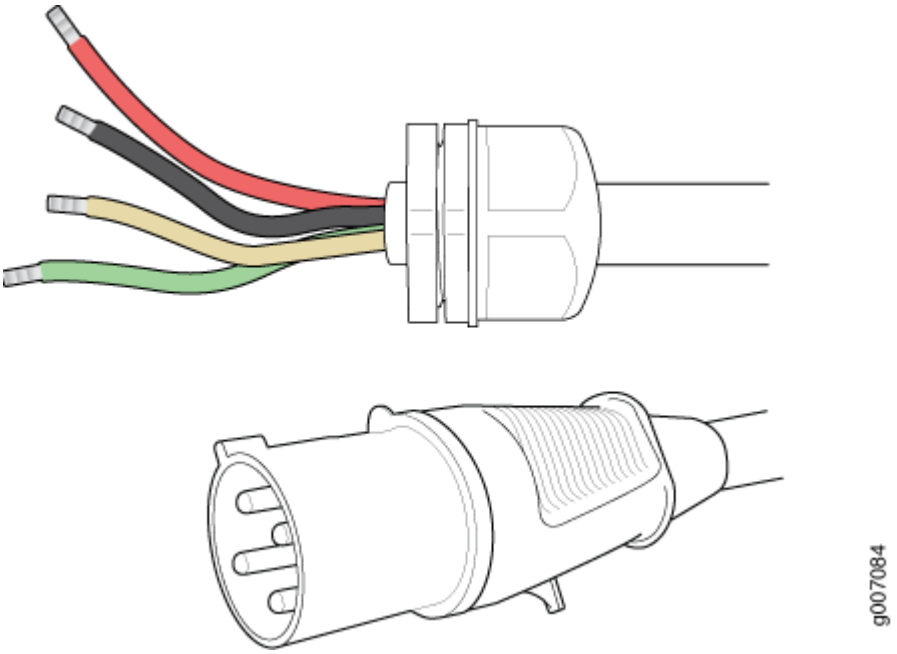


Figure 61 on page 166 shows the three-phase delta AC power cord.

Figure 61: Three-Phase Delta AC Power Cord



RELATED DOCUMENTATION

MX2020 Power Subsystem Description | 156

MX2020 AC Power Requirements | 248

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 62 on page 167 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 62: Three-Phase Wye AC Power Distribution Module

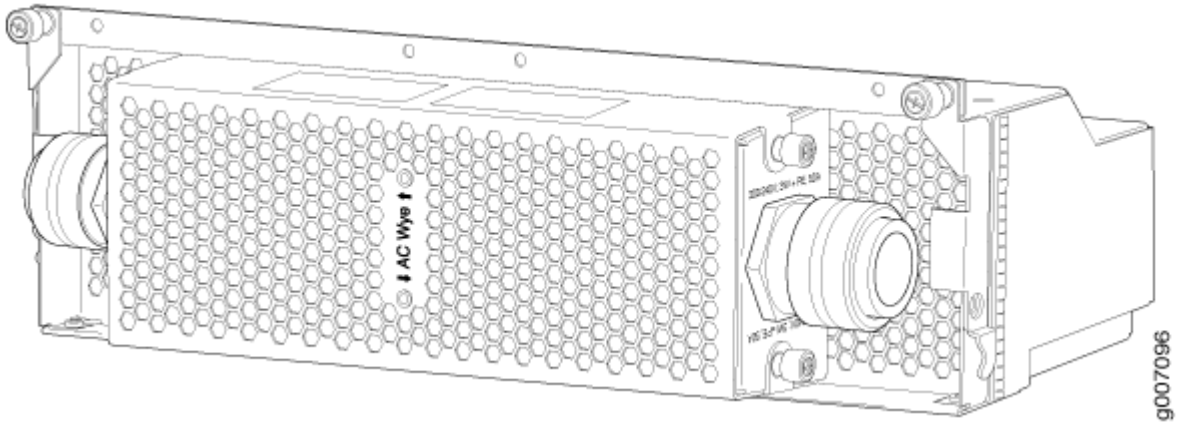


Figure 63 on page 168 shows the three-phase wye AC PDM connections.

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 63: Three-Phase Wye AC Power Distribution Module Connections

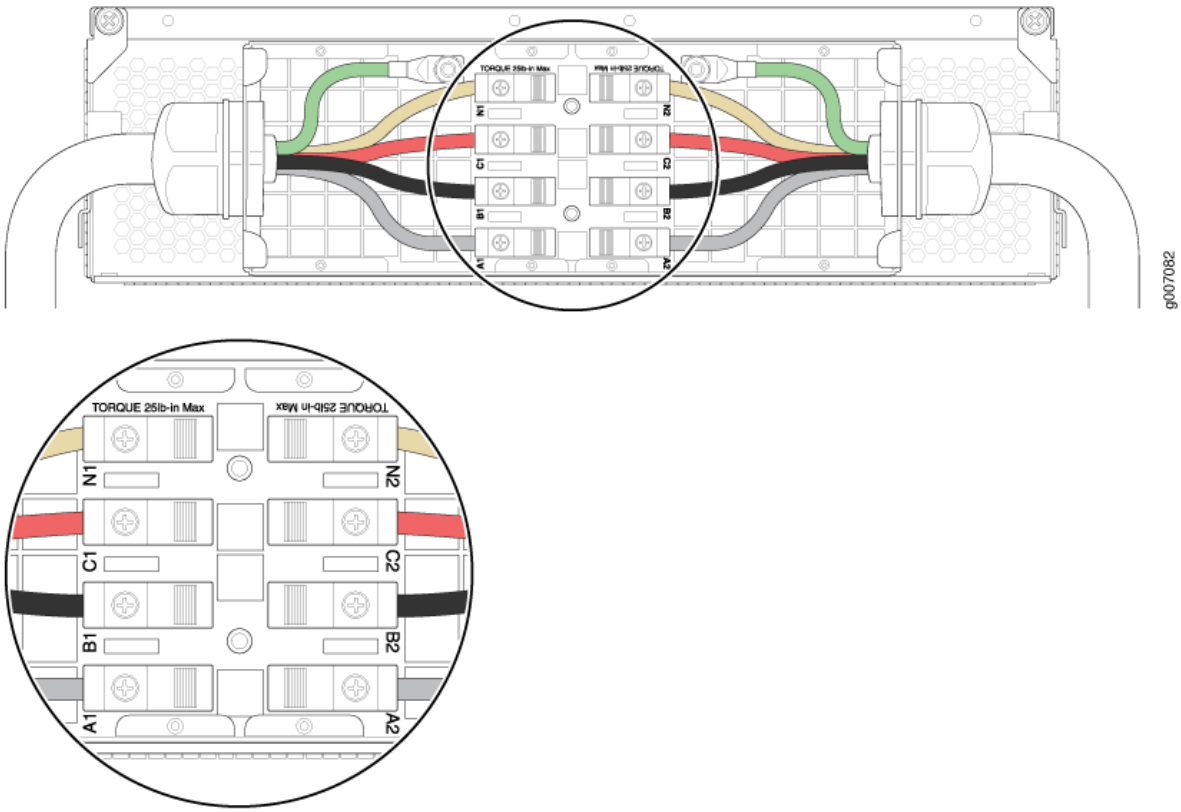
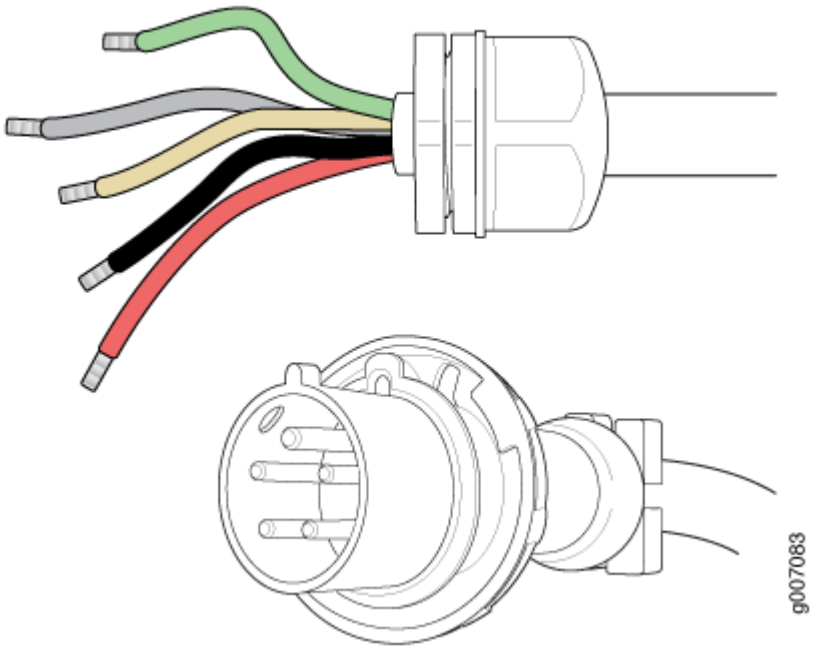


Figure 64 on page 169 shows the three-phase wye AC power cord.

Figure 64: Three-Phase Wye AC Power Cord



RELATED DOCUMENTATION

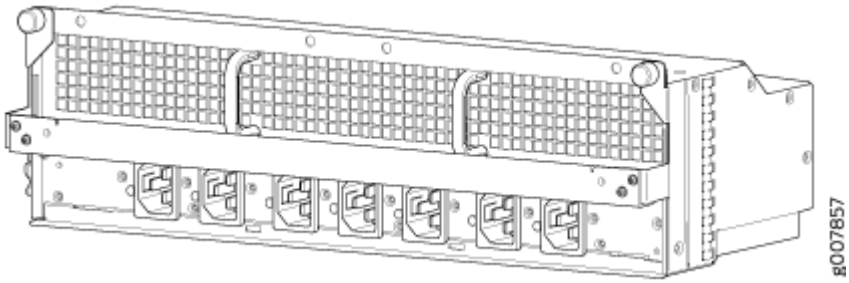
MX2020 Power Subsystem Description | **156**

MX2020 AC Power Requirements | **248**

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 65 on page 170 shows the seven-feed single-phase AC PDM.

Figure 65: 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

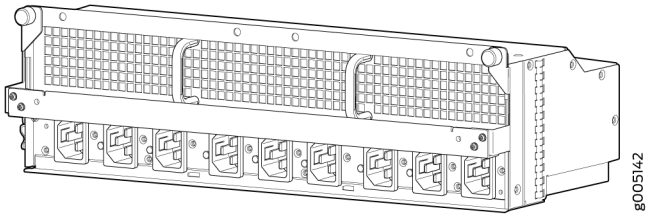
- MX2020 AC Power Requirements | **248**

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 66 on page 171 shows the nine-feed single-phase AC PDM.

Figure 66: 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 | **248**
- MX2020 Power Subsystem Description | **156**

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

Figure 67 on page 172 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 34 on page 172 indicate the status of the AC PDM. In addition, a PDM failure triggers the red alarm LED on the craft interface.

Figure 67: Three-Phase Delta AC PDM LEDs

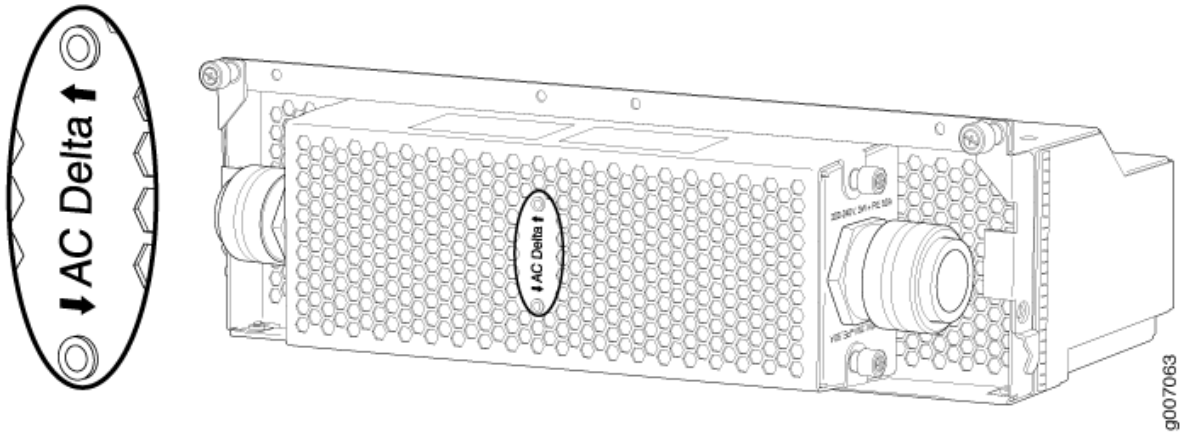


Table 34: Three-Phase Delta AC PDM LEDs

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.

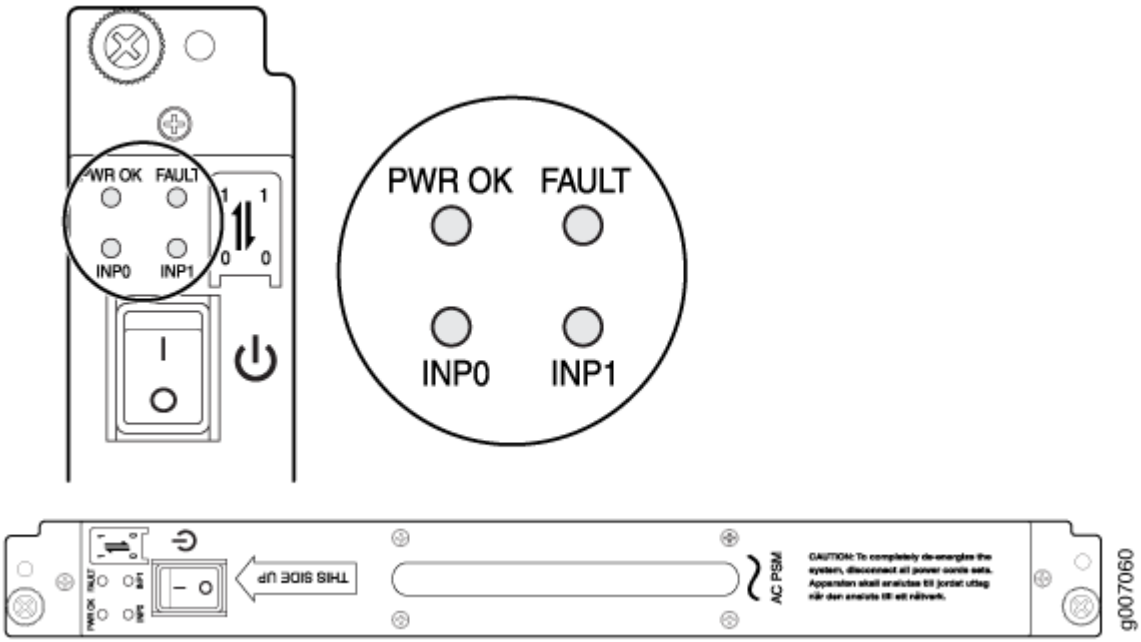
In a three-phase AC power system, the AC power going to the PSMs is split into a pair of phases. Each PSM works on a single phase. This means the power system works independent of the kind of AC feed connected. You can connect one or two feeds, depending on the power system configuration, number of PSMs, 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 68 on page 174 shows the AC PSM.

Figure 68: AC Power Supply Module

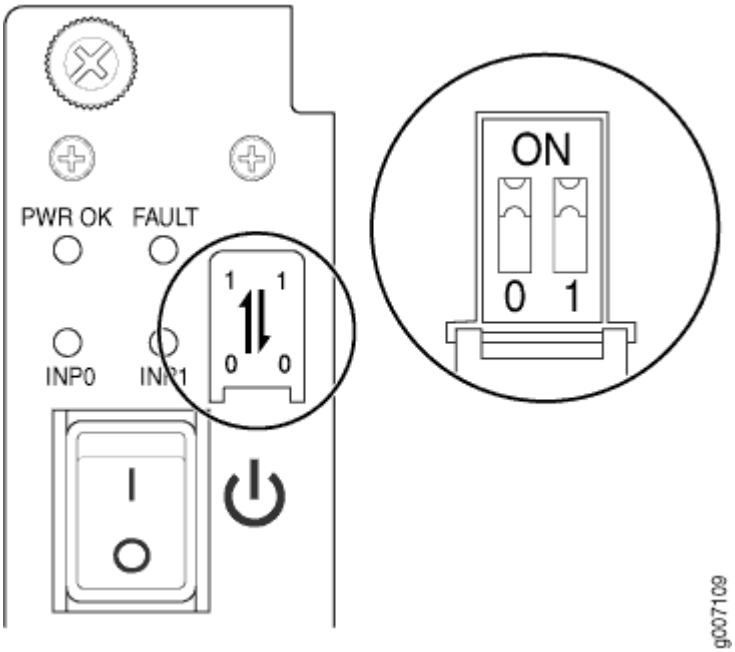


The AC power system provides dual redundant feeds (**INP0** and **INP1**). Each PSM takes in two AC feeds and uses one of the two. One input feed is active during operation. Each feed is a single-phase AC system 200–240 VAC derived from a three-phase delta or wye AC input system. These feeds are set 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 35 on page 174 and Figure 69 on page 175).

Table 35: 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 69: 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*.

RELATED DOCUMENTATION

MX2020 AC Power Supply Module LEDs | **175**

MX2020 AC Power Supply Module LEDs

Each AC PSM faceplate contains four LEDs. These LEDs are described in Table 36 on page 176. There are a total of eighteen bicolor LEDs located in the craft interface, and are labeled **0** through **8** for the bottom nine PSMs, and **9** through **17** for the top 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 36: MX2020 AC Power Supply Module LEDs

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

MX2020 DC Power Distribution Module (-48 V) Description

In the DC power configuration, the MX2020 router contains up to four DC PDMs located at the rear of the chassis in slots **PDM0/Input0** through **PDM3/Input1** (bottom to top). A minimum of one PDM is required per subsystem (two PDMs per MX2020 chassis) for nonredundant power. The DC PDMs provide power interface to seven or nine power supply modules (PSMs).

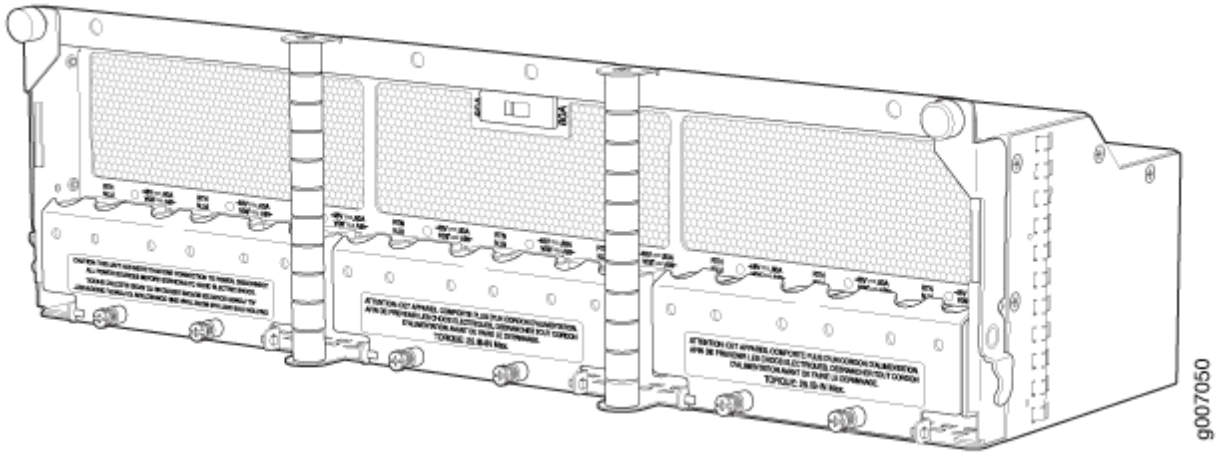
Four PDMs provide full redundancy for the MX2020 router. In a redundant configuration, a total of twenty-eight 60-A or 80-A feeds (7-feed DC PDMs), and a total of thirty-six 60-A or 80-A feeds (9-feed DC PDMs) are supported.

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), (see Figure 70 on page 177). 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 70: MX2020 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 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

- MX2020 DC Power Distribution Module (-48 V) LEDs | 179
- Calculating DC Power Requirements for MX2020 Routers
- DC Power (-48 V) Circuit Breaker Requirements for the MX2020 Router | 304
- MX2020 DC Power Distribution Description | 288
- DC Power Cable Specifications for the MX2020 Router | 305

MX2000 DC Power Distribution Module (240 V China) Description

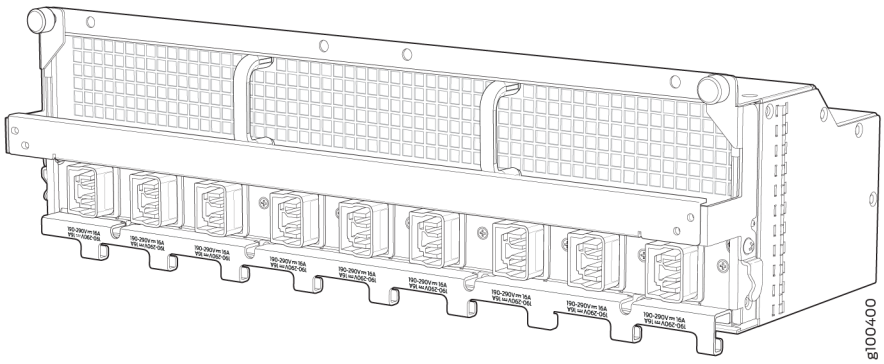
In the DC (240-V China) power configuration, the MX2000 router contains up to four DC PDMs (240-V China) located at the rear of the chassis in slots **PDM0/Input0** through **PDM3/Input1** (bottom to top). A minimum of one PDM is required per subsystem (two PDMs per MX2020 chassis) for nonredundant power. The DC PDMs provide power interface to nine power supply modules (PSMs).

Four PDMs provide full redundancy for the MX2020 router. In a redundant configuration, a total of thirty-six (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 71 on page 178).

Figure 71: MX2000 DC PDM (240 V China)



RELATED DOCUMENTATION

- Calculating DC Power Requirements for MX2020 Routers
- MX2020 DC Power Distribution Description | 288
- MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications | 295

MX2020 DC Power Distribution Module (-48 V) LEDs

Each DC PDM faceplate contains one bicolor LED for each of the seven or nine input power feeds (–48 V), indicating the correct or incorrect polarity connection of each feed. See Table 37 on page 179. Figure 72 on page 179 shows the –48 V DC PDM LEDs.

NOTE: The –48 V DC PDM or PSM will have –48V written on the faceplate.

Figure 72: DC Power Distribution Module LEDs

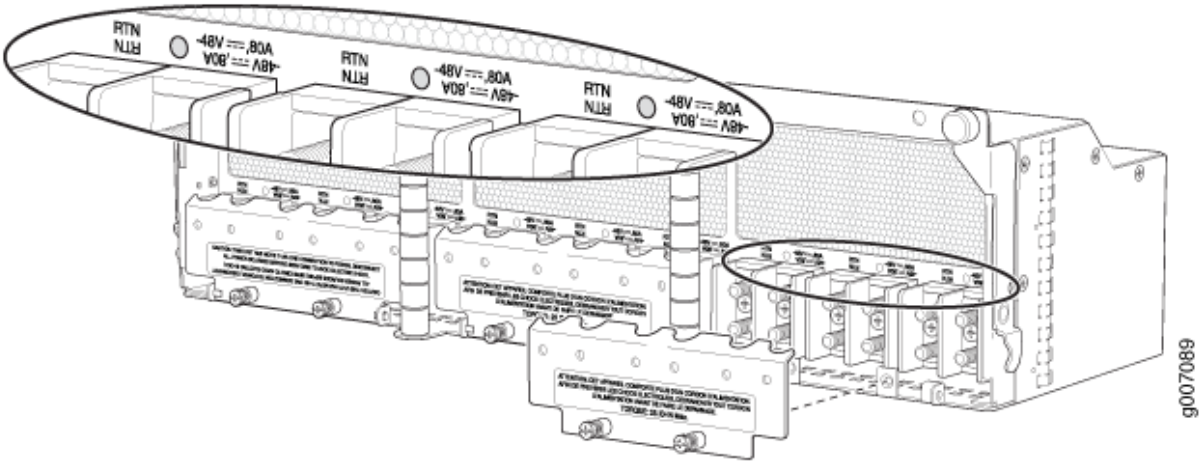


Table 37: DC Power Distribution Module LEDs

Label	Color	State	Description
–48V=80A	Green	On	RTN and –48V input feeds are connected. PDM is functioning normally.

Table 37: DC Power Distribution Module LEDs *(Continued)*

Label	Color	State	Description
	–	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

- MX2020 Component LEDs on the Craft Interface
- MX2020 Power Subsystem Description | **156**
- MX2020 DC Power Distribution Module (-48 V) Description | **176**
- MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

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. Refer to and Figure 73 on page 181 and Table 38 on page 181.

Figure 73: DC PDM (240 V China) LEDs

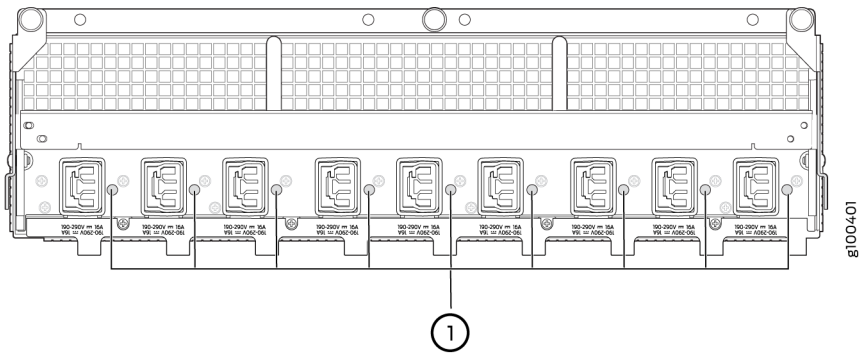


Table 38: DC Power Distribution Module (240 V China) LEDs

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

- MX2020 Component LEDs on the Craft Interface
- MX2020 Power Subsystem Description | **156**
- MX2000 DC Power Distribution Module (240 V China) Description | **178**
- MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications | **295**

MX2020 DC Power Supply Module (-48 V) Description

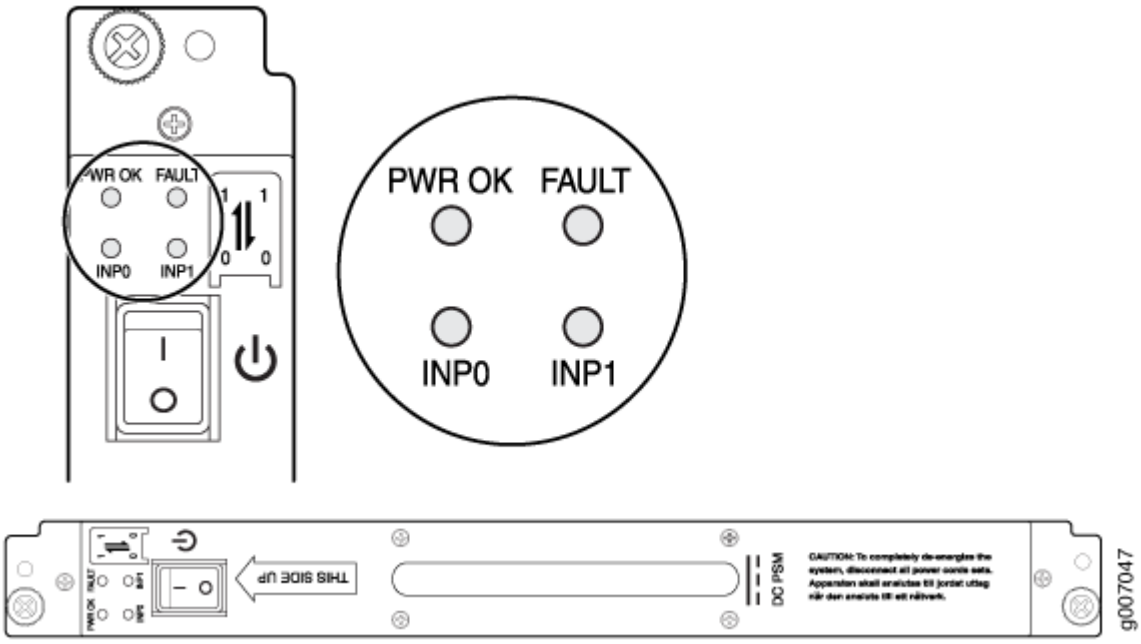
The MX2020 supports a two zone DC power system. Each zone (upper and lower) is provided power by one half of the power subsystem. In the DC power configuration, the router contains up to eighteen DC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8** (bottom), and slots **PSM9** through **PSM17** (top) (left to right). The DC PSMs in slots **PSM0** through **PSM8** provide power to the lower half

of the router components, MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **1**, and **2**. The DC PSMs in slots **PSM9** through **PSM17** provide power to the upper half of the router components, MPCs in slot **10** through **19**, CB_REs in slot **0**, and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **2**, and **3**.

NOTE: The MX2020 systems configured for DC input power must use only DC 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 74 on page 182) shows the DC PSM.

Figure 74: DC (-48 V) Power Supply Module



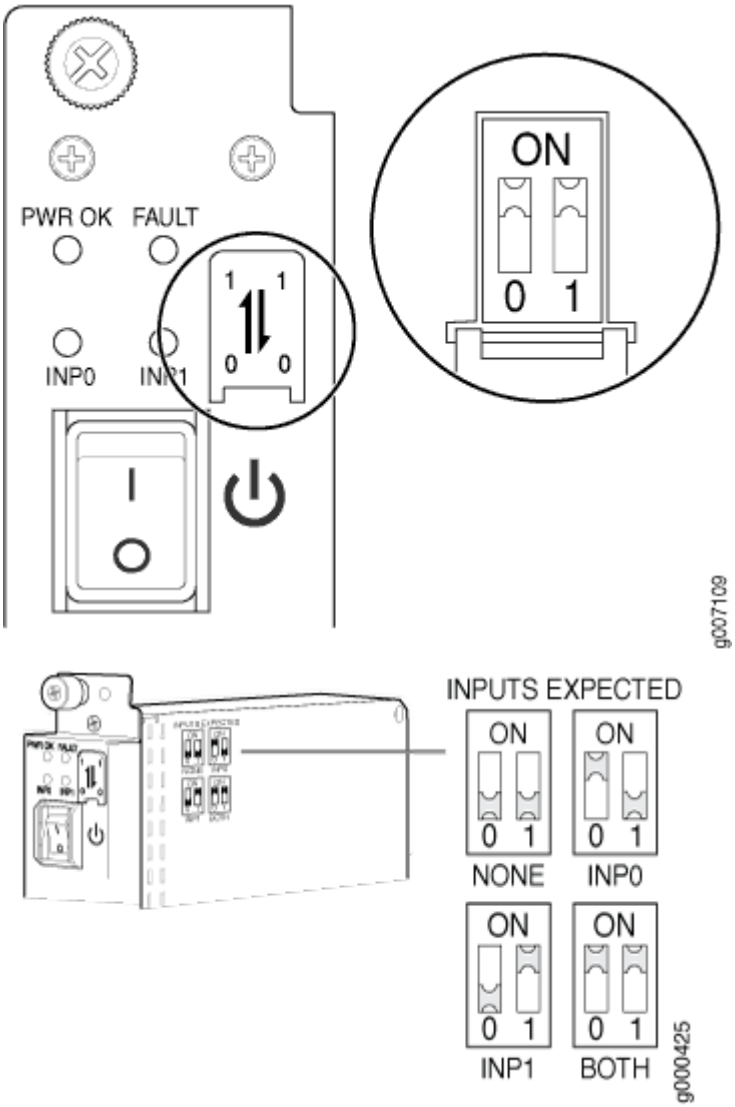
The DC power subsystem is feed redundant. Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. If two feeds are connected, PSM input power will be drawn from the feed with the higher voltage present. There are two PDMs per power subsystem 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 39 on page 183 and Figure 75 on page 184). 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" on page 292.

Table 39: 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 75: Selecting Input Feed on the (-48 V) DC Power Supply Module



RELATED DOCUMENTATION

- MX2020 DC Power Supply Module LEDs | **187**
- DC Power (-48 V) Circuit Breaker Requirements for the MX2020 Router | **304**
- MX2020 DC Power Distribution Description | **288**
- DC Power Cable Specifications for the MX2020 Router | **305**
- Installing an MX2020 Air Filter | **614**
- Removing the MX2020 Air Filter | **606**

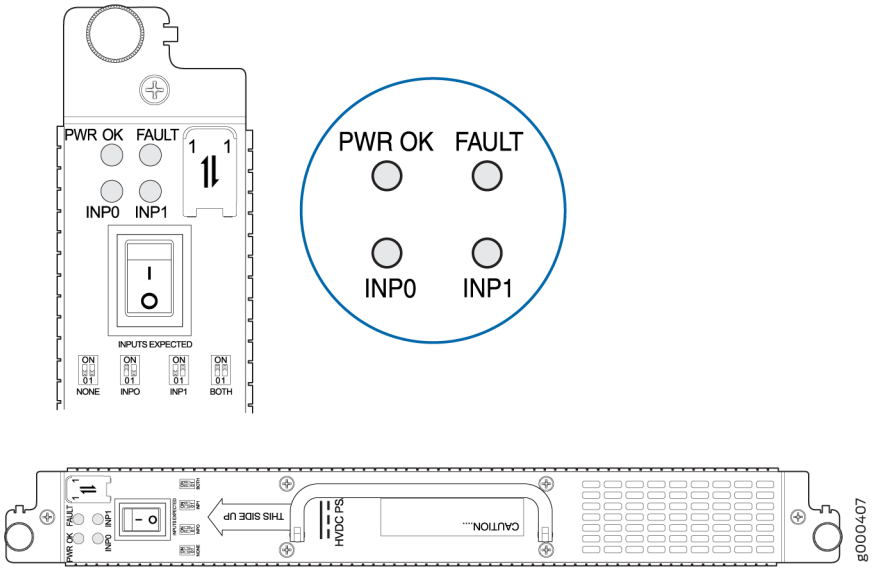
MX2000 DC Power Supply Module (240 V China) Description

The MX2020 supports a two zone DC power system. Each zone (upper and lower) is provided power by one half of the power subsystem. In the DC power configuration, the router contains up to eighteen DC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8** (bottom), and slots **PSM9** through **PSM17** (top) (left to right). The DC PSMs in slots **PSM0** through **PSM8** provide power to the lower half of the router components, MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **1**, and **2**. The DC PSMs in slots **PSM9** through **PSM17** provide power to the upper half of the router components, MPCs in slot **10** through **19**, CB_REs in slot **0**, and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **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 76 on page 185) shows the DC PSM.

Figure 76: DC Power Supply Module (240 V China)



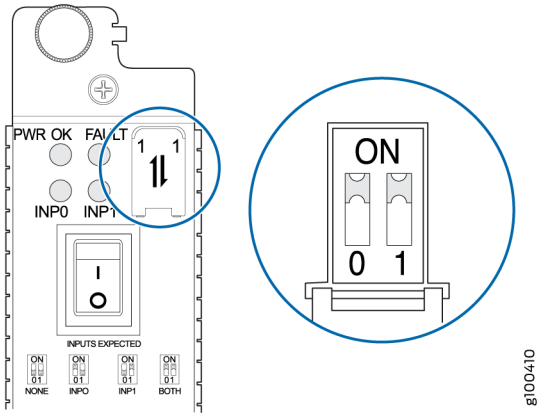
The DC power system is feed redundant. Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. If two feeds are connected, PSM input power will be drawn from the feed with the higher voltage present. There are two PDMs per power subsystem capable 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 40 on page 186 and Figure 77 on page 186). 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 (240 V China) Power Subsystem Electrical Specifications" on page 295.

Table 40: 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**)
On	On	Both Input 0 and Input 1

Figure 77: Selecting Input Feed on the DC Power Supply Module (240 V China)



RELATED DOCUMENTATION

MX2020 DC Power Supply Module LEDs | 187

DC Power (-48 V) Circuit Breaker Requirements for the MX2020 Router | 304

MX2000 DC Power Distribution Module (240 V China) Description | 178

DC Power Cable Specifications for the MX2020 Router | 305

Installing an MX2020 Air Filter | 614

Removing the MX2020 Air Filter | 606

MX2020 DC Power Supply Module LEDs

Each DC PSM (-48 V and 240 V China) faceplate contains four LEDs. These LEDs are described in Table 41 on page 187. Eighteen bicolor LEDs labeled **0** through **8** for the bottom nine PSMs, and **9** through **17** for the top 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 may or may not be providing current. In addition, a PSM failure triggers the alarm LED on the craft interface.

Table 41: MX2020 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.

Table 41: MX2020 DC Power Supply Module LEDs *(Continued)*

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

RELATED DOCUMENTATION

- MX2020 Component LEDs on the Craft Interface
- MX2020 Power Subsystem Description | **156**
- MX2020 DC Power Supply Module (-48 V) Description | **181**
- MX2000 DC Power Supply Module (240 V China) Description | **185**
- MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

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

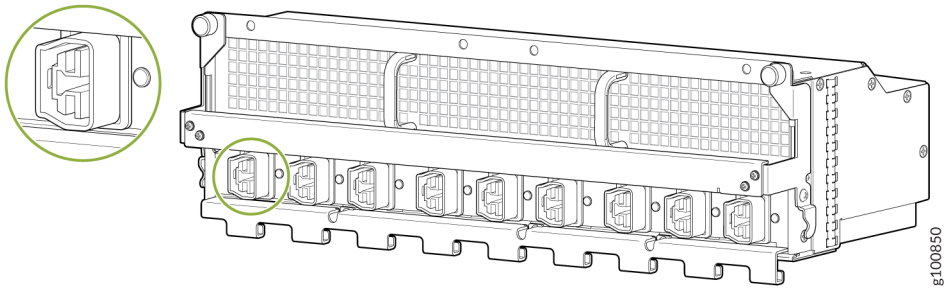
In the high-voltage second-generation universal (HVAC/HVDC) power configuration, the MX2000 router contains up to four high-voltage universal (MX2K-PDM-HV) PDMs located at the rear of the chassis in slots **PDM0/Input0** through **PDM3/Input1** (bottom to top). A minimum of one PDM is required per subsystem (two PDMs per MX2020 chassis) for nonredundant power. The universal (HVAC/HVDC) PDMs provide power interface to nine power supply modules (PSMs).

Four PDMs provide full redundancy for the MX2020 router. In a redundant configuration, a total of four (9-feed universal PDMs) with 36 input feeds 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 78 on page 189).)

Figure 78: MX2000 High-VoltageUniversal (HVAC/HVDC) PDM



RELATED DOCUMENTATION

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs | **189**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs | **189**

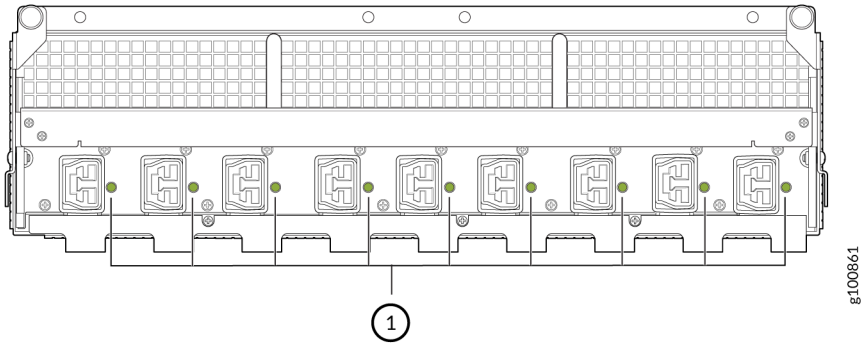
MX2020 High-Voltage Universal Power Requirements | **307**

Determining High-Voltage Universal Power Requirements for Your MX2020 Router | **321**

MX2000 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 42 on page 190 and Figure 79 on page 190 high-voltage universal (HVAC/HVDC) PDM LEDs.

Figure 79: High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs



1– LED

Table 42: 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 | **156**
- MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | **188**

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

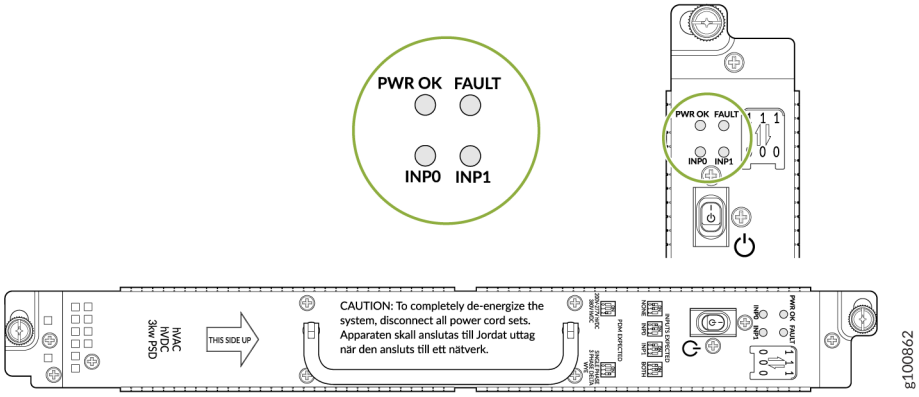
The MX2020 supports a two zone power system. Each zone upper and lower provides power to zone subsystem. In the HVAC/HVDC power configuration, the router contains up to eighteen universal (HVAC/HVDC) PSMs located at the rear of the chassis in slots **PSM0** through **PSM8** (bottom), and slots **PSM9** through **PSM17** (top) (left to right). The universal (HVAC/HVDC) PSMs in slots **PSM0** through

PSM8 provide power to the lower half of the router components, MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **1**, and **2**. The universal PSMs in slots **PSM9** through **PSM17** provide power to the upper half of the router components, MPCs in slot **10** through **19**, CB_REs in slot **0**, and **1**, SFBs in slot **0** through **7**, and Fan Trays **0**, **2**, and **3**. CB_REs in slot 0 and 1, and SFBs in slot 0 through 7 are powered from parallel connected **PSM0** through **PSM8**, and parallel connected **PSM9** through **PSM17**.

NOTE: The MX2020 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 80 on page 191 shows the universal PSM.

Figure 80: High-Voltage Universal (HVAC/HVDC) Power Supply Module



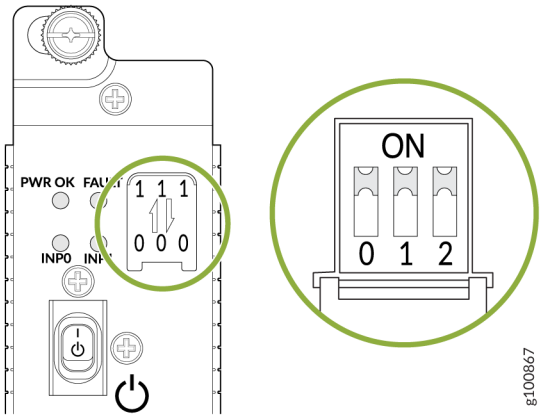
The HVAC/HVDC power system is feed redundant. Each universal PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. The PSM has two independent power trains connected in parallel at the output while each input is connected to its own feed. Power always is drawn from both feeds. There are two PDMs per power subsystem 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 43 on page 192 and Figure 81 on page 192). 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 "MX2020 High-Voltage Universal Power Supply Module LEDs" on page 193.

Table 43: 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 81: 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 81 on page 192. 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 44:

Switch Location Right (Input 2)	Meaning

On. See Figure 81 on page 192.	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

- MX2020 DC Power Supply Module LEDs | **187**
- MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | **188**
- MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module LEDs | **189**
- DC Power Cable Specifications for the MX2020 Router | **305**
- Installing an MX2020 Air Filter | **614**
- Removing the MX2020 Air Filter | **606**

MX2020 High-Voltage Universal Power Supply Module LEDs

Each high-voltage second-generation universal (HVAC/HVDC) PSM faceplate contains four LEDs. These LEDs are shown in Figure 82 on page 194 and Table 45 on page 194. Eighteen bicolor LEDs labeled **0** through **8** for the bottom nine PSMs, and **9** through **17** for the top 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 82: MX2020 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs

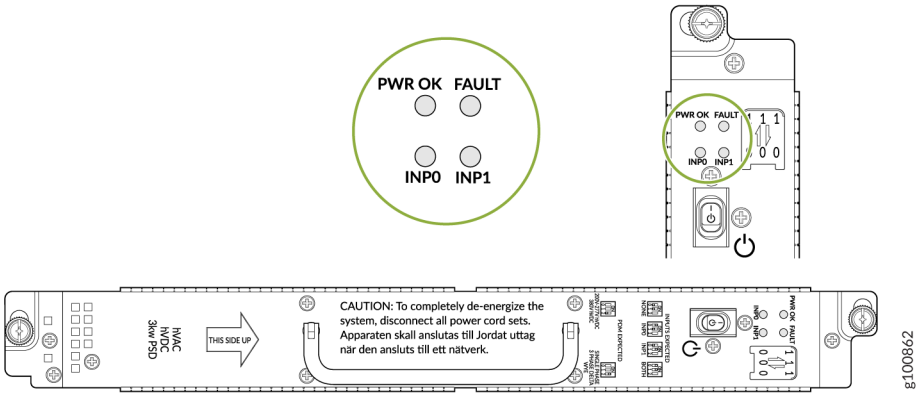


Table 45: MX2020 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs

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
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

Table 45: MX2020 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
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 | **156**
- MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description | **190**
- MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

PART 2

Site Planning, Preparation, and Specifications

CHAPTER 9

Planning and Preparing the Site

IN THIS CHAPTER

Overview of Preparing the Site for the MX2020 Router

To prepare a site for router installation:

1. Verify that environmental factors such as temperature and humidity do not exceed router tolerances. See:
   - "MX2020 Router Environmental Specifications" on page 216
2. Verify that the site and installation plan meets all safety guidelines and requirements. See:
   - *General Electrical Safety Guidelines and Warnings*
3. Locate sites for connection of system grounding. See:
   - *MX2000 Router Grounding Specifications*

4. Calculate the power consumption and requirements.

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

   - AC power:
     - MX2020 AC Power Electrical Safety Guidelines
     - MX2020 AC Power Subsystem Electrical Specifications
     - MX2020 Three-Phase Delta AC Power Distribution Module Specifications
     - MX2020 Three-Phase Wye AC Power Distribution Module Specifications
     - "MX2020 AC Power Requirements" on page 248
     - MX2020 AC Power Cord Specifications
   - DC power:
     - MX2020 DC Power Electrical Safety Guidelines
     - "MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications" on page 292
     - "MX2020 DC Power Supply Module (-48 V) Description" on page 181
     - "MX2000 DC Power Supply Module (240 V China) Description" on page 185
     - "MX2020 DC Power Requirements" on page 278
     - "DC Power Cable Specifications for the MX2020 Router" on page 305
     - "MX2020 DC Power Distribution Description" on page 288
     - "MX2020 DC Power Distribution (240 V China) Description" on page 290
   - Universal HVAC/HVDC power:
     - "MX2020 High-Voltage Universal Power Requirements" on page 307
     - *MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications*
     - MX2020 High Voltage Universal Power Distribution Description
     - *MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications*
     - "Determining High-Voltage Universal Power Requirements for Your MX2020 Router" on page 321

- *High-Voltage Universal (HVAC/HVDC) Power Circuit Breaker Requirements for the MX2000 Router*

5. Plan rack location, including required space clearances. See:
   - "Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router" on page 212
   - "MX2020 Physical Specifications" on page 202
6. Verify that the plan for power installation meets all electrical safety guidelines. See:
   - *General Electrical Safety Guidelines and Warnings*
7. Verify that your rack meets the minimum requirements for the installation of the router. See:
   - "MX2020 Rack Requirements" on page 208
   - "MX2020 Chassis Description" on page 36
8. Plan to secure the rack to the floor and building structure. See:
   - "MX2020 Rack Requirements" on page 208
9. Acquire cables and connections:
   - Determine the number of cables and type of cable needed based on your planned configuration. See:
     - *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:
    - "MX2020 Cable Management Description" on page 74
    - "Maintaining Cables That Connect to MX2020 MPCs or MICs" on page 781

RELATED DOCUMENTATION

MX2020 Universal Edge Router Overview | 34

MX2020 Site Preparation Checklist

The checklist in Table 46 on page 200 summarizes the tasks you must perform when preparing a site for router installation.

Table 46: MX2020 Site Preparation Checklist

Item or Task	For More Information	Performed By	Date
Environment			
Verify that environmental factors such as temperature and humidity do not exceed router tolerances.	"MX2020 Router Environmental Specifications" on page 216		
Power			
Measure distance between external power sources and router installation site.	"MX2020 DC Power Distribution Module (-48 V) Description" on page 176 "MX2000 DC Power Distribution Module (240 V China) Description" on page 178 "MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description" on page 188		
Locate sites for connection of system grounding.	*MX2000 Router Grounding Specifications*		

Table 46: MX2020 Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
Calculate the power consumption and requirements.	"MX2020 AC Power Requirements" on page 248 "MX2020 DC Power Requirements" on page 278		
Rack			
Verify that your rack meets the minimum requirements for the installation of the router. **NOTE**: There must be a minimum of 45U of usable rack space when installing the MX2020 router into a 45U rack.	"MX2020 Rack Requirements" on page 208 "MX2020 Cabinet Size and Clearance Requirements" on page 211		
Plan rack or cabinet location, including required space clearances. **NOTE**: If you are installing the MX2020 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 45U rack space from access during installation.	"MX2020 Cabinet Size and Clearance Requirements" on page 211, "MX2020 Rack Requirements" on page 208, "Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router" on page 212		
If a rack is used, secure rack to floor and building structure.	"MX2020 Rack Requirements" on page 208		
Cables and Transceivers			

Table 46: MX2020 Site Preparation Checklist *(Continued)*

Item or Task	For More Information	Performed By	Date
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*		
Plan the cable routing and management.	"Maintaining Cables That Connect to MX2020 MPCs or MICs" on page 781		

RELATED DOCUMENTATION

Installing an MX2020 Router Overview | 326

Unpacking the MX2020 Router | 333

MX2020 Physical Specifications

Table 47 on page 203 and Table 48 on page 203 summarize the physical specifications for the router chassis and the components.

Table 47: MX2020 Shipping Weight Specifications

Item	Shipping Weight
Shipping crate and pallet	308.5 lb (139.3 kg)
Unpopulated MX2020	390.5 lb (177.1 kg)
Unpopulated MX2020 with shipping crate and pallet	699 lb (317.1 kg)
Fully populated MX2020 with shipping crate and pallet	1,680 lb (762 kg)

Table 48: MX2020 Physical Specifications

Description	Weight	Width	Depth	Height
Chassis dimensions	• Chassis with components removed: 390.5 lb (177.1 kg) • Chassis with maximum configuration: 1371.5 lb (622.1 kg)	19 in. (48.26 cm) (including the mounting flanges)	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	78.75 in (200 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)

Table 48: MX2020 Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
ADC	15 lb (6.80 kg) Fully populated with 20 total: 300 lb (136.07 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)
MPC	MPC without MICs: 23.8 lb (10.79 kg) MPC with MICs: 25 lb (11.34 kg) Fully populated with 20 total: 500 lb (226.79 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 (4.08 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 18 total: 126 lb (57.15 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 4 total: 48 lb (21.77 kg)	17.1 in. (43.43 cm)	4.76 in. (12.09 cm)	7.361 in. (18.69 cm)
DC PDM (-48 V)	8.0 lb (3.62 kg) Fully populated with 4 total: 32 lb (14.515 kg)	16.8 in. (42.67 cm)	5.2 in. (13.20 cm)	4.2 in. (10.66 cm)

Table 48: MX2020 Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
DC PSM (-48 V)	7.0 lb (3.17 kg) Fully populated with 18 total: 126 lb (57.15 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 18 total: 147.6 lb (66.95 kg)	1.65 in. (4.19 cm)	7.224 in. (18.34 cm)	15.10 in. (38.35 cm)
DC PDM (240 V China)	9.2 lb (4.17 kg) Fully populated with 4 total: 36.80 lb (16.69 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 18 total: 142.2 lb (64.8 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 4 total: 34.8 lb (15.92 kg)	16.7 in. (42.4 cm)	5.2 in. (13.20 cm)	5.12 in. (13.00 cm)
Air filter (lower)	1 lb (0.5 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)

Table 48: MX2020 Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
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)	16.225 in. (41.21 cm)
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	17 lb (7.7 kg) Fully populated with 2 total: 34 lb (15.4 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)

Table 48: MX2020 Physical Specifications *(Continued)*

Description	Weight	Width	Depth	Height
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)
Standard DC cable manager (rear)	1.2 lb (0.54 kg) Fully populated with 4 total: 4.8 lb (2.17 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 4 total: 2.8 lb (2.16 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

- MX2020 Chassis Moving Guidelines | **219**
- MX2020 Universal Edge Router Overview | **34**
- MX2020 Chassis Description | **36**

MX2020 Rack Requirements

IN THIS SECTION

Rack Size and Strength

The MX2020 router is designed for installation in a rack that complies with either 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 which supports the chassis at the correct vertical position to properly line up the rack mount holes. Juniper Networks does not supply this hardware, but consideration for the size and weight of the chassis is important for a safe installation.

The rack rails must be spaced widely enough to accommodate the chassis's external dimensions: 78.75 in. (200 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 MX2020 Router" on page 212.

For instructions about installing the mounting hardware, see "Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet" on page 344.

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

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

- The rack must have sufficient vertical usable space to accommodate the height of the router: 78.75 in. (200 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) to 30 in. (76.2 cm) deep, and 19 in. (48.3 cm) wide (see Figure 83 on page 210).

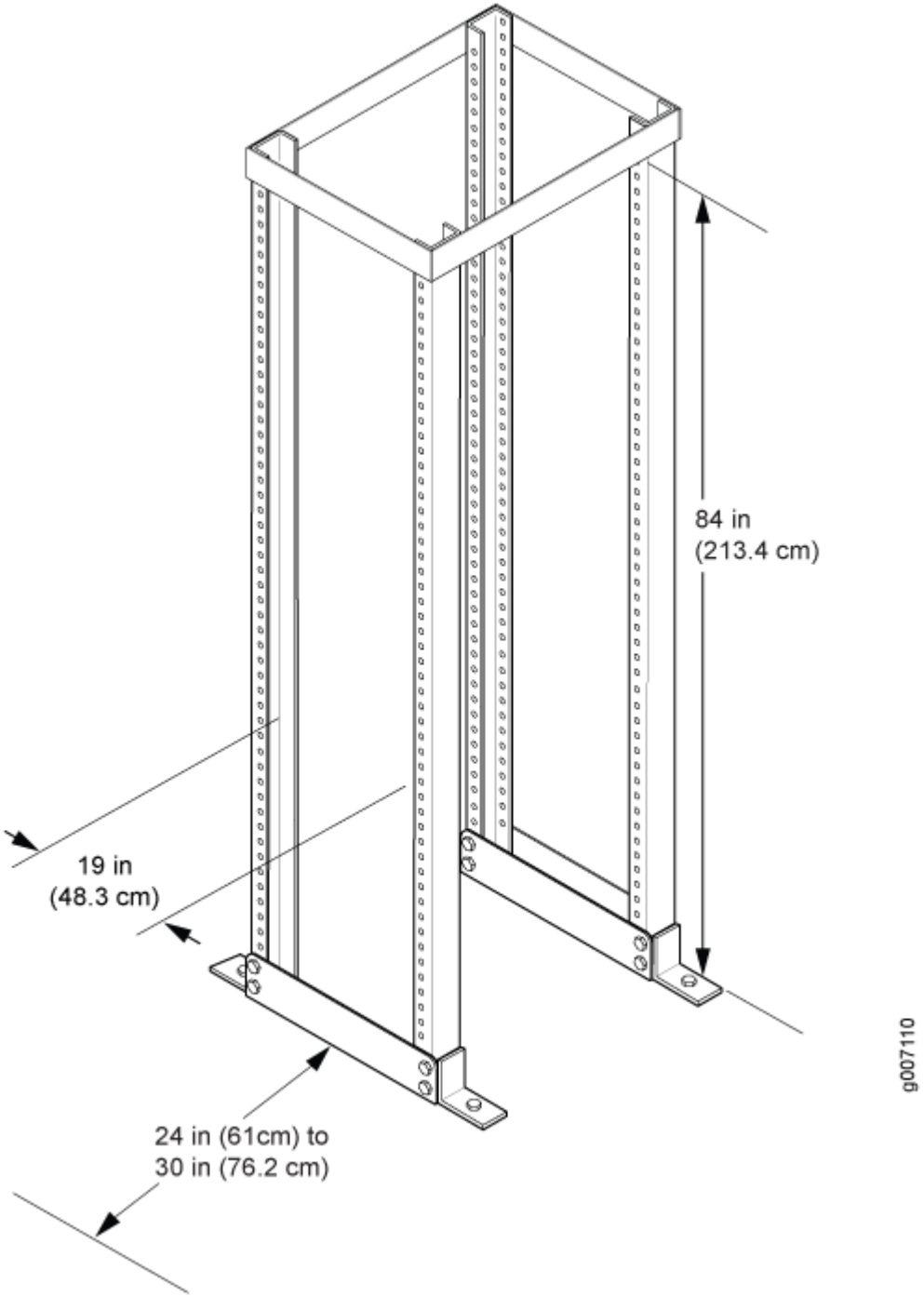
  NOTE: A **U** is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronic Components Industry Association (ECIA) (http://www.ecianow.org).

- The location of the rack must provide sufficient space to accommodate the depth of the router. The chassis with the standard cable management system is 35.72 in. (90.7 cm) deep.
- The chassis with the extended cable management system is 37.46 in. (95.1 cm) deep.
- The rack must be strong enough to support the weight of the fully configured router, up to 1,515 lb (687.19 kg).

NOTE: For a complete list of chassis and component weights and measurements, see "MX2020 Physical Specifications" on page 202.

NOTE: There must be a minimum of 45-U of usable rack space when installing the MX2020 router into a 45-U rack.

Figure 83: Typical Four-Post Rack



Spacing of Mounting Bracket Holes

The router can be mounted in any four-post rack or cabinet that provides holes or hole patterns spaced at 1 U (1.75 in.) increments. The front-mount flanges used to attach the chassis to a rack are designed to fasten to holes spaced at those distances.

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 MX2020 Router | 212
- MX2020 Rack-Mounting Hardware | 82
- MX2020 Cabinet Size and Clearance Requirements | 211
- MX2020 Cabinet Airflow Requirements | 214
- MX2020 Moving Requirements and Guidelines Using a Router Transport Kit | 220

MX2020 Cabinet Size and Clearance Requirements

The minimum size cabinet that can accommodate the router is 23.62 in. (600 mm) wide, and 39.37 in. (1000 mm) 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 45 U high that has a clearance of 35.72 in (90.7 cm) to accommodate the standard cable managers or 37.46 in (95.1 cm) to accommodate the extended cable managers. .

The minimum front and rear clearance requirements depend 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 MX2020 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 45-U rack space from access during installation.

RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router

When planning the installation site, you need to allow sufficient clearance around the rack (seeFigure 84 on page 213 and Figure 85 on page 213):

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

  Airflow must always be from front to back with respect to the rack to ensure that fresh air from the front of the rack is supplied to the inlets, and exhaust exits the rear of the rack. Care must also be taken around cables to ensure that no leakage of air in situations where recirculation may result.

  NOTE: There are no additional clearance requirements to accommodate the depth of the MX2020 Power Distribution Modules (PDMs), and Power Supply Modules (PSMs); they are within specification.

- An MX2020 router with an extended cable manager requires extra clearance to accommodate the depth of 37.46 in. (95.1 cm).

Figure 84: Chassis Dimensions and Clearance Requirements for the MX2020 Router with the Standard Cable Manager

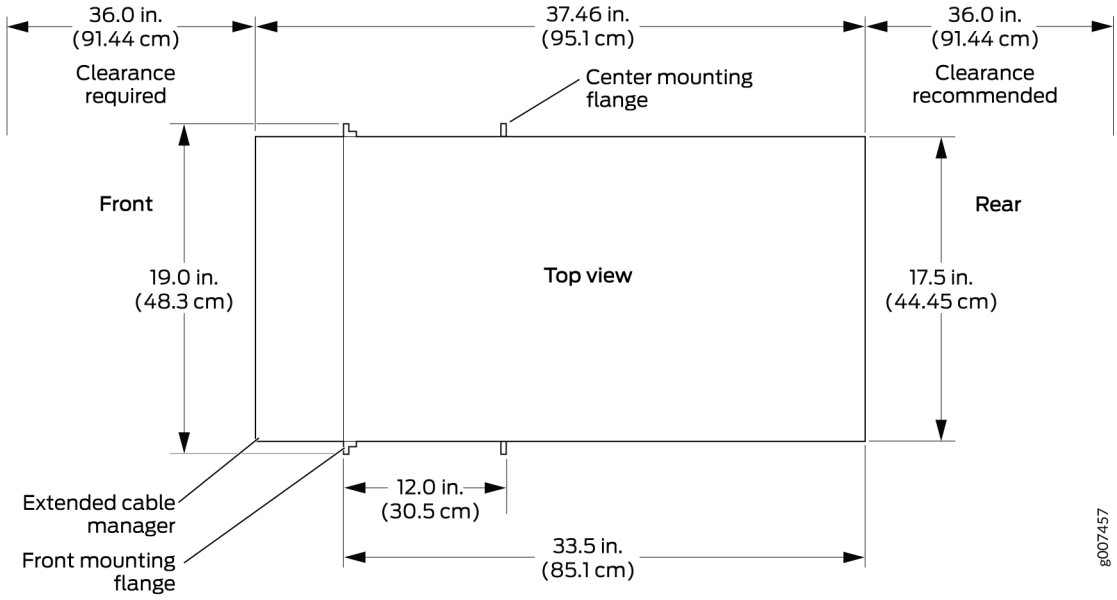
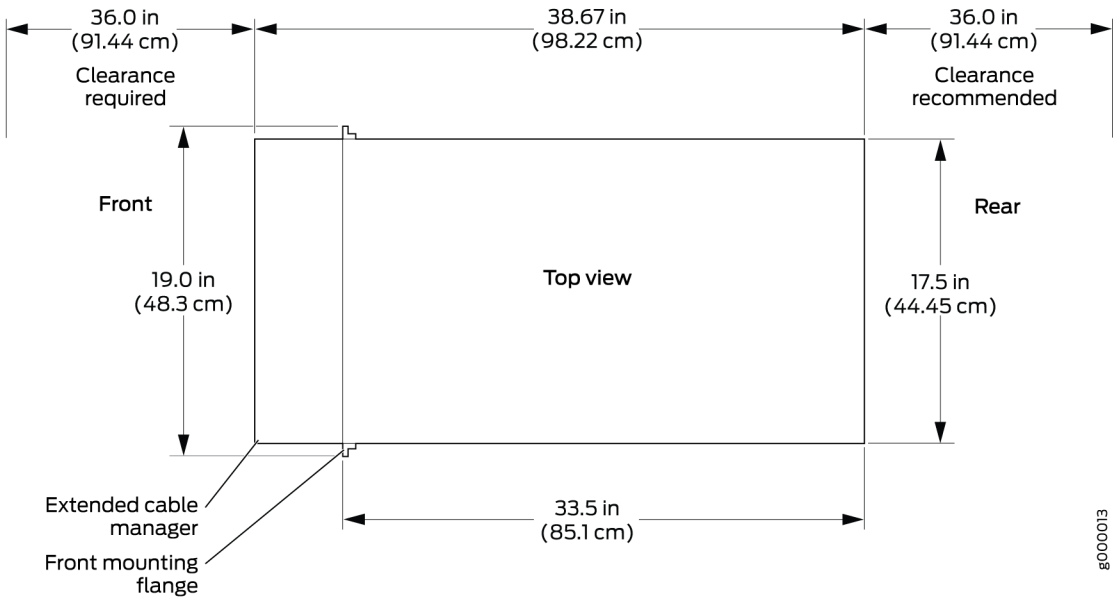


Figure 85: Chassis Dimensions and Clearance Requirements for the MX2020 Router with the Extended Cable Manager



NOTE: There must be a minimum of 45 U of usable rack space when you install the MX2020 router into a 45-U rack.

RELATED DOCUMENTATION

MX2020 Rack Requirements | 208

MX2020 Rack-Mounting Hardware | 82

MX2020 Cabinet Size and Clearance Requirements | 211

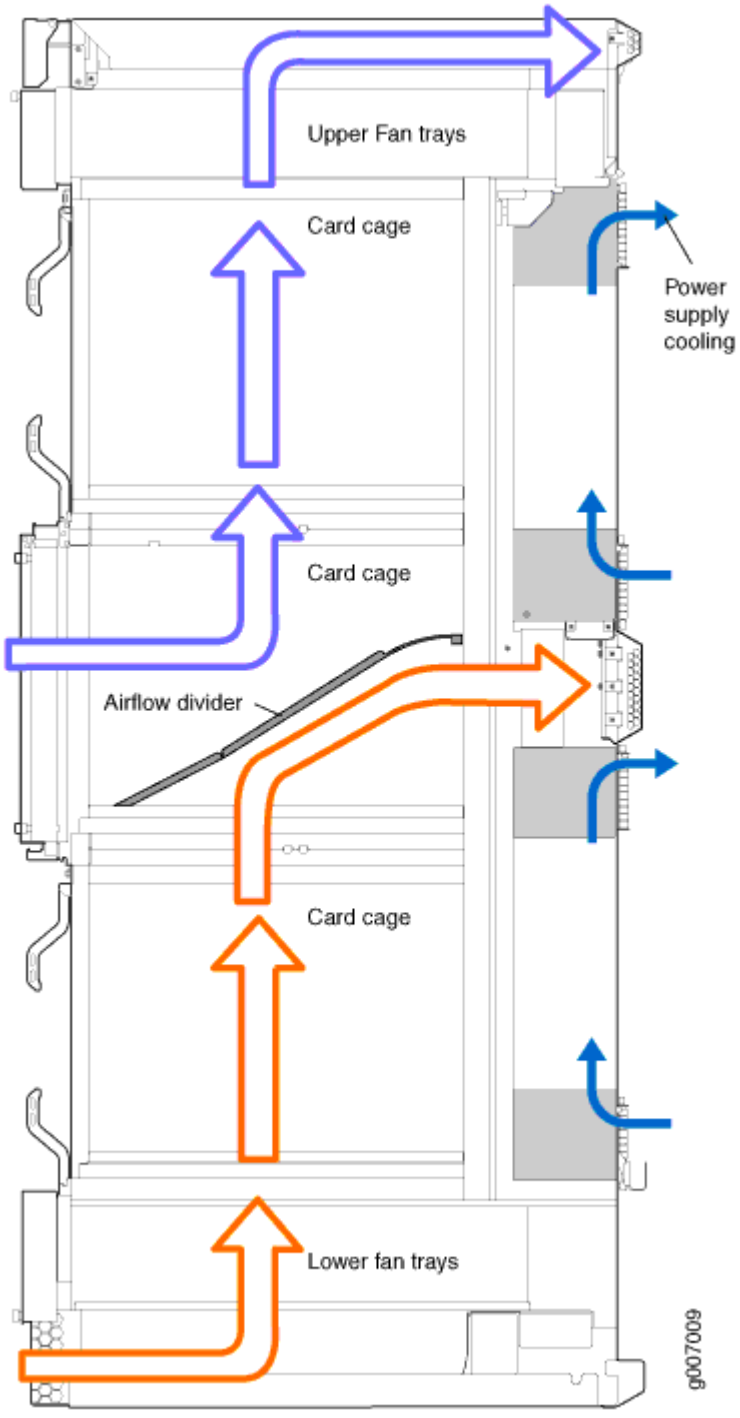
MX2020 Cabinet Airflow Requirements | 214

MX2020 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 86 on page 215.
- 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 86: Airflow Through Chassis



RELATED DOCUMENTATION

- Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router | 212
- MX2020 Cabinet Size and Clearance Requirements | 211
- MX2020 Rack Requirements | 208
- MX2020 Rack-Mounting Hardware | 82

MX2020 Router Environmental Specifications

Table 49 on page 216 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% to 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32°F (0°C) to 104°F (40°C) Nonoperating storage temperature in shipping container: –40°F (–40°C) to 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 MX2020 Hardware Components | 330

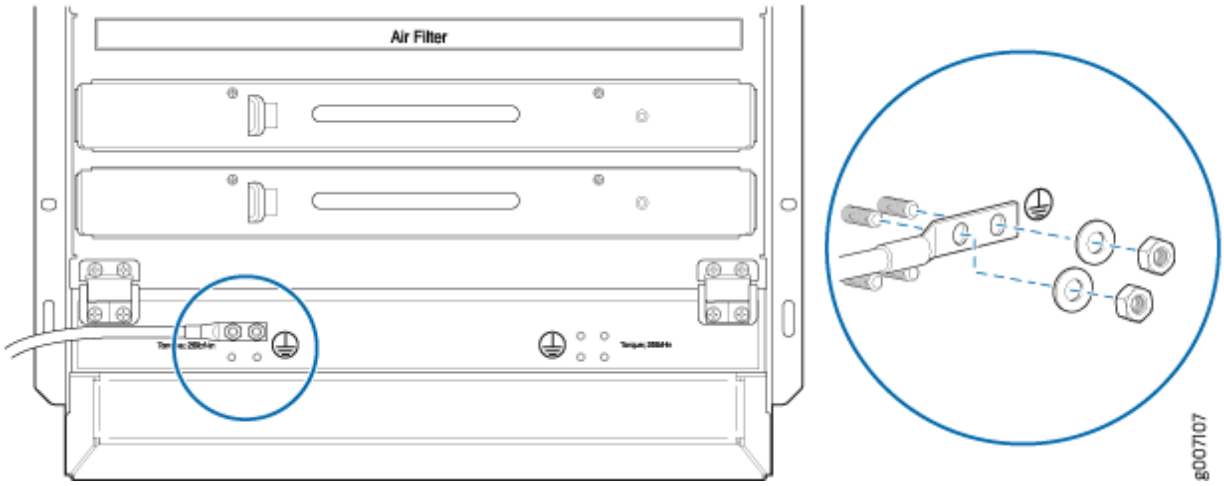
MX2000 Router Grounding Specifications

IN THIS SECTION

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 87 on page 217. 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 87: 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 88 on page 218).

Figure 88: 4-AWG DC Power Cable Lug

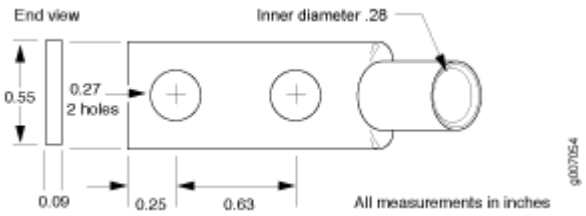


Table 50 on page 219 summarizes the specifications for the power cables, which you must supply.

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.

MX2020 Chassis Moving Guidelines

The fully configured chassis with the cable managers weighs up to 1,515 lb (687.19 kg), or 429.6 lb (194.86 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 MX2020 Router" on page 197 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. Using a pallet jack with attachment and a four person team to maneuver the router into a rack is recommended.
- 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 Electrical Safety Guidelines and Warnings

MX2020 Moving Requirements and Guidelines Using a Router Transport Kit

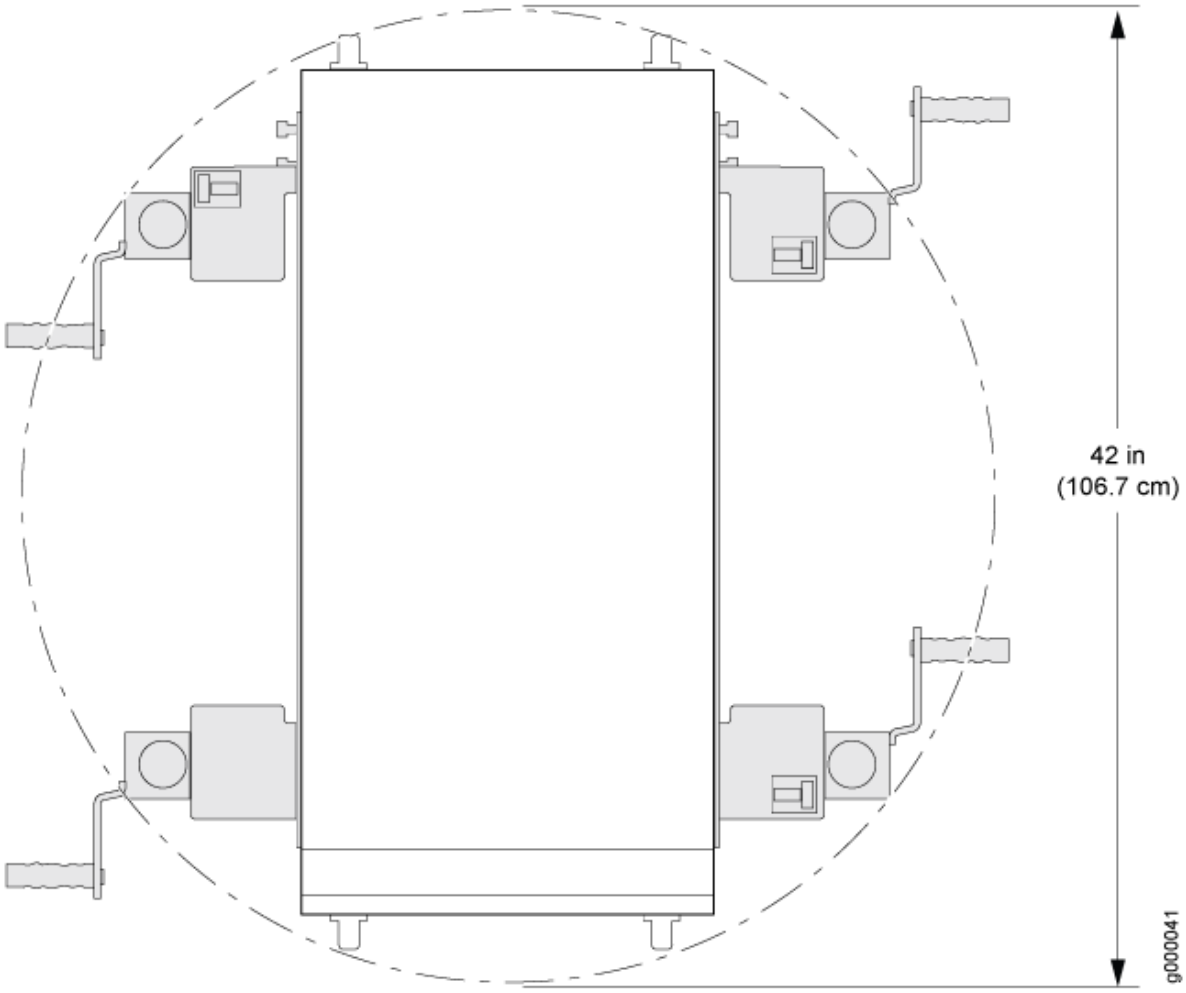
IN THIS SECTION

Router Transport Kit Turning Radius

The MX2020 requires a minimum 42 in. (106.7 cm) diameter of space to turn the chassis on the router transport kit (see Figure 89 on page 221.

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

Figure 89: Turning Diameter of Router Transport Kit

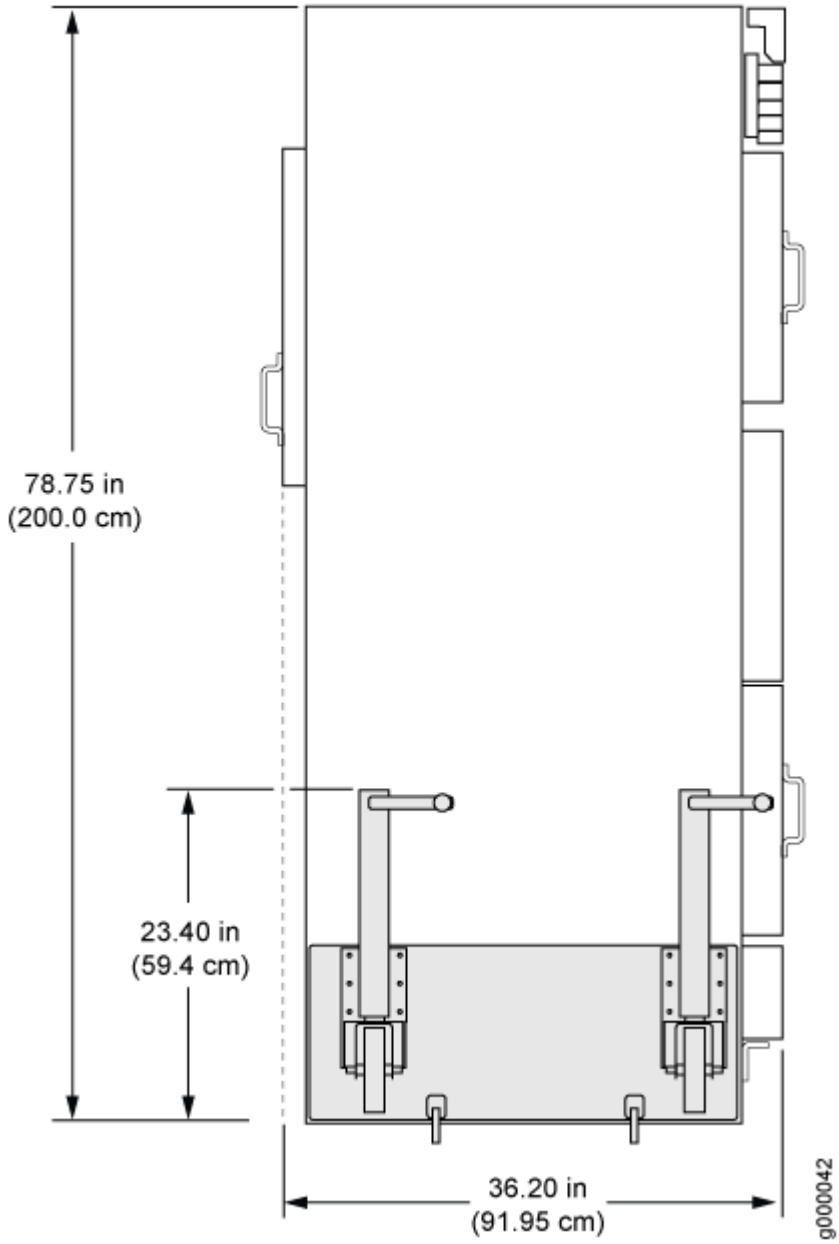


The weight of the router transport kit is 138.5 lb (63 kg). The maximum recommended height the MX2020 should be lifted from the floor using the router transport kit is 1.5 in. (3.8 cm).

Router Transport Kit Requirements

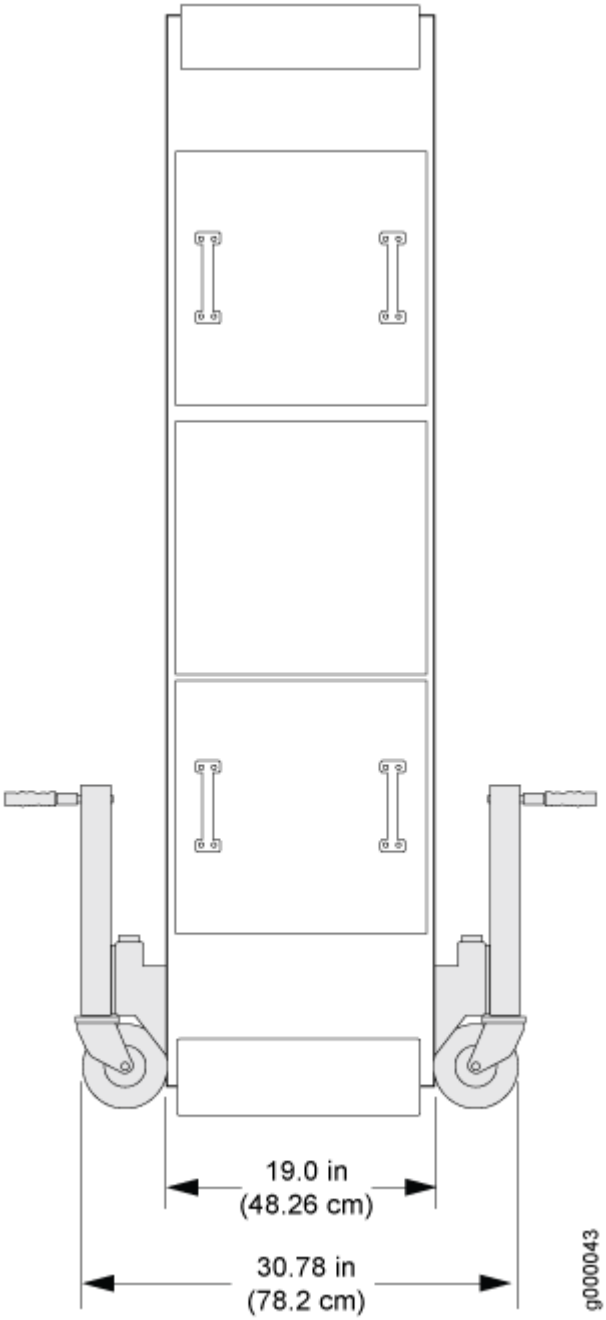
The side view measurements of the MX2020 router with the router transport kit installed is: 78.75 in. (200 cm) high, 36.20 in. (91.95 cm) wide, and 23.40 in. (59.4 cm) high (see Figure 90 on page 222).

Figure 90: Measurements of the Router Transport Kit Installed on the MX2020 (Side View)



The front view measurements of the MX2020 router with the router transport kit installed is: 30.78 in. (78.2 cm), 19 in. (48.3 cm) wide (see Figure 91 on page 223).

Figure 91: Measurements of the Router Transport Kit Installed on the MX2020 (Front View)



RELATED DOCUMENTATION

Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router | **212**

MX2020 Rack-Mounting Hardware | **82**

Rack-Mounting Requirements

- You can install the router in a four-post rack or cabinet.

  NOTE: The shipping and installation site must be an ESD approved area.

- The rack rails must be spaced wide enough to accommodate the router chassis's external dimensions: 78.75 in. (200 cm) high, 36.20 in. (91.95 cm) deep, and 19 in. (48.3 cm) wide (see Figure 92 on page 227).

  NOTE: A typical four-post rack measures 84 in. (213.4 cm) high, 24 in. (61 cm) to 30 in. (76.2 cm) deep, and 19 in. (48.3 cm) wide.

  NOTE: The dimensions also include the standard cable management system and standard EMI covers.

- The rack must be able to accommodate the additional depth of the extended cable management system, 37.46 in. (95.1 cm) deep (see Figure 92 on page 227).

- The rack must be strong enough to support the weight of the fully configured router, up to 1,500 lb (681.8 kg). See Table 51 on page 224 for MX2020 shipping weight specifications.

  Table 51: MX2020 Shipping Weight Specifications

Item	Shipping Weight
Shipping crate and pallet	180 lb (81.8 kg)
Unpopulated MX2020	300 lb (136.4 kg)

Table 51: MX2020 Shipping Weight Specifications *(Continued)*

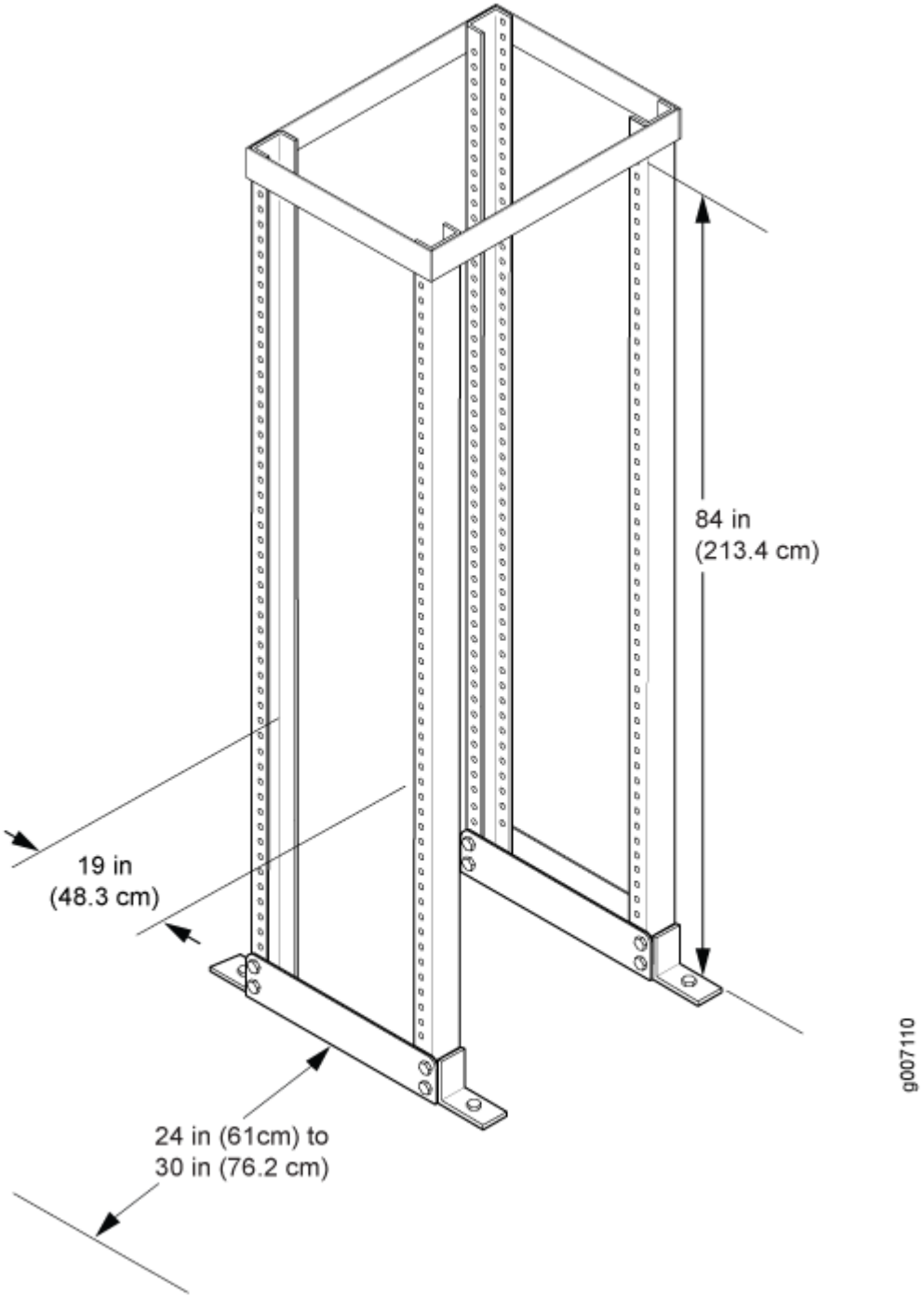
Item	Shipping Weight
Unpopulated MX2020 with shipping crate and pallet	480 lb (218.2 kg)
Fully populated MX2020 with shipping crate and pallet	1,680 lb (763.6 kg)

NOTE: For a complete list of individual line card and component weights and measurements, see the *MX2020 3D Universal Edge Router Hardware Guide* at https://www.juniper.net/documentation/.

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. Allow at least 36 in. (91.44 cm) of clearance between front-to-rear-cooled routers. Allow 2.8 in. (7 cm) between the side of the chassis and any non-heat-producing surface such as a wall.
- For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. Allow at least 36 in. (91.44 cm) in front of the router and 36 in. (91.44 cm) behind the router.
- The rack or cabinet must have an adequate supply of cooling air.
- Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router.
- The router must have the front and rear shipping covers installed to help move the router into the rack or cabinet.
- The router must be installed into a rack or cabinet that is secured to the building structure.
- Ensure that there is adequate turn radius and aisle space for the router to be installed into a rack or cabinet using a pallet jack with attachment.
- Ensure that there is adequate turn radius and aisle space for the router to be installed into a rack or cabinet using a router transport kit.
- The cabinet must be clear of any hardware, device, rack, or cabinet component that obstructs the 45 U rack space from being access during installation.

NOTE: There must be a minimum of 45-U of usable rack space when installing the MX2020 router into a 45-U rack.

Figure 92: Typical Four-Post Rack



CHAPTER 10

Transceiver and Cable Specifications

IN THIS CHAPTER

Calculating Power Budget and Power Margin for Fiber-Optic Cables

IN THIS SECTION

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

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

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

Calculate Power Budget for Fiber-Optic Cables

To ensure that fiber-optic connections have sufficient power for correct operation, you need to calculate the link's power budget (P_B), which is the maximum amount of power it can transmit. When you calculate the power budget, you use a worst-case analysis to provide a margin of error, even though all

the parts of an actual system do not operate at the worst-case levels. To calculate the worst-case estimate of P_B, you assume minimum transmitter power (P_T) and minimum receiver sensitivity (P_R):

$P_B = P_T - P_R$

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

$P_B = P_T - P_R$

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

$P_B = 13 \text{ dB}$

How to Calculate Power Margin for Fiber-Optic Cables

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

$P_M = P_B - LL$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 52 on page 229 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 P_B of 13 dB uses the estimated values from Table 52 on page 229. This example calculates LL as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The P_M is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 7\ dB$

The following sample calculation for an 8-km-long single-mode link with a P_B of 13 dB uses the estimated values from Table 52 on page 229. This example calculates LL as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The pP_M is calculated as follows:

$P_M = P_B - LL$

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

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

$P_M = 5.5\ dB$

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

Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

IN THIS SECTION

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

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

Single-mode fiber is so small in diameter that rays of light can reflect internally through one layer only. Interfaces with single-mode optics use lasers as light sources. Lasers generate a single wavelength of light, which travels in a straight line through the single-mode fiber. Compared with multimode fiber, single-mode fiber has a higher bandwidth and can carry signals for longer distances.

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

Attenuation and Dispersion in Fiber-Optic Cable

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

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

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

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

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

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

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

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

Table 53 on page 232 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 the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

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

CHAPTER 11

Pinout Specifications

IN THIS CHAPTER

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

The ports on the Control Board and Routing Engine (CB-RE) labeled **AUX** and **CONSOLE** are asynchronous serial interfaces that accept an RJ-45 connector. The ports connect the Routing Engine to an auxiliary or console management device.Table 54 on page 234 describes the RJ-45 connector pinout.

Table 54: RJ-45 Connector Pinout for the Auxiliary and Console Ports

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

Table 54: RJ-45 Connector Pinout for the Auxiliary 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

RELATED DOCUMENTATION

- *MX2000 Host Subsystem CB-RE Description*
- *Removing a CB-RE from an MX2000 Router*
- *Installing an MX2020 CB-RE*
- *CB-RE and RCB Interface Cable and Wire Specifications for MX Series Routers*

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 55 on page 236 describes the RJ-45 connector pinout.

Table 55: RJ-45 Management Port Connector Pinouts for the CB-RE or RCB MGMT Port

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

Management Cable Specifications

Table 56 on page 236 lists the specifications for the cables that connect the console and management ports to management devices.

Table 56: Specifications of Cables to Connect to Management Devices

Ports	Cable Specifications	Receptacle	Additional Information
RJ-45 Console port	Rollover cable	RJ-45	*Connect a Device to a Management Console Using an RJ-45 Connector*

Table 56: Specifications of Cables to Connect to Management Devices *(Continued)*

Ports	Cable Specifications	Receptacle	Additional Information
Management Ethernet port	Ethernet cable with an RJ-45 connector	RJ-45	*Connect a Device to a Network for Out-of-Band Management*
Mini-USB Type-B Console port	Mini-USB cable with standard-A and Mini-USB Type-B (5-pin) connector	Mini-USB	

Console Port Connector Pinout Information

The console port on a Juniper Networks device is an RS-232 serial interface that uses an RJ-45 connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 57 on page 238 provides the pinout information for the RJ-45 console connector.

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

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

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

NOTE: If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC directly to a device, use a combination of the RJ-45-to-DB-9

socket adapter and a USB-to-DB-9 plug adapter. You must provide the USB-to-DB-9 plug adapter.

Table 57: Console Port Connector Pinout Information

Pin	Signal	Description
1	NC	No connect
2	NC	No connect
3	TxD Output	Transmit data
4	GND	Signal ground
5	GND	Signal ground
6	RxD Input	Receive data
7	DCD Input	Data carrier detect
8	NC	No connect

RJ-45 to DB-9 Serial Port Adapter Pinout Information

The console port on a Juniper Networks device is an RS-232 serial interface that uses an RJ-45 connector to connect to a management device such as a laptop or a desktop PC. If your laptop or desktop PC does not have a DB-9 plug connector pin and you want to connect your laptop or desktop PC to the device, use a combination of the RJ-45 to DB-9 socket adapter along with a USB to DB-9 plug adapter.

Table 58 on page 239 provides the pinout information for the RJ-45 to DB-9 serial port adapter.

Table 58: RJ-45 to DB-9 Serial Port Adapter Pinout Information

RJ-45 pin	Signal	DB-9 pin	Signal
1	NC	8	CTS
2	NC	6	DSR
3	TxD	2	RxD
4	GND	5	GND
6	RxD	3	TxD
7	DCD	4	DTR
8	NC	7	RTS

Mini-USB Port Pinout Specifications

If your management host (laptop or PC) does not have a DB-9 plug connector pin or an RJ-45 connector pin but has a USB port, you can connect your management host to the Mini-USB Type-B console port by using a cable that has a standard Type-A USB connector on one end and a Mini-USB Type-B (5-pin) connector on the other end.

The Mini-USB Type-B console port uses a Mini-USB Type-B connector to connect to a console management device. The default baud rate for the console port is 9600 baud.

Table 59 on page 239 provides the pinout information of the Mini-USB Type-B console port.

Table 59: Mini-USB Type-B Console Port Pinout Information

Pin	Signal	Description
1	VCC	+5 VDC

Table 59: Mini-USB Type-B Console Port Pinout Information *(Continued)*

Pin	Signal	Description
2	D-	Data -
3	D+	Data +
X	N/C	Could be not connected (N/C), connected to ground (GND), or used as an attached device presence indicator
4	GND	Ground

RJ-45 Management Port Connector Pinout Information

Table 60 on page 240 provides the pinout information for the RJ-45 connector for the management port on Juniper Networks devices.

Table 60: RJ-45 Management Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1
2	TRP1-	Transmit/receive data pair 1
3	TRP2+	Transmit/receive data pair 2
4	TRP3+	Transmit/receive data pair 3
5	TRP3-	Transmit/receive data pair 3
6	TRP2-	Transmit/receive data pair 2

Table 60: RJ-45 Management Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
7	TRP4+	Transmit/receive data pair 4
8	TRP4-	Transmit/receive data pair 4

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

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

- Table 61 on page 241—10/100/1000BASE-T Ethernet network port connector pinout information
- Table 62 on page 242—SFP network port connector pinout information
- Table 63 on page 243—SFP+ network port connector pinout information
- Table 64 on page 245—QSFP+ and QSFP28 network module ports connector pinout information

Table 61: 10/100/1000BASE-T Ethernet Network Port Connector Pinout Information

Pin	Signal	Description
1	TRP1+	Transmit/receive data pair 1 Negative Vport (in PoE models)
2	TRP1-	Transmit/receive data pair 1 Negative Vport (in PoE models)
3	TRP2+	Transmit/receive data pair 2 Positive Vport (in PoE models)

Table 61: 10/100/1000BASE-T Ethernet Network Port Connector Pinout Information *(Continued)*

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

Table 62: SFP Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault
3	TX_Disable	Transmitter disabled
4	SDA	2-wire serial interface data line
5	SCL-	2-wire serial interface clock
6	MOD_ABS	Module absent
7	RS	Rate select
8	RX_LOS	Receiver loss of signal indication

Table 62: SFP Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
9	VeeR	Module receiver ground
10	VeeR	Module receiver ground
11	VeeR	Module receiver ground
12	RD-	Receiver inverted data output
13	RD+	Receiver noninverted data output
14	VeeR	Module receiver ground
15	VccR	Module receiver 3.3 V supply
16	VccT	Module transmitter 3.3 V supply
17	VeeT	Module transmitter ground
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 63: SFP+ Network Port Connector Pinout Information

Pin	Signal	Description
1	VeeT	Module transmitter ground
2	TX_Fault	Module transmitter fault

Table 63: SFP+ Network Port Connector Pinout Information *(Continued)*

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

Table 63: SFP+ Network Port Connector Pinout Information *(Continued)*

Pin	Signal	Description
18	TD+	Transmitter noninverted data input
19	TD-	Transmitter inverted data input
20	VeeT	Module transmitter ground

Table 64: QSFP+ and QSFP28 Network Port Connector Pinout Information

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

Table 64: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

Pin	Signal
12	SDA
13	GND
14	RX3p
15	RX3n
16	GND
17	RX1p
18	RX1n
19	GND
20	GND
21	RX2n
22	RX2p
23	GND
24	RX4n
25	RX4p
26	GND

Table 64: QSFP+ and QSFP28 Network Port Connector Pinout Information *(Continued)*

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

CHAPTER 12

AC Power Requirements, Specifications, and Guidelines

IN THIS CHAPTER

MX2020 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 (PSM), use the information in Table 65 on page 249 and Table 66 on page 249 to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output.

Table 67 on page 250 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*, *MPC9E*, and *MX2K-MPC11E* do not require an adapter card (ADC) to house the MPC in the MX2020 router.

Table 65: 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], four fan trays, a craft interface, eight PSMs, and two PDMs.	9,439 W (based on 55° C operation) 2,142 W (Typical)

Table 66: Typical AC Power Requirements for MX2020 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2020	
Fan trays, upper	MX2000-FANTRAY	200W * 2 = 400 W
Fan trays, lower	MX2000-FANTRAY	200 W * 2 = 400 W
MPC	MPC-3D-16XGE-SFPP	440 W * 20 = 8800 W
ADC	ADC	150 W * 20 = 3000 W
CB-RE	RE-MX2000-1800X4	150 W
	REMX2K-X8-64G	400 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 66: Typical AC Power Requirements for MX2020 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
SFB—slots 0 through 7	MX2000-SFB	200 W * 8 = 1600 W

If you do not plan to provision as recommended above, you can use the information in Table 67 on page 250 to calculate the power consumption for your hardware configuration.

Table 67: MX2020 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	250 W (Typical) 295 W at 55° C 280 W at 40° C 270 W at 25° C
Fan Trays		

Table 67: MX2020 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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		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	RE-MX2000-1800X4	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
	REMX2K-X8-64G	400 W
MPCs		
MPC-3D-16XGE-SFPP	MPC-3D-16XGE-SFPP	440 W at 55° C ambient

Table 67: MX2020 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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
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

Table 67: MX2020 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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:** 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	MPC4E-3D-32XGE-SFPP	610 W **With optics:** 607 W at 55° C, with SFPP ZR optics 590 W at 40° C, with SFPP ZR optics 585 W at 25° C, with SFPP ZR optics

Table 67: MX2020 FRU AC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	610 W **With optics:** 607 W at 55° C, with SFPP ZR and CFP LR4 optics 590 W at 40° C, with SFPP ZR and CFP LR4 optics 585 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 67: MX2020 FRU AC 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 67: MX2020 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 67: MX2020 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 67: MX2020 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

- MX2020 Power Subsystem Description | 156
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules
- *Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules*
- *Connecting Power to an MX2000 Single-Phase AC Power Distribution Module*
- MX2020 AC Power Subsystem Electrical Specifications
- *MX2000 AC Power Cord Specifications*
- MX2020 AC Power Electrical Safety Guidelines

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*.

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 68 on page 260 and Table 69 on page 261 provide specifications for the AC power cords for each region supported. Figure 93 on page 260 and Figure 94 on page 261 illustrate the plug on the three-phase Delta and Wye AC power cords.

Table 68: Three-Phase Delta and Wye AC Power Cord Specifications

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

Figure 93: Three-Phase Delta AC Power Cord

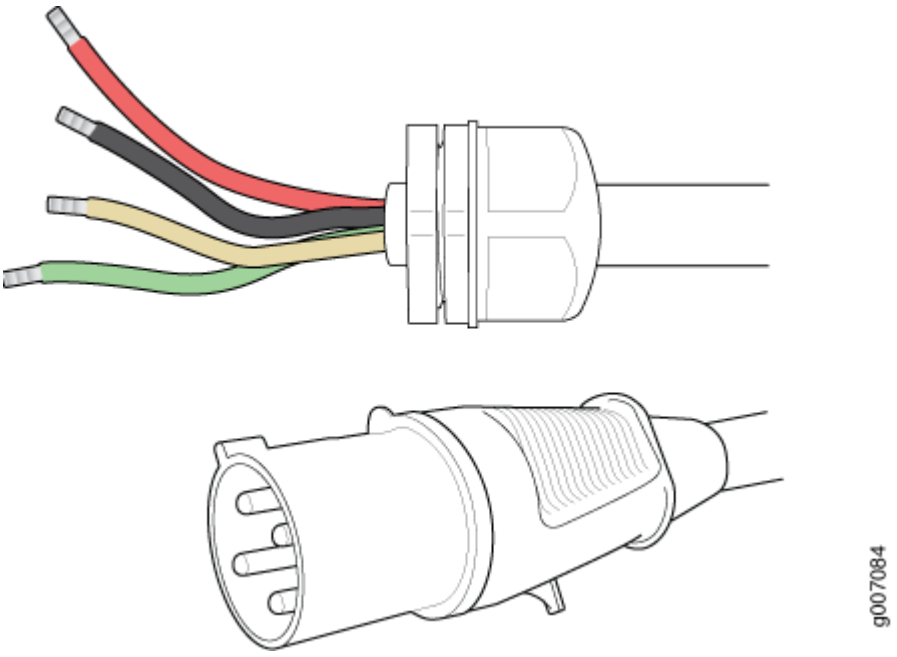


Figure 94: Three-Phase Wye AC Power Cord

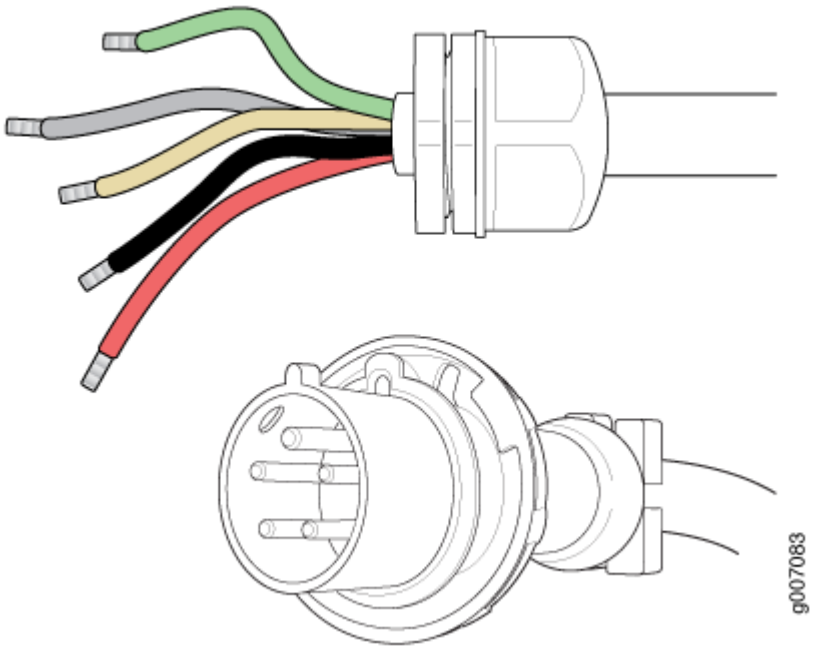


Table 69: Single-Phase AC Power Cord Specifications

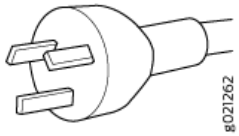
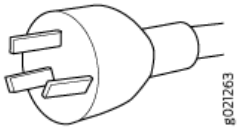
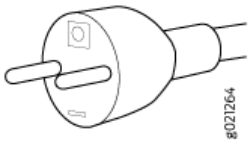
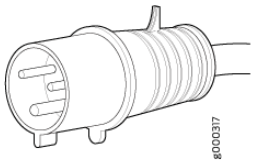
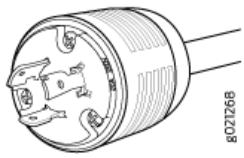
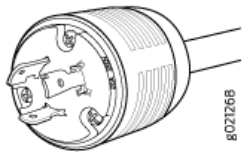
Region	Model Number	Electrical Specification	Plug Type	Graphic
Australia	CBL-PWR-C21S-AU	15 A @ 250 VAC	AS/NZS 3112	
China	CBL-PWR-C21S-CH	16 A @ 250 VAC	GB 1002/GB 2099	
Europe	CBL-PWR-C21S-EU	16 A @ 250 VAC	CEE (7) VII	

Table 69: 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

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

Replacing an MX2020 Three-Phase Delta AC Power Cord | **809**

Replacing an MX2020 Three-Phase Wye AC Power Cord | **816**

MX2000 AC Power System Electrical Specifications

IN THIS SECTION

Table 70 on page 263 lists the AC power system electrical specifications for the MX2000 line of routers.

Table 70: 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 71 on page 264 lists the electrical specifications for each fuse.

Table 71: 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*
- *MX2000 Three-Phase Wye AC Power Distribution Module Description*
- *MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description*
- *MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description*
- *MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications*
- *MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications*
- *MX2000 Single-Phase AC Power Distribution Module Electrical Specifications*

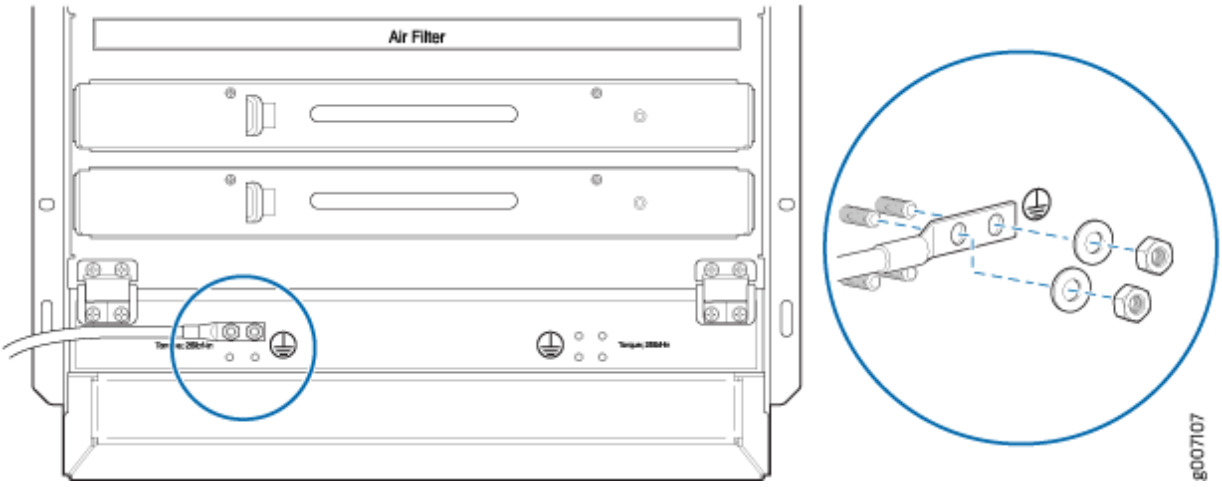
MX2000 Router Grounding Specifications

IN THIS SECTION

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 95 on page 266. 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 95: 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 96 on page 267).

Figure 96: 4-AWG DC Power Cable Lug

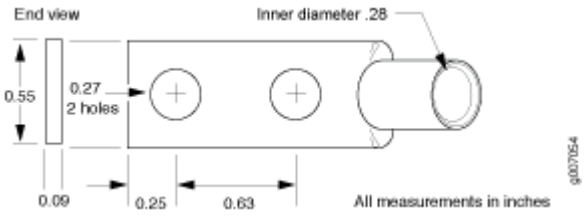


Table 72 on page 267 summarizes the specifications for the power cables, which you must supply.

Table 72: 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 73 on page 268 lists the three-phase delta AC power distribution monitor (PDM) electrical specifications.

Table 73: 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*
- *Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules*
- *MX2000 AC Power System Electrical Specifications*
- *MX2000 AC Power Cord Specifications*

MX2000 Three-Phase Wye AC Power Distribution Module Electrical Specifications

Table 74 on page 269 lists the three-phase wye AC PDM electrical specifications.

Table 74: 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*
- *Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules*
- *MX2000 AC Power System Electrical Specifications*
- *MX2000 AC Power Cord Specifications*

MX2000 Single-Phase AC Power Distribution Module Electrical Specifications

Table 75 on page 269 lists the single-phase AC power distribution module (PDM) electrical specifications for the MX2000 line of routers.

Table 75: 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 75: 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

Calculating AC Power Requirements for MX2020 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 PSM. 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 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.

To calculate the AC power requirements:

1. Calculate the power (usage) using the values, (see "MX2020 AC Power Requirements" on page 248).
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.

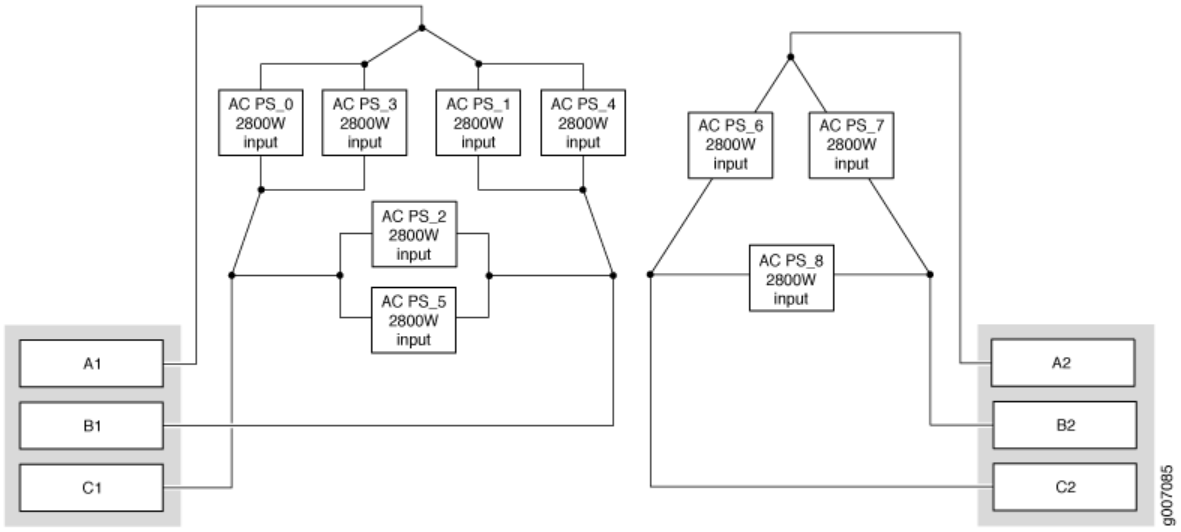
   Table 76 on page 271 lists the three-phase delta and wye feed requirements, maximum input and output power per PSM, and power efficiency.

Table 76: 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 (4 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 (4 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 97 on page 271).

Figure 97: 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. So, input #1 rated current is 50 A.

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

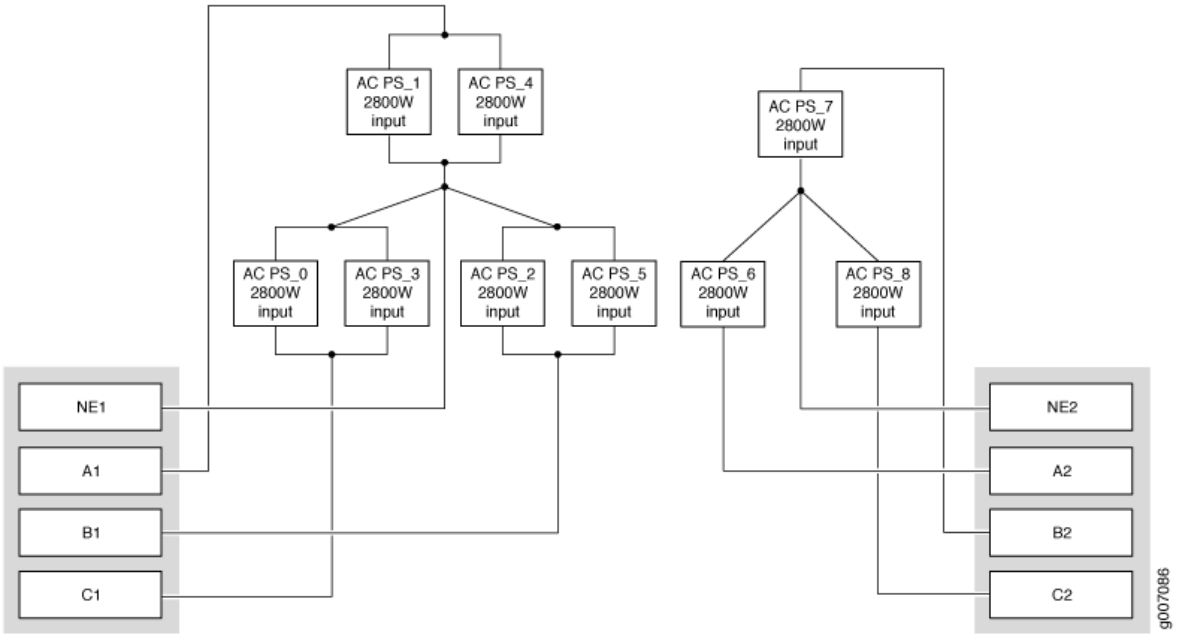
g. Nominal value of input current for one AC PSM is 2800 W/200 V=14 A.

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 98 on page 272).

Figure 98: 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. So, input #1 rated current 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 77 on page 273.

Table 77: Calculating AC Thermal Output

Power Distribution Module	Thermal Output (BTUs per hour)
MX2020 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 "MX2020 AC Power Requirements" on page 248 to calculate maximum power, which is dependent on configuration and temperature.
MX2020 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 "MX2020 AC Power Requirements" on page 248 to calculate maximum power, which is dependent on configuration and temperature.

RELATED DOCUMENTATION

- MX2020 Power Subsystem Description | **156**
- MX2020 AC Power Requirements | **248**
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules
- *Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules*
- MX2020 AC Power Subsystem Electrical Specifications
- MX2020 AC Power Cord Specifications

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 99 on page 274 shows the mapping for the MX2010 and Figure 100 on page 275 shows the mapping for the MX2020. The arrangement matches the internal components of the PDM. Table 78 on page 276 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1** (MX2010 and MX2020). Table 79 on page 276 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1** (MX2020 only).

Figure 99: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2010)

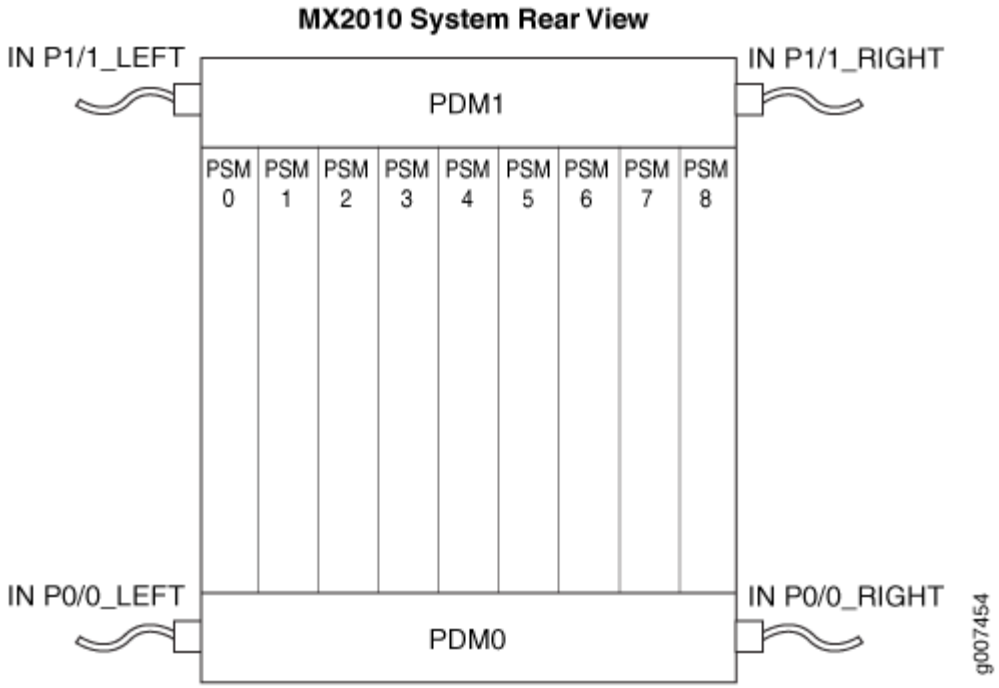


Figure 100: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2020)

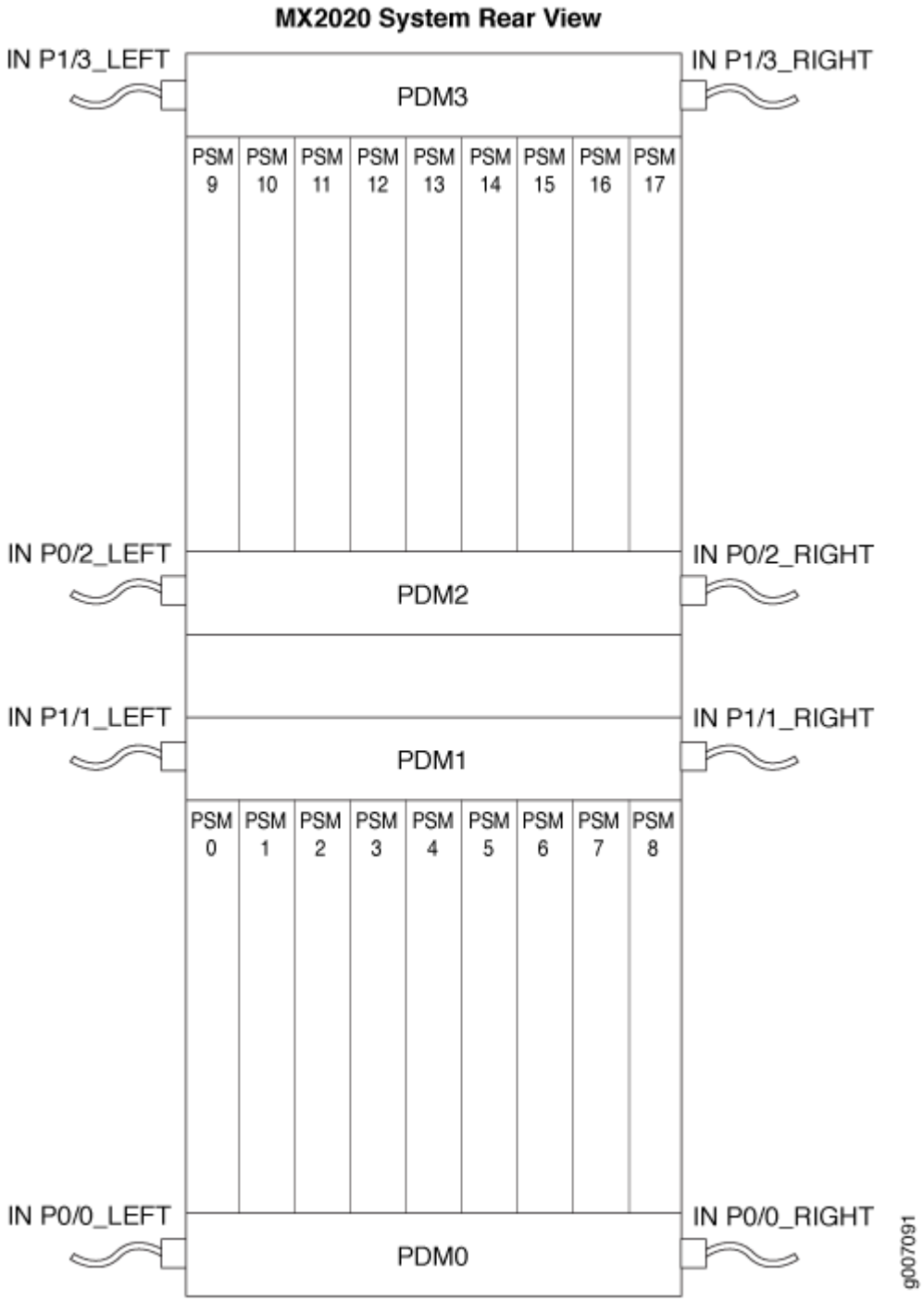


Table 78: Input AC Power Mapping for PDM0 and PDM1

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 79: 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

MX2020 DC Power Requirements

Table 80 on page 279 lists the FRU power requirements for SFBs, CB-REs, MPCs, and MICs. In addition, Table 80 on page 279 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 switch for each input.

For PDMs with 80 A feeds, we recommend that you select the 80 A switch for each input.

If you do not plan to provision as recommended above, you can use the information in Table 80 on page 279 to calculate the power consumption for your hardware configuration.

NOTE: The 240 V China DC PDMs do not have a switch selection.

NOTE: Unlike all the other MPCs, *MPC6E*, *MPC8E*, *MPC9E*, and *MX2K-MPC11E* does not require an adapter card (ADC) to house the MPC in the MX2020 router.

Table 80: 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
SFB3	MX2000-SFB3	500 W (Typical) 540 W at 55° C 540 W at 40° C 515 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

Table 80: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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)		
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	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
MPCs		
MPC-3D-16XGE-SFPP	MPC-3D-16XGE-SFPP	440 W at 55° C ambient

Table 80: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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
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

Table 80: FRU DC Power Requirements *(Continued)*

Component	Model Number	Maximum Power Requirement
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 80: 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 80: 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
MX2K-MPC11E (without MICs)	MX2K-MPC11E	1800 W (Typical) 1980 W at 55° C 1980 W at 40° C 1855 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 80: 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 80: 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 80: 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 80: 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

- MX2020 Power Subsystem Description | 156
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules (-48 V) | 440
- MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | 292
- MX2020 DC Power Distribution Description | 288

MX2020 DC Power Distribution 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. 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 up to four PDMs located in slots **PDM0/Input0**, **PDM2/Input0**, **PDM1/Input1**, and **PDM3/Input1**. Each feed (feed **A** or feed **B**) 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 using the commonly deployed A/B feed redundancy.

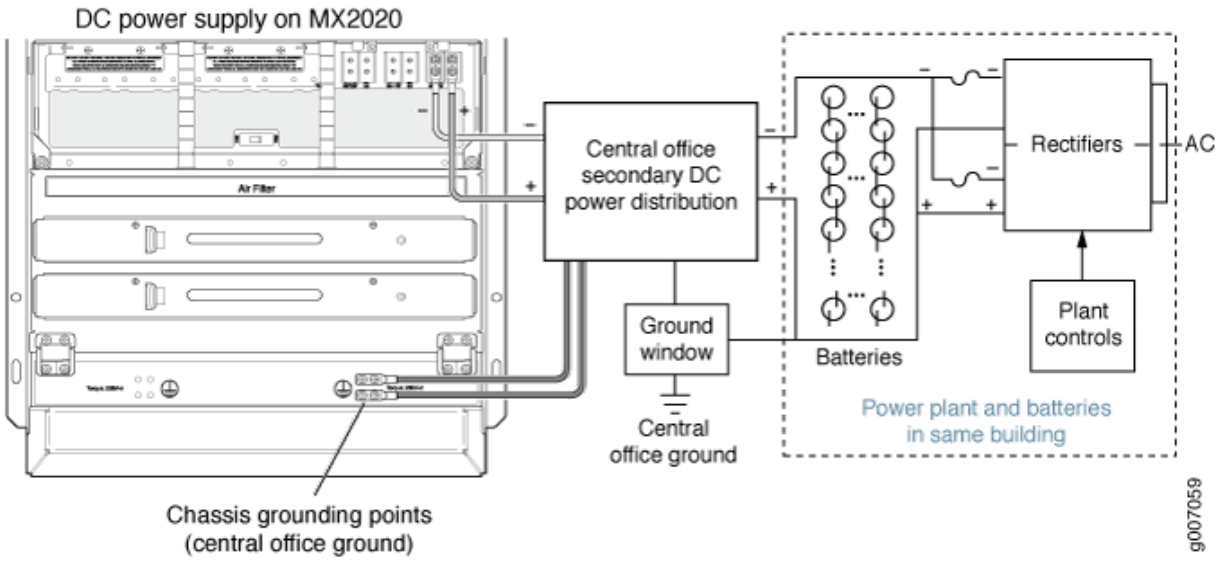
Each subsystem provides N+1 PSM redundancy along with N+N feed redundancy. If both DC feeds are available, operating power draws from the feed with higher voltage.

NOTE: Depending on the voltage of the DC feeds, 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.

These feeds are set by the input mode DIP switch located on the DC PSM (see "MX2020 DC Power Supply Module (-48 V) Description" on page 181). 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 provides full power .

Figure 101 on page 289 shows a typical DC source cabling arrangement.

Figure 101: Typical DC Source Cabling to the Router



All DC PSMs in a subsystem share the load (nine PSMs on the top half share the load, as well as the nine PSMs on the bottom share the load). If one PSM fails in a redundant configuration, the remaining PSMs provide power to FRUs. Up to eighteen PSMs may be required to supply power to a fully configured router. Nine PSMs in the lower card cage supply power to the two CB-REs (active and redundant), eight SFBs, lower ten MPCs, two lower fan trays and one fan tray on the top half. Nine PSMs in the upper card cage supply power to the two upper fan trays, upper ten MPCs, two CB-REs (active and redundant), eight SFBs, and a fan tray in the lower card cage. 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.

For more information, see "Determining DC Power Requirements for Your MX2020 Router" on page 297.

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

- MX2020 DC Power Distribution Module (-48 V) Description | **176**
- MX2020 DC Power Supply Module (-48 V) Description | **181**
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules (-48 V) | **440**
- *Installing MX2000 Router DC Power Supply Modules (-48 V)*
- Replacing an MX2020 DC Power Distribution Module Cable | **823**
- *Connecting an MX2000 DC Router Power Distribution Module (-48 V) Cable*
- DC Power Cable Specifications for the MX2020 Router | **305**
- Determining DC Power Requirements for Your MX2020 Router | **297**

MX2020 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 up to four PDMs located in slots **PDM0/Input0**, **PDM2/Input0**, **PDM1/Input1**, and **PDM3/Input1**. Each feed (feed **A** or feed **B**) 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 using the commonly deployed A/B feed redundancy.

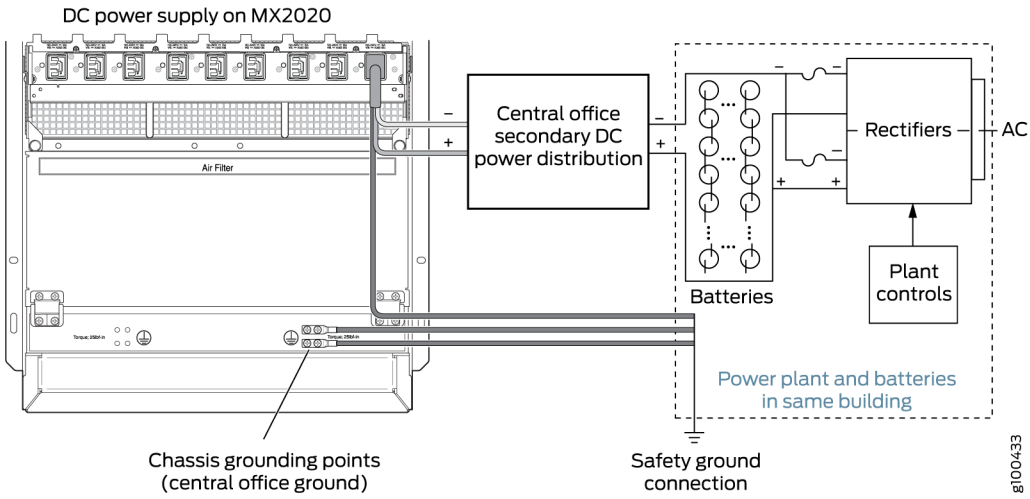
Each subsystem provides N+1 PSM redundancy along with N+N feed redundancy. If both DC feeds are available, operating power draws from the feed with higher voltage.

NOTE: Depending on the voltage of the DC feeds, 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.

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 provides full power.

Figure 102 on page 291 shows a typical DC source cabling arrangement.

Figure 102: Typical DC (240 V China) Source Cabling to the Router



All DC PSMs in a subsystem share the load (nine PSMs on the top half share the load, as well as the nine PSMs on the bottom share the load). If one PSM fails in a redundant configuration, the remaining PSMs provide power to FRUs. Up to eighteen PSMs may be required to supply power to a fully configured router. Nine PSMs in the lower card cage supply power to the two CB-REs (active and redundant), eight SFBs, lower ten MPCs, two lower fan trays and one fan tray on the top half. Nine PSMs in the upper card cage supply power to the two upper fan trays, upper ten MPCs, two CB-REs (active and redundant), eight SFBs, and a fan tray in the lower card cage. 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.

For more information, see "Determining DC Power Requirements for Your MX2020 Router" on page 297.

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 240 V China PDM power cable.

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.

RELATED DOCUMENTATION

- MX2000 DC Power Distribution Module (240 V China) Description | **178**
- MX2000 DC Power Supply Module (240 V China) Description | **185**
- *Connecting Power to a DC-Powered MX2000 Router with DC Power Distribution Modules (240 V China)*
- Installing MX2000 Router DC Power Supply Modules (240 V China) or High-Voltage Universal (HVAC/HVDC) Power Supply Modules | **434**
- DC Power Cable Specifications for the MX2020 Router | **305**

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications

IN THIS SECTION

Table 81 on page 293 lists the DC power subsystem electrical specifications.

Table 81: DC (-48 V) 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
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 82 on page 294 lists the electrical specification for this fuse.

Table 82: 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
Approvals	UL Recognized (File: E71611)
Construction	Body: Glass melamine Caps: Silver-plated brass
Environmental	RoHS Compliant, Lead (Pb) Free

RELATED DOCUMENTATION

- Calculating DC Power Requirements for MX2020 Routers
- MX2020 DC Power Distribution Module (-48 V) Description | **176**
- MX2020 DC Power Supply Module (-48 V) Description | **181**
- MX2020 DC Power Electrical Safety Guidelines

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

IN THIS SECTION

Table 83 on page 295 lists the DC power subsystem electrical specifications.

Table 83: 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

Table 83: DC PSM (240 V China) Electrical Specifications Per Input Configurations *(Continued)*

Item	Specification
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 84 on page 296 lists the electrical specification for this fuse.

Table 84: 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

RELATED DOCUMENTATION

- Calculating DC Power Requirements for MX2020 Routers
- MX2000 DC Power Distribution Module (240 V China) Description | **178**
- MX2000 DC Power Supply Module (240 V China) Description | **185**
- MX2020 DC Power Electrical Safety Guidelines

Determining DC Power Requirements for Your MX2020 Router

IN THIS SECTION

This topic describes the MX2020 DC power subsystem, power zones, and DC power usage to help you determine which Power Supply Modules (PSMs) are suitable for your router configuration.

We recommend that you provision power according to the maximum input current listed in the power subsystem electrical specifications (see "MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications" on page 292).

MX 2020 DC Power Subsystem Components

The MX2020 DC power system is comprised of two subsystems. Each subsystem provides power to:

- 10 line-card slots
- Nine DC Power Supply Modules (PSMs)
- Two DC Power Distribution Modules (PDMs)
- 20 Modular Port Concentrators (MPCs) (10 MPCs per zone)
- Two fan trays
- Eight Switch Fabric Boards (SFBs)
- Two Control Board and Routing Engines (CB-REs)

Understanding Power Zones in the MX2020 DC Power Subsystem

The MX2020 DC power subsystem has two power zones: zone 0 and zone 1. Some FRUs draw power only from zone 0, some FRUs draw power only from zone 1, and some FRUs draw power from both zone 0 and zone 1. When calculating power requirements, ensure there is adequate power for each zone. Each zone needs to provide 70% of the total power required by shared FRUs. This means 140% of the power required by the FRUs is available in the two power zones combined.

There are two types of DC power subsystems available for the MX2020: a “base” DC power subsystem (MX2020-BASE-DC) and an “optimized” or premium DC power subsystem (MX2020-PREMIUM2-DC). The fan trays in an optimized DC power subsystem draw power from the power zones differently than the fan trays in a base DC power subsystem. In a base DC power subsystem, two of the four fan trays draw power from both zones. In the optimized DC power subsystem, two of the fan trays draw power from only one zone. Because of this, the optimized power subsystem requires less power. Since the two fantrays share power in a zone, they only require 100% of the power they are rated at (not 140%). This is a net savings of 40% * 1700W/fantray * 2 for the system and half that amount per power zone.

NOTE: 70% of the total power from zone 0 + zone 1 must be provided by each zone in the calculation.

NOTE: Four DC Power Supply Modules (PSMs) per zone are mandatory for the MX2020 router with DC Power Distribution Modules (PDMs).

As illustrated in Figure 103 on page 299 and described in Table 85 on page 299, the power zones in the MX2020 DC base power subsystem distribute power to FRUs as follows:

- Zone 0 powers only line card slots 0-9, and fan tray 1
- Zone 1 powers only line card slots 10-19, and fan tray 3
- Zone 0 + Zone 1 (both zones provide power) to CB-RE slot 0 and CB-RE slot 1, fabric card slots 0-7, and fan tray 0 and 2

  NOTE: MX2020 routers do not support power redundancy mode for the MX2000-SFB3 fabric card in both the power zones.

Figure 103: Power Distribution in a DC Base Power Subsystem

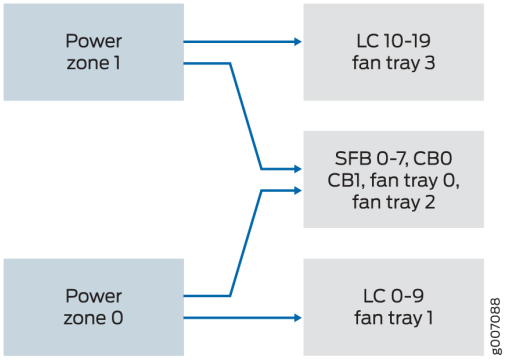


Table 85: MX2020 DC Power Zoning (Base DC Power Implementations)

Chassis Power Configuration	Power Zone	Power Distribution Module (PDM)	Power Supply Module (PSM)	Components Receiving Power
DC power to lower half of MX2020 components	Lower (zone 0)	PDM 0 and 1	PSM slots 0 through 8	• MPC slots 0 through 9 • Fan Tray 1
DC power to upper half of MX2020 components	Upper (zone 1)	PDM 2 and 3	PSM slots 9 through 17	• MPC slots 10 through 19 • Fan Tray 3
Zone 0 + Zone 1				• CB-RE slot 0 and slot 1 • SFB slots 0 through 7 • Fan tray 0 and 2

As illustrated in Figure 104 on page 300 and described in Table 86 on page 300, the power zones in MX2020 DC optimized power subsystems distribute power to FRUs as follows:

- Zone 0 powers only line card slots 1-7, and fan trays 0 and 1
- Zone 1 powers only line card slots 10-16, and fan trays 2 and 3

- Zone 0 and Zone 1 (both zones provide power) to CB-RE slot 0 and CB-RE slot 1, and fabric card slots 0-7

Figure 104: Power Distribution in an Optimized DC Power Subsystem

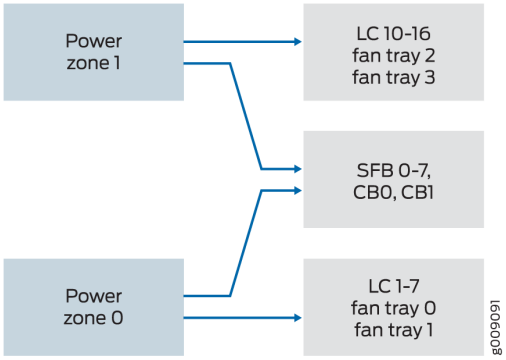


Table 86: MX2020 DC Power Zoning (Optimized DC Power Implementations)

Chassis Power Configuration	Power Zone	Power Distribution Module (PDM)	Power Supply Module (PSM)	Components Receiving Power
DC power to lower half of MX2020 components	Lower (zone 0)	PDM 0 and 1	PSM slots 1 through 7	• MPC slots 1 through 7 • Fan tray 0 and 1
DC power to upper half of MX2020 components	Upper (zone 1)	PDM 2 and 3	PSM slots 10 through 16	• MPC slots 10 through 16 • Fan Tray 2 and 3

Table 86: MX2020 DC Power Zoning (Optimized DC Power Implementations) *(Continued)*

Zone 0 + Zone 1				• CB-RE slot 0 and slot 1 • SFB slots 0 through 7

Calculating the DC Power Requirements for Your MX2020 Router

Follow these steps to calculate the DC power requirements for your MX2020 Router configuration.

1. Calculate the total output power required for your MX2020 FRUs.Table 87 on page 301 shows the typical power usage for the MX2020 DC power subsystem FRUs.

   Table 87: Typical DC Power Usage for MX2020 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2020	
Fan trays (upper and lower)	MX2000-FANTRAY	1700 W * 4 = 6800 W
MPC	MPC-3D-16XGE-SFPP	440 W * 20 = 8800 W
ADC	ADC	150 W * 20 = 3000 W
CB-RE	RE-MX2000-1800X4	250 W * 2 = 500 W
SFB—slots 0 through 7	MX2000-SFB	220 W * 8 = 1760 W
MX2020 DC power subsystem (upper and lower half of chassis, 60 A feeds to each PDM input) MX2020 DC power subsystem (upper and lower half of chassis, 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)
MX2020 DC power subsystem (upper and lower half of chassis, 240-V feeds to each PDM input)		2500 W * 8 PSMs=20,000 W (+ 1 PSM@2500 W redundant capacity)

   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.

Table 88: Power Reservation for MX2020 Router Configuration to Power Critical FRUs

Switch Fabric Board (SFB)	Power Reserved for the Critical FRUs	Power Reserved for the Critical FRUs with Droop sharing between the Two Zones	Maximum Power Allocated for the SFB
MX2000-SFB-S	7360 W	5662 W This number assumes a 70/30% load on the power zones when droop sharing is enabled.	220 W
MX2000-SFB2-S	7840 W	5998 W This number assumes a 70/30% load on the power zones when droop sharing is enabled.	280 W
MX2000-SFB3	7760 W	6590 W **NOTE**: MX2020 routers do not support power redundancy mode for the MX2000-SFB3 fabric card in both the power zones.	540 W

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 PSM options. Table 89 on page 303 lists the MX2020 PSMs, their maximum output power, and unused power (or power deficit).

Table 89: MX2020 PSM DC Output Power Budget

Power Supply Module	Maximum Output Power of Power Supply Module (Watt)	Maximum Output Power for System (Watt)—including redundant capacity
MX2020 DC PSM 60 A (feed to each input)	2100	37,800
MX2020 DC PSM 80 A or DC PSM (240 V China) (feed to each input)	2500	45,000

3. Calculate input power. Divide the total output requirement by the efficiency of the PSM. Refer to Table 90 on page 303.

Table 90: Calculating DC Input Power

Power Supply Module	Power Supply Module Efficiency	Output Power Requirement (Watt)—per PSM	Input Power Requirement (Watt)—per PSM
MX2020 DC PSM 60 A	91%	2100	2307
MX2020 DC PSM 80 A or DC PSM (240 V China)	91%	2500	2747

4. Calculate thermal output (BTUs) for cooling requirements. Multiply the input power requirement (in watts) by 3.41. Refer to Table 91 on page 304.

Table 91: Calculating DC Thermal Output (BTUs)

Loaded Chassis Heat Load	Thermal Output (BTUs per hour)
Loaded chassis configuration	34.5 KW divided by 0.91 * 3.41 = 129,280 BTU/hr (Zone 0 output. The calculation method for Zone 1 is the same as for Zone 0). 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 34.5 divided by 0.91 = 37.9 KW.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description

MX2020 Power Subsystem Description | **156**

Overview of Preparing the Site for the MX2020 Router | **197**

MX2020 DC Power Distribution Description | **288**

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

DC Power (-48 V) Circuit Breaker Requirements for the MX2020 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

MX2020 DC Power Distribution Module (-48 V) Description | 176

MX2020 DC Power Electrical Safety Guidelines

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | 292

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.

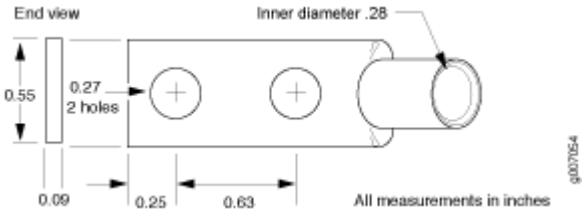
If you plan to operate a DC-powered router at less than the maximum configuration, we recommend that you provision a 2 pole circuit breaker according to respective National Electrical Code and customer site internal standards to maintain proper level of protection for the current specified above or each 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 MX2020 Router

The cable lugs attach to the terminal studs of each PDM (see Figure 105 on page 305).

NOTE: The MX2020 supports 4-AWG DC power cable lugs for 80-A input, and for 60-A input.

Figure 105: 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 92 on page 306 summarizes the specifications for the power cables, which you must supply.

Table 92: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 80-A or 60-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.

For high-voltage universal PDM power cable, see *MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications*.

RELATED DOCUMENTATION

- MX2020 DC Power Electrical Safety Guidelines

CHAPTER 14

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

IN THIS CHAPTER

MX2020 High-Voltage Universal Power Requirements

Table 93 on page 308 lists the FRU power requirements for SFBs, CB-REs, MPCs, and MICs. In addition, Table 93 on page 308 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 93 on page 308 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 93: 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 93: 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 93: 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 93: 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 93: 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 93: 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 93: 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 93: 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

- MX2020 Power Subsystem Description | 156
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules (-48 V) | 440
- MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | 292
- MX2020 DC Power Distribution Description | 288

MX2000 High-Voltage Universal PDM (MX2K-PDM-HV) Power Cord Specifications

Table 94 on page 316 provides specifications and plug standards for the AC (20-input and 16-input) power cord applicable to the universal (HVAC/HVDC) PDMs.

Table 94: 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 95 on page 317 provides specifications and connectors on the 30-A power cord provided for each country or region applicable to the universal (HVAC/HVDC) PDMs.

Table 95: 30-A Cabling Options

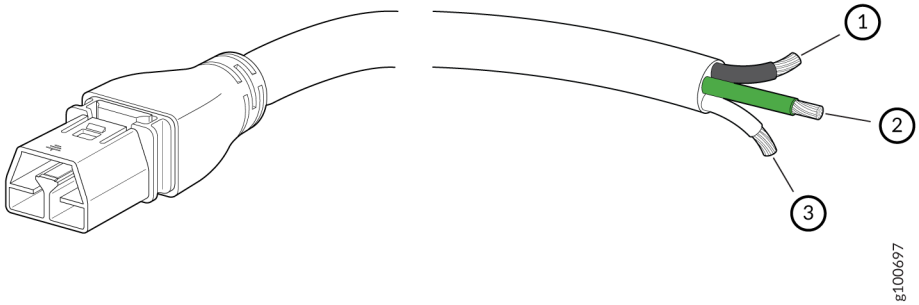
Spare Juniper Model Number	Locale	Cord Set Rating	Connector
CBL-PWR2-BARE See Figure 106 on page 318.	North America HVAC/HVDC power cord	30 A, 400 VAC	Anderson/straight to bare wire
CBL-PWR-SG4	North America HVAC/HVDC power cord	30-A, 400 VAC	SAF-D-GRID 400 right-angle (LH)
CBL-PWR2-L6-30P See Figure 107 on page 318.	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 108 on page 318.	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 106 on page 318 and Table 95 on page 317. 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 106 on page 318.

For connection to AC systems, Juniper provides a cable with either a NEMA 30-A connector (Figure 107 on page 318).

Figure 106: Bare Cable with Anderson Connector



1– Black wire–Positive (+)	3– White wire–Negative
2– Green wire-Ground	

Figure 107: NEMA L6-P30 Connector

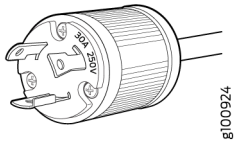
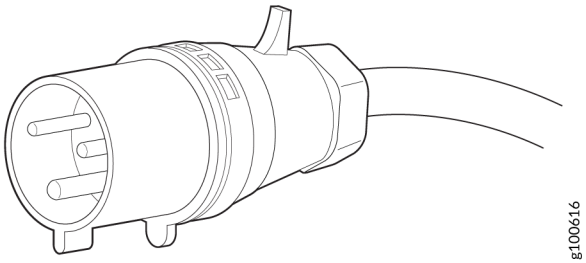


Figure 108: IEC 330P6W Connector



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 96 on page 320 lists the high-voltage second-generation universal power subsystem electrical specifications.

Table 96: 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 | 188

MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Description | 190

Determining High-Voltage Universal Power Requirements for Your MX2020 Router

IN THIS SECTION

This topic describes the MX2020 HVAC/HVDC power subsystem, power zones, and power usage to help you determine which Power Supply Modules (PSMs) are suitable for your router configuration.

We recommend that you provision power according to the maximum input current listed in the power subsystem electrical specifications (see "MX2000 Router High-Voltage Universal (HVAC/HVDC) Power Subsystem Electrical Specifications" on page 319).

MX2020 Power Subsystem Components

The MX2020 HVAC/HVDC power system is comprised of two subsystems. Each subsystem provides power to:

- 10 line-card slots, housing 10 Modular Port Concentrators (MPCs)
- Nine Universal (HVAC/HVDC) Power Supply Modules (PSMs)
- Two Universal (HVAC/HVDC) Power Distribution Modules (PDMs)
- Two fan trays
- Eight Switch Fabric Boards (SFBs)
- Two Control Board and Routing Engines (CB-REs)

Calculating the HVAC/HVDC Power Requirements for Your MX2020 Router

Follow these steps to calculate the HVAC/HVDC power requirements for your MX2020 Router configuration.

1. Calculate the total output power required for your MX2020 FRUs. Table 97 on page 322 shows the maximum power usage for the MX2020 HVAC/HVDC power subsystem FRUs.

   Table 97: HVAC/HVDC Power Usage for MX2020 Router

Component	Model Number	Power Requirement (Watts) with 91% Efficiency
Base chassis	CHAS-BP-MX2020	
Fan trays (upper and lower)	MX2000-FANTRAY	1500 W * 4 = 6000 W
MPC	MX2K-MPC11E	1980 W * 20 = 39600 W
CB-RE	RE-MX2000-1800X4	250 W * 2 = 500 W
SFB—slots 0 through 7	MX2000-SFB3	540 W * 8 = 4320 W
MX2020 HVAC/HVDC power subsystem (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)

   NOTE: The power reservation for the critical FRUs is 7360 W. With power droop-sharing between the two zones, the power reservation for critical FRUs is reduced to 5662 W. This number assumes a 70/30% load on the power zones when droop sharing is enabled.

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 PSM options. Table 98 on page 323 lists the MX2020 PSMs, their maximum output power, and unused power (or power deficit).

Table 98: MX2020 PSM Output Power Budget

Power Supply Module	Maximum Output Power of Power Supply Module (Watt)	Maximum Output Power for System (Watt)—including redundant capacity
MX2020 Universal (HVAC/HVDC) PSM	3000 W for single feed 3400 W for dual feed	3000 * 18 PSM with single feed = 54,000 W (PSM redundancy) 3400 * 17 PSM with dual feed = 57,800 W (feed redundancy)

3. Calculate input power. Divide the total output requirement by the efficiency of the PSM. Refer to Table 99 on page 323.

Table 99: Calculating Input Power

Power Supply Module	Power Supply Module Efficiency	Input Power Requirement (Watt)—per PSM
MX2020 Universal (HVAC/HVDC) PSM	91%	3300 W for single feed, 3800 W for dual feed

4. Calculate thermal output (BTUs) for cooling requirements. Multiply the input power requirement (in watts) by 3.41. Refer to Table 100 on page 323.

Table 100: Calculating Typical Thermal Output (BTUs)

Loaded Chassis Heat Load	Typical Thermal Output (BTUs per hour)
Loaded chassis configuration	(Typical power divided by 0.91) * 3.41 = BTU/hr. (BTU = 36,274 divided by 0.91) * 3.41 = 11,690 BTU/hr. 36,274 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

MX2020 Power Subsystem Description | **156**

Overview of Preparing the Site for the MX2020 Router | **197**

MX2000 High-Voltage Universal (HVAC/HVDC) Power Distribution Module Description | **188**

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

CHAPTER 15

Installation Overview

IN THIS CHAPTER

Installing an MX2020 Router Overview

To install the MX2020 router:

1. Prepare your installation site. See:
   - "Overview of Preparing the Site for the MX2020 Router" on page 197
2. Review the safety guidelines. See:
   - *General Safety Guidelines for Juniper Networks Devices*
3. Unpack the router and verify the parts. See:
   - "Unpacking the MX2020 Router" on page 333
   - "Verifying the MX2020 Parts Received" on page 337
   - "Unpacking the Router Transport Kit" on page 341
4. Install the mounting hardware. See:
   - "Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet" on page 344
5. Remove all components. See:
   - "Removing Components from the MX2020 Router Chassis Before Installing it in a Rack" on page 349

6. Install the router into the rack. See:
   - "Installing a MX2020 Router Using a Pallet Jack Overview" on page 366
   - "Installing a MX2020 Router Using a Router Transport Kit Overview" on page 375
7. Ground the router. See:
   - See: Grounding the MX2020 Router
8. Reinstall all components. See:
   - "Reinstalling Components in the MX2020 Router After Installing in a Rack" on page 392
9. Connect cables to the network and external devices. See:
   - "Connecting the MX2020 Router to Management and Alarm Devices" on page 459
10. Connect the AC power cord, DC power cables, 240-V China cables, universal (HVAC/HVDC) power cables. See:
    - "Installing MX2020 AC Power Supply Modules" on page 426
    - Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules
    - *Connecting AC Power to an MX2000 Router with Three-Phase Wye AC Power Distribution Modules*
    - *Installing MX2000 Router DC Power Supply Modules (-48 V)*
    - "Installing MX2000 Router DC Power Supply Modules (240 V China) or High-Voltage Universal (HVAC/HVDC) Power Supply Modules" on page 434
    - "Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules (-48 V)" on page 440
    - *Connecting Power to a DC-Powered MX2000 Router with DC Power Distribution Modules (240 V China)*

      Connecting Power to a High Voltage-Powered MX2000 Router with Power Distribution Modules
11. Power on the router. See:
    - Powering On the AC-Powered MX2020 Router
    - "Powering On the DC-Powered (-48 V) MX2020 Router" on page 452
    - "Powering On the DC-Powered (240 V China) MX2000 Router" on page 454
    - *Powering On the High-Voltage Powered Universal (HVAC/HVDC) MX2000 Router*
12. Perform the initial system configuration. See:
    - "Initially Configuring the MX2020 Router" on page 475

RELATED DOCUMENTATION

MX2020 Chassis Description | 36

Routine Maintenance Procedures for the MX2020 Router | 835

MX2020 Troubleshooting Resources | 847

Tools and Parts Required to Unpack the MX2020 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 MX2020 Router | 333

Unpacking the Router Transport Kit | 341

Verifying the MX2020 Parts Received | 337

MX2020 Universal Edge Router Overview | 34

Tools Required to Install the MX2020 Router Using a Pallet Jack

To install the router using a pallet jack with attachment, 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 MX2020 Router | 197

Removing Components from the MX2020 Router Chassis Before Installing it in a Rack | 349

Installing the MX2020 Router Using a Pallet Jack with Attachment | 369

Reinstalling Components in the MX2020 Router After Installing in a Rack | 392

Tools Required to Install the MX2020 Router Using a Router Transport Kit

To install the router using a router transport kit, you need the following tools and equipment:

- Router transport kit—MX2K-TRNSPRT-KIT
- Front component shipping covers
- Rear component shipping covers
- 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 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 MX2020 Router | 197

Removing Components from the MX2020 Router Chassis Before Installing it in a Rack | 349

Installing the MX2020 Router Using a Router Transport Kit | 382

Reinstalling Components in the MX2020 Router After Installing in a Rack | 392

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

MX2000 Router Grounding Specifications

Tools and Parts Required to Maintain the MX2020 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 MX2020 Router | 835
Maintaining the MX2020 Host Subsystem | 645
Maintaining the MX2020 Power Supply Modules

Tools and Parts Required for MX2020 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 MX2020 Router to a Network for Out-of-Band Management | 464
Connecting the MX2020 Router to a Console or Auxiliary Device | 465
Connecting an MX2020 Router to an External Alarm-Reporting Device | 467

CHAPTER 16

Unpacking the Router

IN THIS CHAPTER

Overview of Unpacking the MX2020 Router

To unpack the router:

1. Gather the tools required to unpack the router.

   See: "Tools and Parts Required to Unpack the MX2020 Router" on page 328

2. Unpack the router.

   See: "Unpacking the MX2020 Router" on page 333

3. Unpack the router transport kit, if ordered.

   See: "Unpacking the Router Transport Kit" on page 341

4. Verify that all parts have been received.

   See: "Verifying the MX2020 Parts Received" on page 337

RELATED DOCUMENTATION

- Installing an MX2020 Router Overview | 326

Unpacking the MX2020 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, large rack mount tray, pallet jack attachment, EMI covers, 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 2,042 lb (926.23 kg).

NOTE: Depending on your configuration, the MX2020 may be shipped with additional components already installed.

NOTE: The MX2020 can be ordered with extended EMI covers and extended cable managers.

There are two styles of shipping crates for the MX2020. Figure 109 on page 334 shows the smaller crate that measures 85.0 in. (215.9 cm) high, 42.0 in. (106.7 cm) wide, and 48.0 in. (121.9 cm) deep. Figure 110 on page 335 shows the larger crate that measures 87.6 in. (222.50 cm) high, 44.04 in. (112.8 cm) wide, and 51.6 in. (131.06 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 "MX2020 Physical Specifications" on page 202 for MX2020 shipping weight specifications.

Figure 109: MX2020 Shipping Crate Dimensions (smaller)

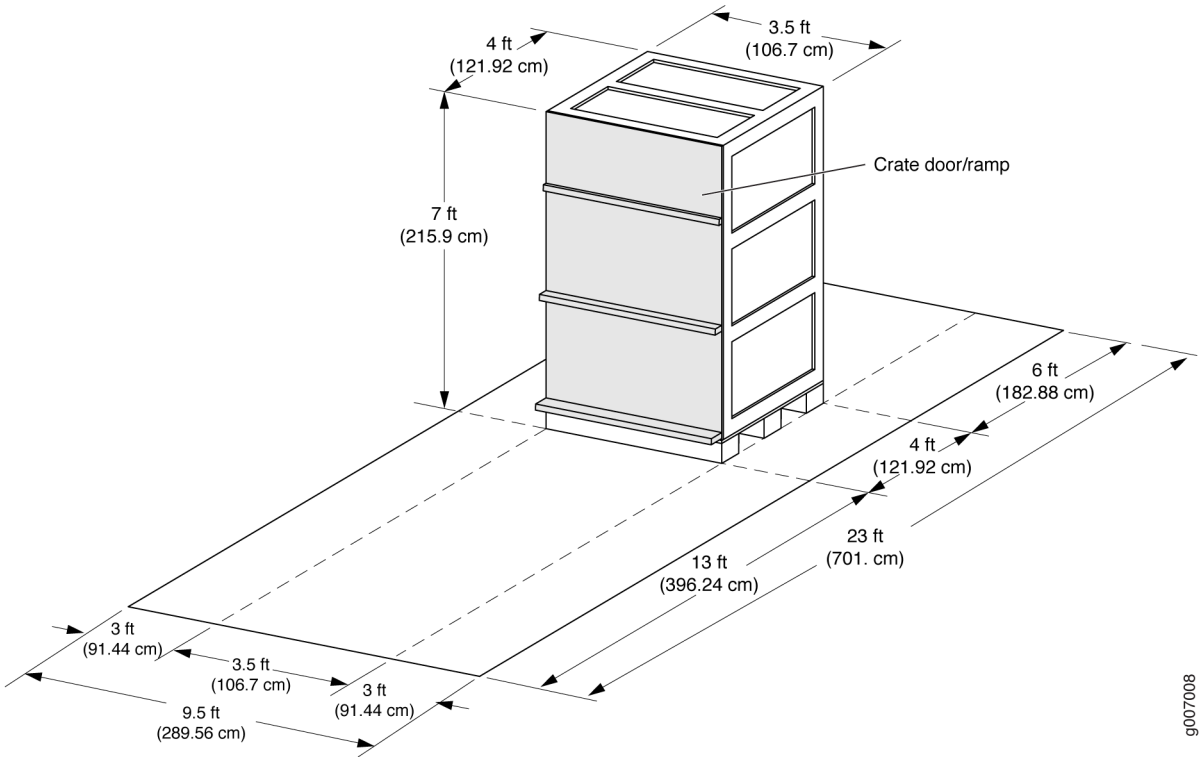
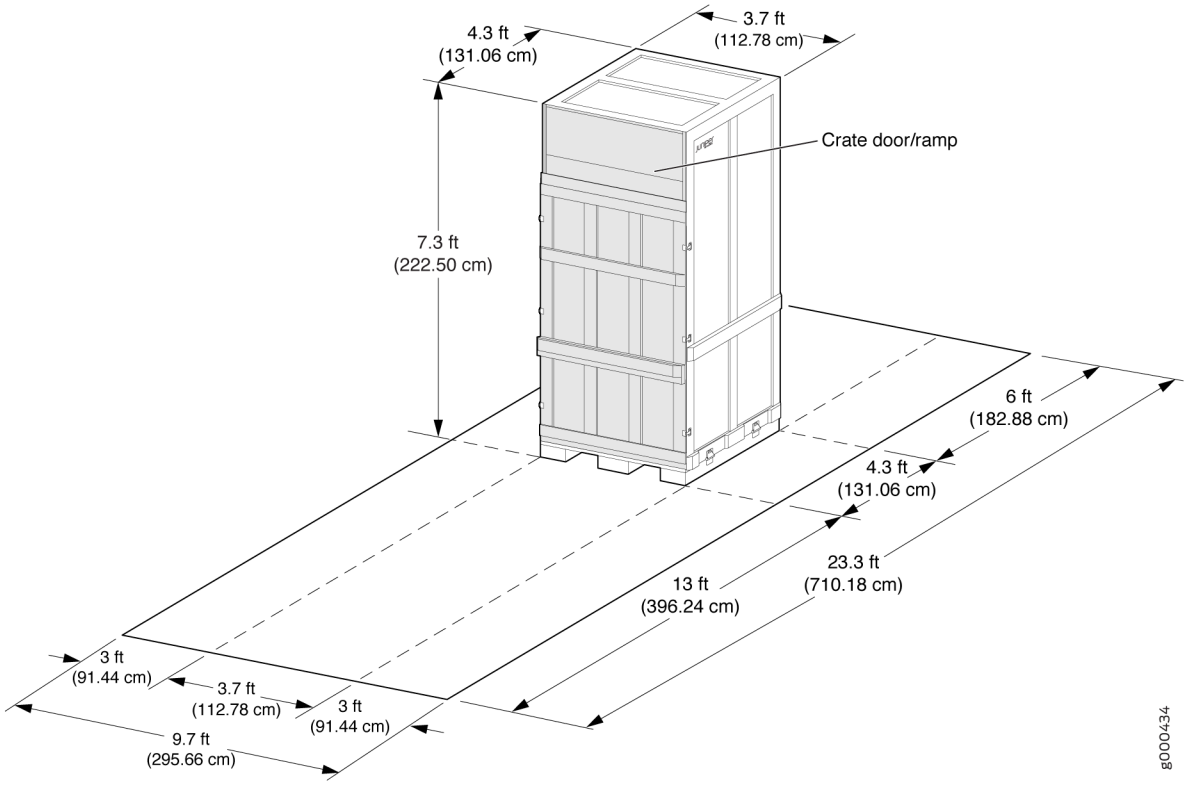


Figure 110: MX2020 Shipping Crate Dimensions (larger)



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:

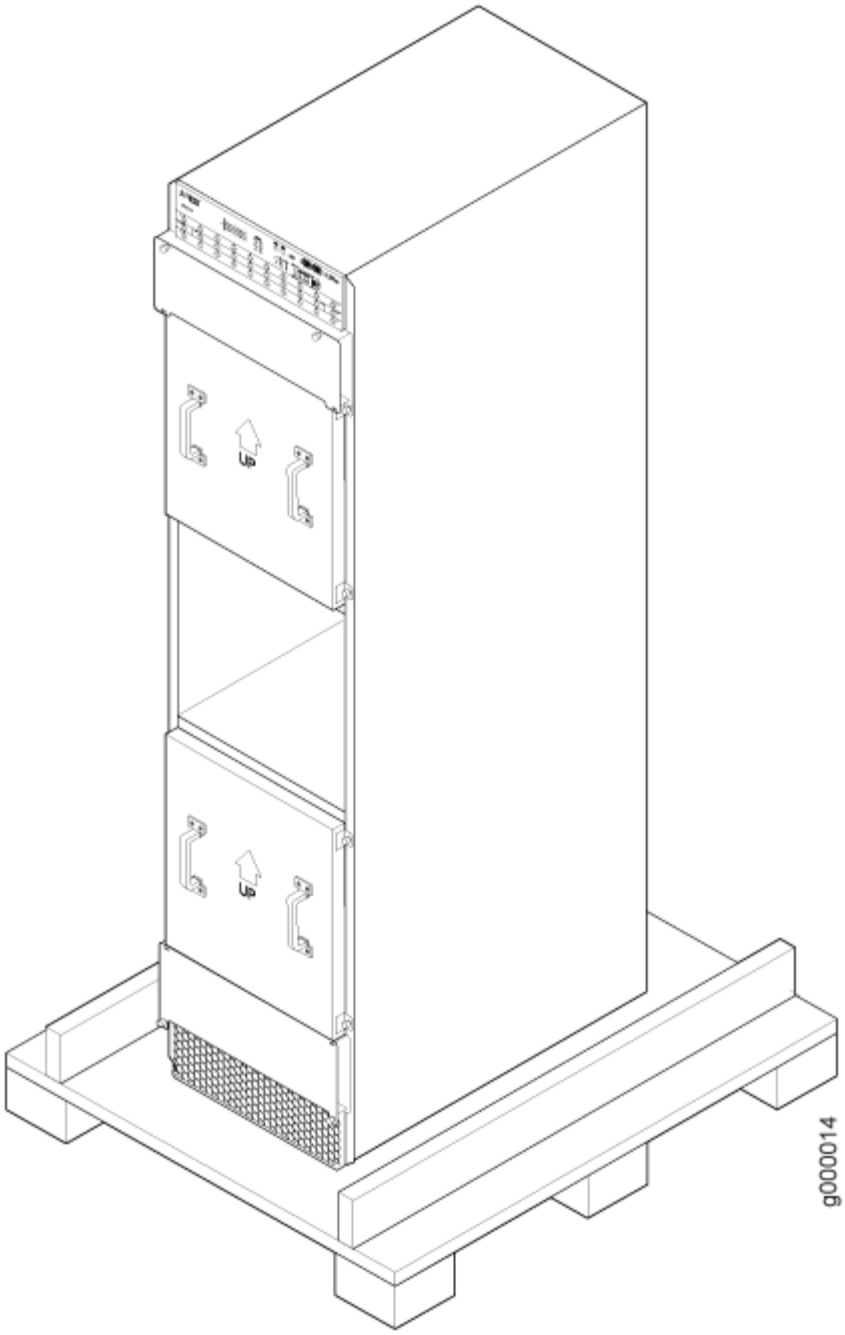
1. Move the shipping crate to an ESD approved staging area as close to the installation site as possible, where you have enough room to remove the components from the chassis. While the chassis is bolted to the shipping pallet, you can use a forklift or pallet jack to move it.
2. Position the shipping 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.

   NOTE: If you ordered a router transport kit, the shipping crate door is used as a ramp to guide the MX2020 out of the crate.

5. Using a two person team, slide the remainder of the shipping crate off the pallet (see Figure 111 on page 336).

6. Remove the foam covering the top of the router.
7. Remove the large rack mounting tray, pallet jack attachment, accessory box and the Quick Start installation instructions.

Figure 111: Unpacking the MX2020



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 1/2-in. socket wrench; and 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 Router Transport Kit" on page 341.

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 MX2020 Router | 328

Verifying the MX2020 Parts Received | 337

Installing the MX2020 Router Using a Pallet Jack with Attachment | 369

Installing the MX2020 Router Using a Router Transport Kit | 382

Verifying the MX2020 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 101 on page 337, and an accessory box, which contains the parts listed in Table 102 on page 339. The parts shipped with your router can vary depending on the configuration you ordered.

Table 101: Parts List for a Fully Configured MX2020 Router

Component	Quantity
Chassis, including backplane, and craft interface.	1

Table 101: Parts List for a Fully Configured MX2020 Router *(Continued)*

Component	Quantity
Standard EMI covers	2
Extended EMI covers (optional)	2
Large mounting shelf	1
MPCs	Up to 20
ADCs	Up to 20
MICs	Up to 40
SFBs	Up to 8
Combed Control Board with Routing Engines (CB-REs)	1 or 2
Power distribution modules (PDMs)	Up to 4
Power supply modules (PSMs)	Up to 18
Fan trays	4
Air baffle (optional)	1
PSM air filter	2
Air filter (lower)	1
Standard upper cable manager	1

Table 101: Parts List for a Fully Configured MX2020 Router *(Continued)*

Component	Quantity
Middle cable manager and air filter	1
Standard lower cable manager	1
Standard DC cable manager	4
Extended upper cable manager (optional)	1
Extended lower cable manager (optional)	1
Extended DC cable manager (optional)	4
Quick start installation instructions	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component.

Table 102: 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, MX2020	1
USB flash drive with Junos OS	1
Read me first document	1

Table 102: Accessory Box Parts List *(Continued)*

Part	Quantity
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Document sleeve	1
3" x 5" pink bag	2
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 the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

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

RELATED DOCUMENTATION

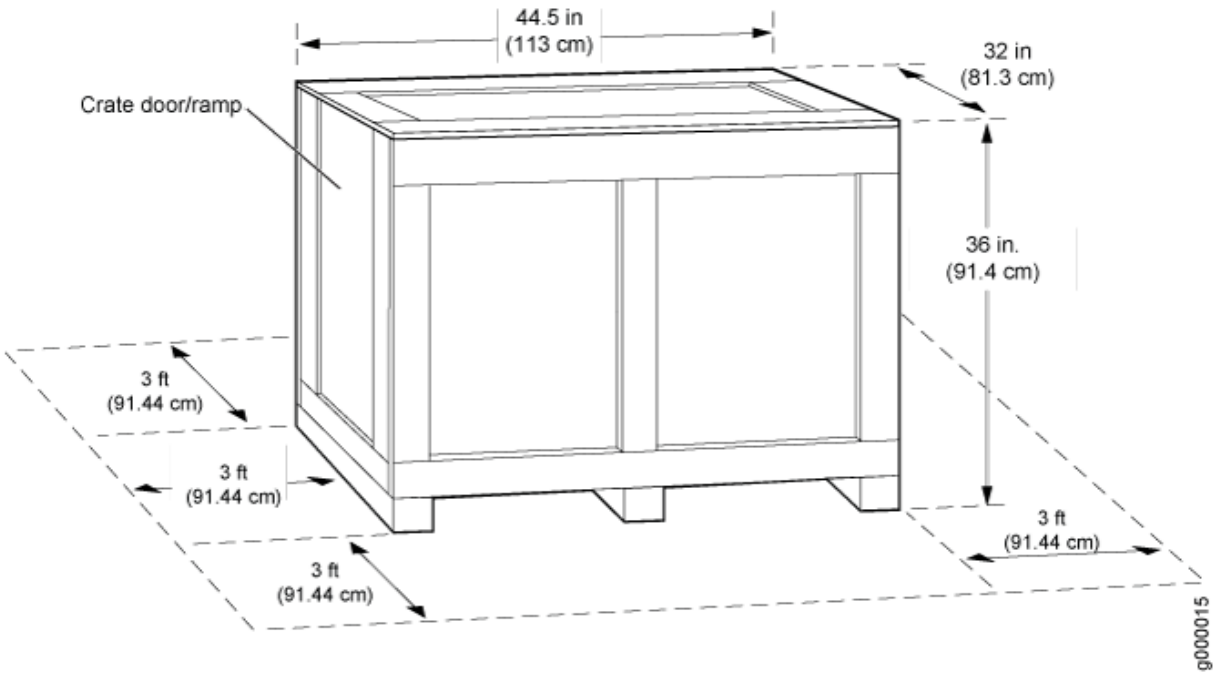
Tools and Parts Required to Unpack the MX2020 Router | 328

Unpacking the 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 112 on page 341). The total weight of the container containing the router transport kit is 200 lb (90.71 kg).

Figure 112: Router Transport Kit Crate Dimensions

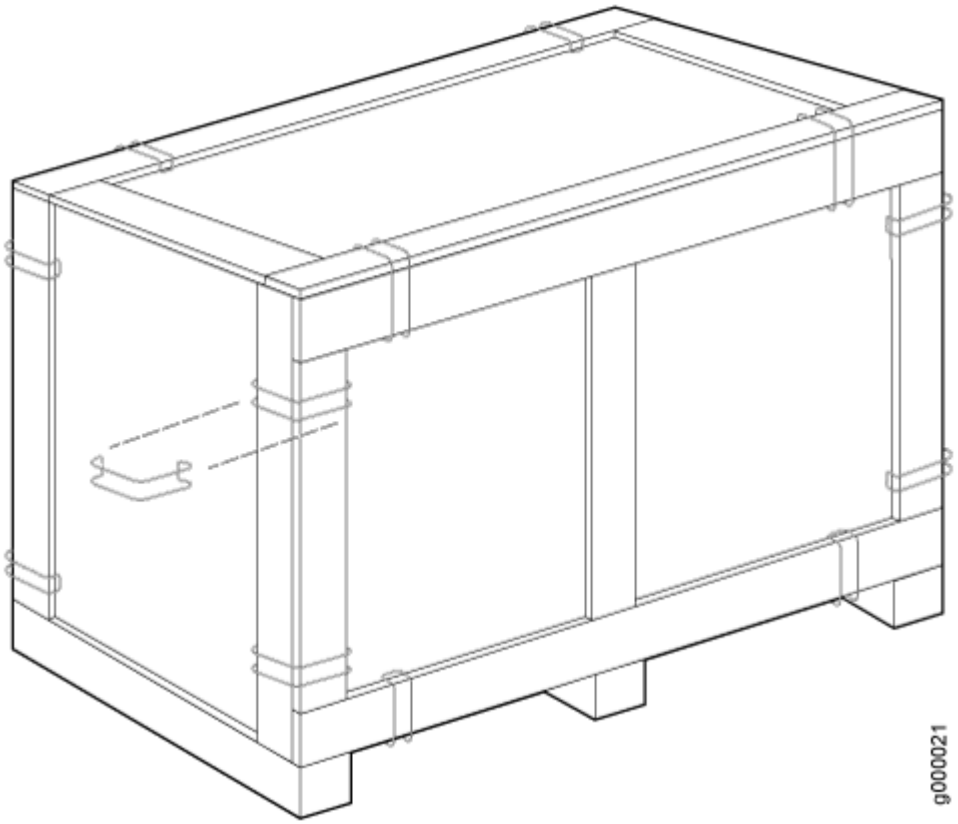


NOTE: The router transport kit is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the router transport kit:

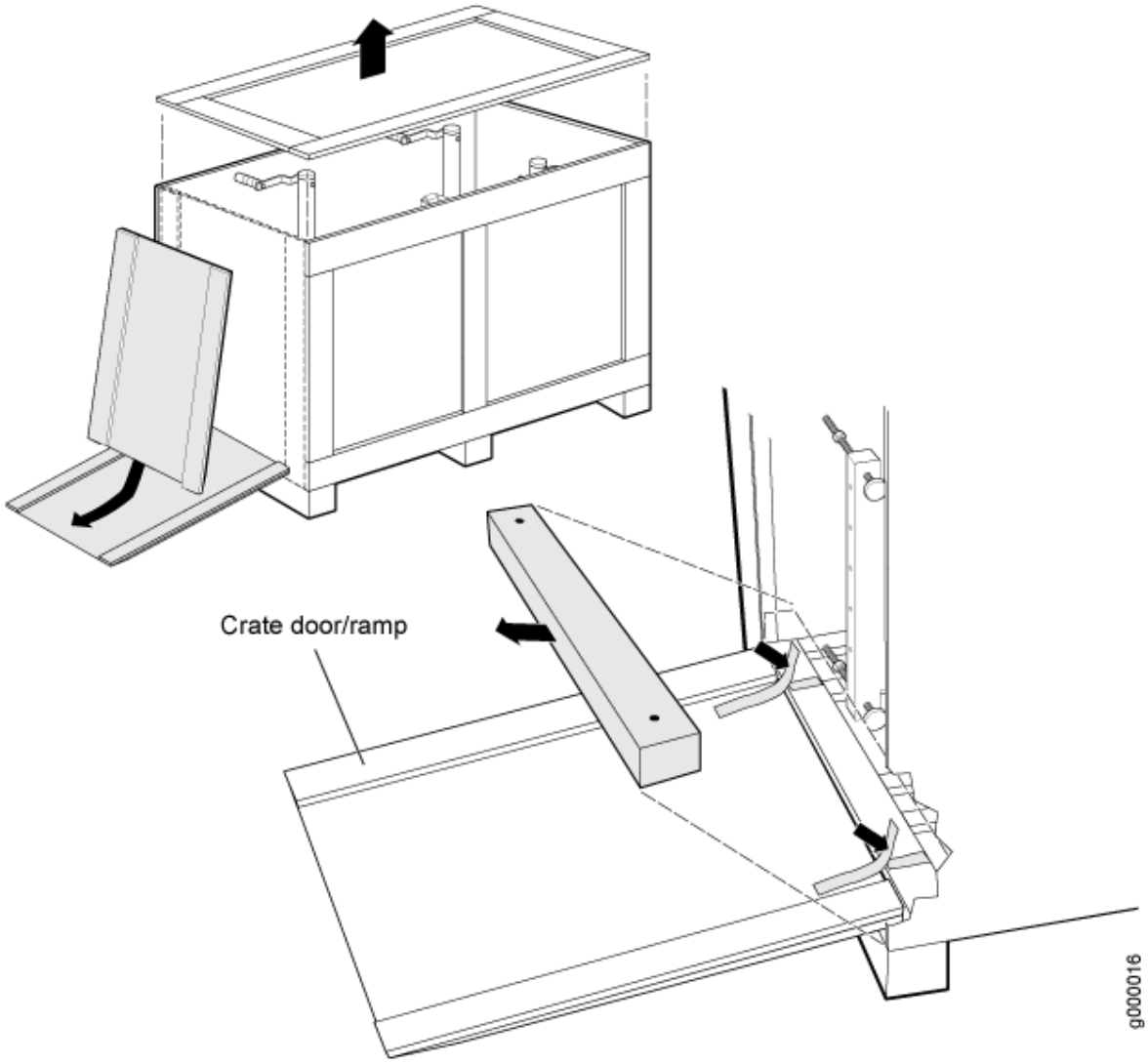
1. Move the router transport kit shipping crate to an ESD-approved staging area, where you have enough room to remove the kit for assembly.
2. Position the shipping crate with the arrows pointing up.
3. Remove the metal clips on the shipping crate that secure the top and front to the crate (see Figure 113 on page 342).

Figure 113: 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 114 on page 343).

Figure 114: 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 MX2020 Router | **328**

Verifying the MX2020 Parts Received | **337**

Installing the MX2020 Router Using a Router Transport Kit | **382**

CHAPTER 17

Installing the Mounting Hardware

IN THIS CHAPTER

Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet

IN THIS SECTION

Installing Cage Nuts, If Needed

Insert cage nuts, if needed, into the holes listed in Table 103 on page 345 and Table 104 on page 345. 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 103 on page 345).
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 104 on page 345).

Table 103: Mounting Hole Locations for Installing the Four-Post Mounting Shelf

Hole	Distance Above U Division
6	3.25 in. (8.3 cm)
5	2.63 in. (6.7 cm)
4	2.00 in. (5.1 cm)
3	1.50 in. (3.8 cm)
2	0.88 in. (2.2 cm)
1	0.25 in. (0.6 cm)

Table 104: Mounting Hole Locations for Installing a MX2020 Chassis in a Four-Post Rack or Cabinet

Hole	Distance Above U Division
111	64.5 in. (163.8 cm)
102	59.25 in (150.5 cm)
93	54 in (127.2 cm)
84	48.75 in (123.8 cm)
75	43.5 in (110.5 cm)
66	38.25 in (97.15 cm)
57	33 in (83.8 cm)
48	27.75 in (70.5 cm)

Table 104: Mounting Hole Locations for Installing a MX2020 Chassis in a Four-Post Rack or Cabinet *(Continued)*

Hole	Distance Above U Division
39	22.5 in. (57.1 cm)
30	17.25 in. (43.8 cm)
25	14.25 in (36.2 cm)
12	6.75 in. (17.1cm)
7	3.75 in (9.5 cm)

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

SEE ALSO

Verifying the MX2020 Parts Received | 337

Installing the Four-Post Mounting Shelf

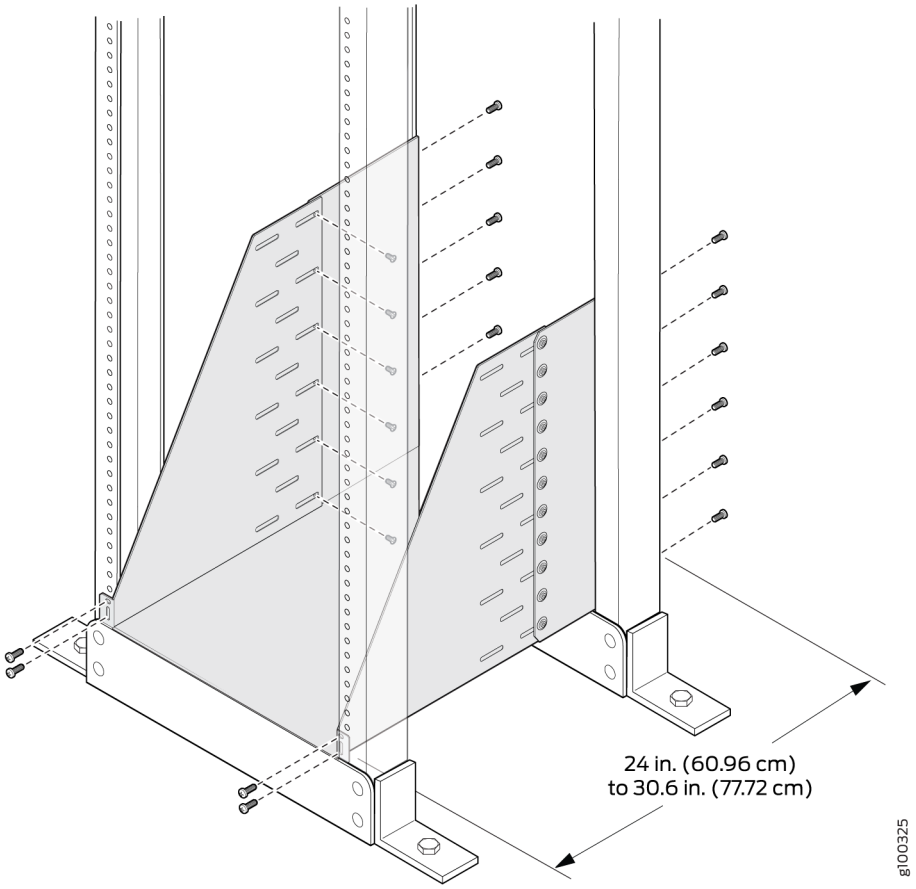
To install the four-post mounting shelf (see Figure 115 on page 347):

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.

   NOTE: There must be a minimum of 45-U unobstructed front-to-back usable rack space when installing the MX2020 router into a four-post rack or cabinet.

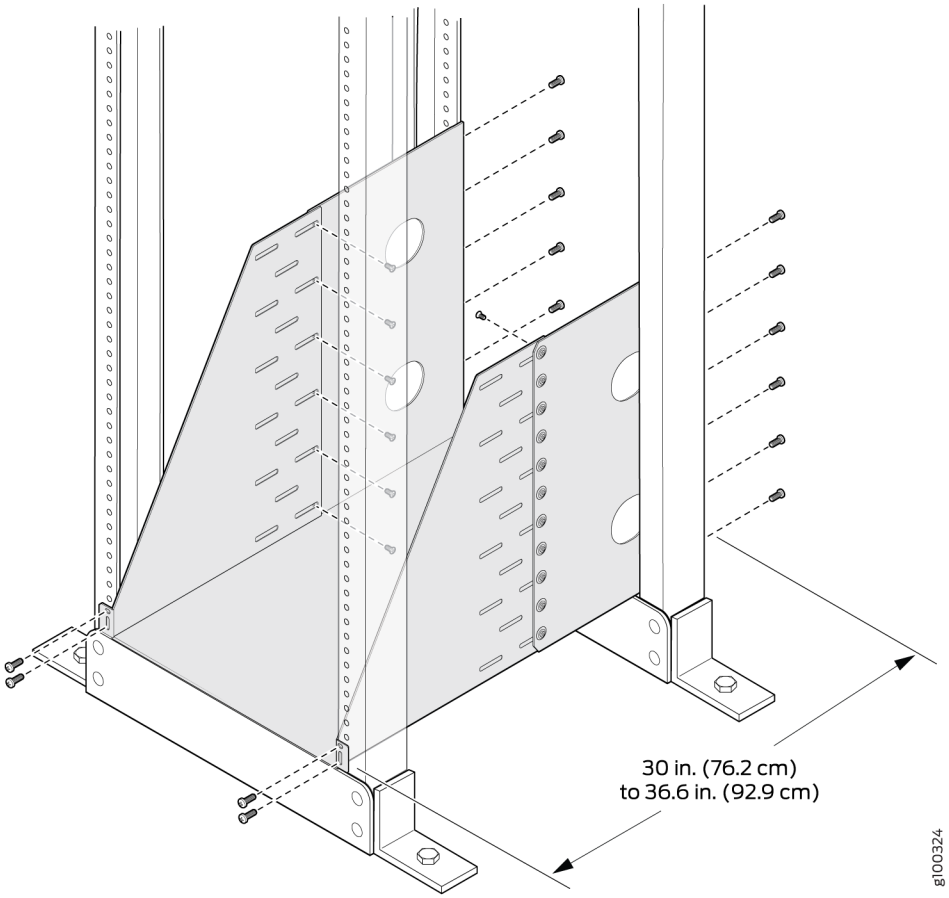
2. Partially insert screws into the open holes in the rear flanges of the four-post mounting shelf.
3. Tighten all the screws completely.
4. On the front of each front rack rail, partially insert a mounting screw into the holes in each ear of the four-post mounting shelf.
5. Tighten all the screws completely.

Figure 115: Installing a Four-Post Mounting Shelf



NOTE: The two rear flanges on the four-post mounting shelf are adjustable from 24in (60.96cm) to 30.6in (77.72cm) to accommodate different types of racks rails. If you need to extend the depth of the rack, you can purchase an extended mounting kit (MX2K-TRAY-XTND-S). The kit contains rack mount tray brackets that have an adjustable range from 30in (76.2cm) to 36.6in (92.9cm). Figure 116 on page 348 illustrates how to install an extended rack.

Figure 116: Installing an Extended Rack



SEE ALSO

Installing the Router Transport Kit on the MX2020 Router | **376**

Installing the MX2020 Router Using a Pallet Jack with Attachment | **369**

RELATED DOCUMENTATION

MX2020 Rack-Mounting Hardware | **82**

CHAPTER 18

Installing the Router

IN THIS CHAPTER

Removing Components from the MX2020 Router Chassis Before Installing it in a Rack

IN THIS SECTION

Before installing the router with a router transport kit, you must first remove shipping covers and components from the chassis. With components removed, the chassis weighs approximately 429.6 lb (194.86 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 MX2020 Router

Remove the topmost PDM (**PDM3/Input1**) first, and then work your way downward. To remove an AC, DC, 240 V China, or universal (HVAC/HVDC) PDM (see Figure 117 on page 351, Figure 118 on page 352, Figure 119 on page 353, and Figure 120 on page 354).

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: **PDM3/Input1** and **PDM1/Input1** locking levers are pulled down to release from chassis, and **PDM0/Input0** and **PDM2/Input0** 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 117: Removing an AC Power Distribution Module Before Installing the MX2020 Router

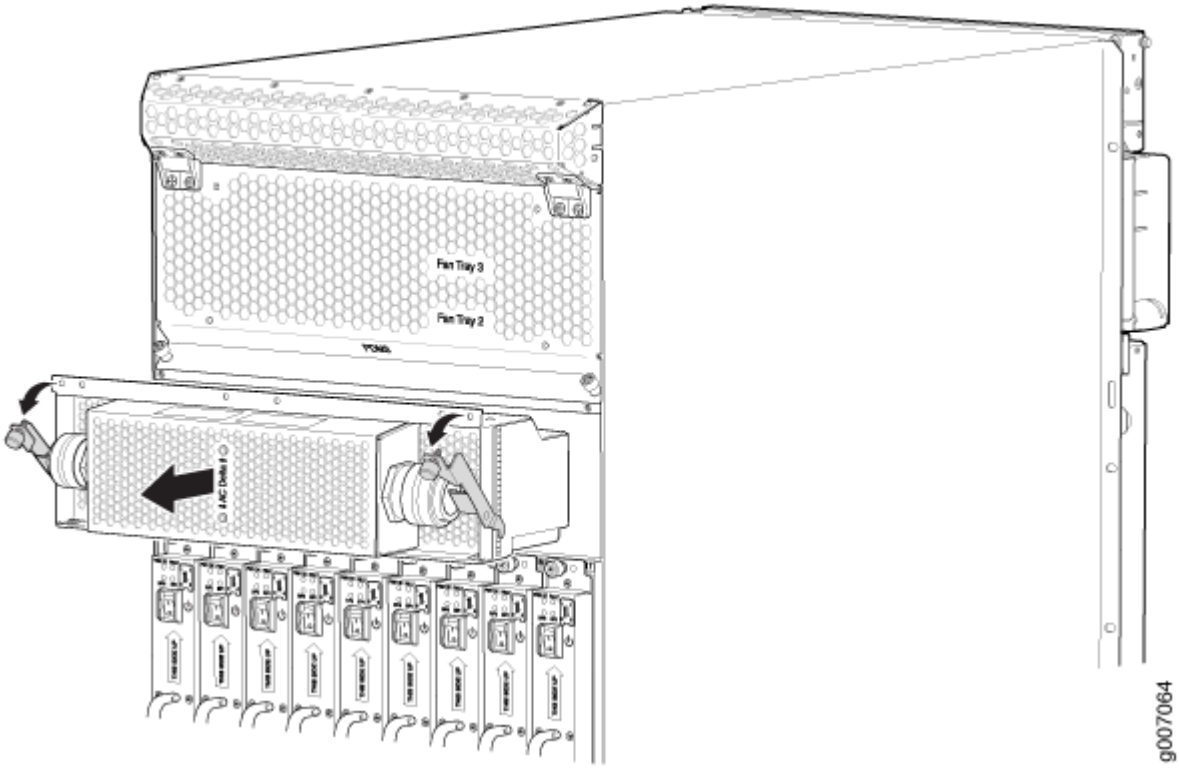


Figure 118: Removing a DC Power Distribution Module (-48 V) Before Installing the MX2020 Router

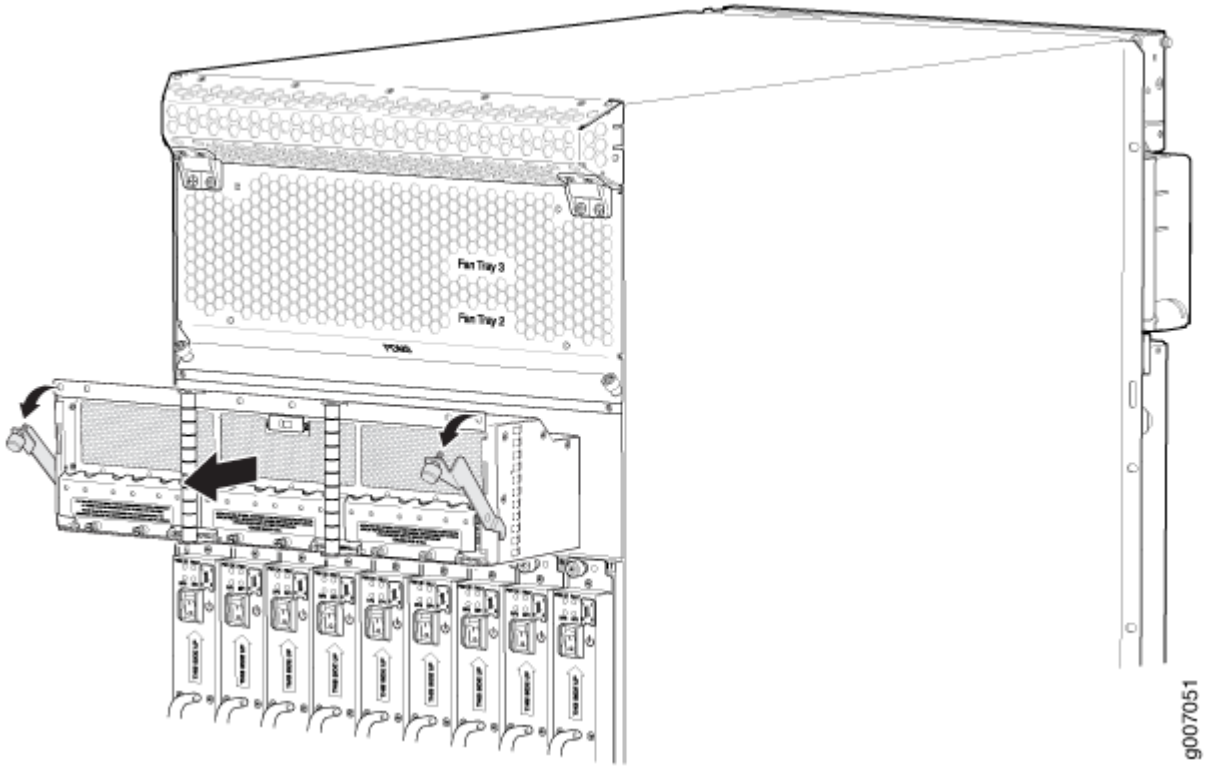


Figure 119: Removing a DC Power Distribution Module (240 V China) Before Installing the MX2000 Router

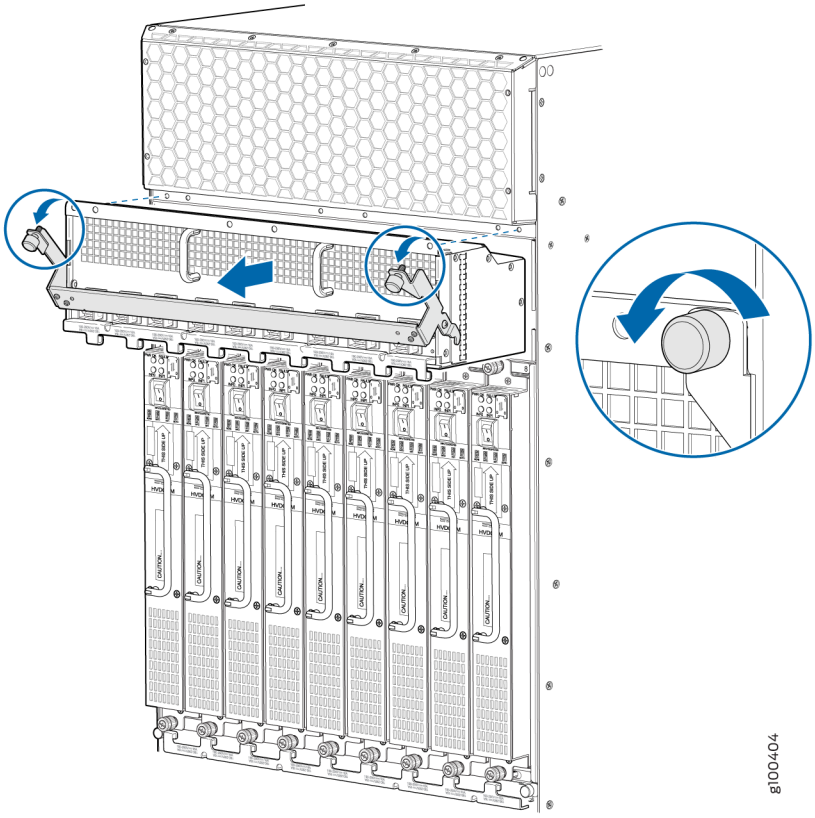
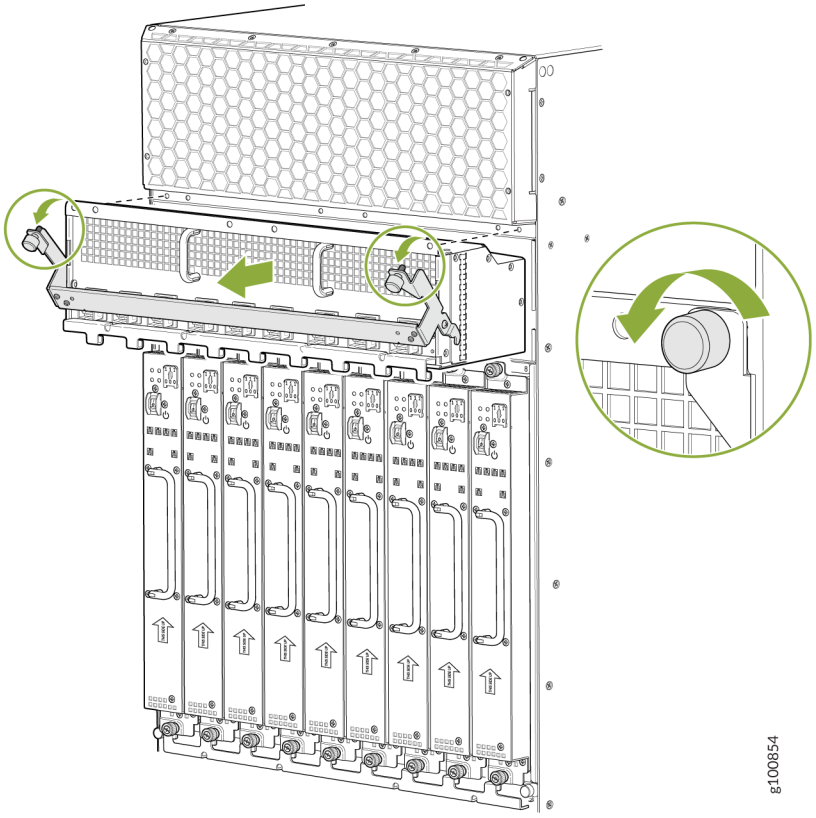


Figure 120: Removing a High-Voltage Universal (HVAC/HVDC) Power Distribution Module Before Installing the MX2000 Router



Removing the Power Supply Modules Before Installing an MX2020 Router

To remove the AC, DC, 240 V China, universal (HVAC/HVDC) PSMs (see Figure 121 on page 356, Figure 122 on page 357, Figure 123 on page 358, and Figure 124 on page 359):

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 precaution 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 121: Removing a AC Power Supply Module Before Installing the MX2020 Router

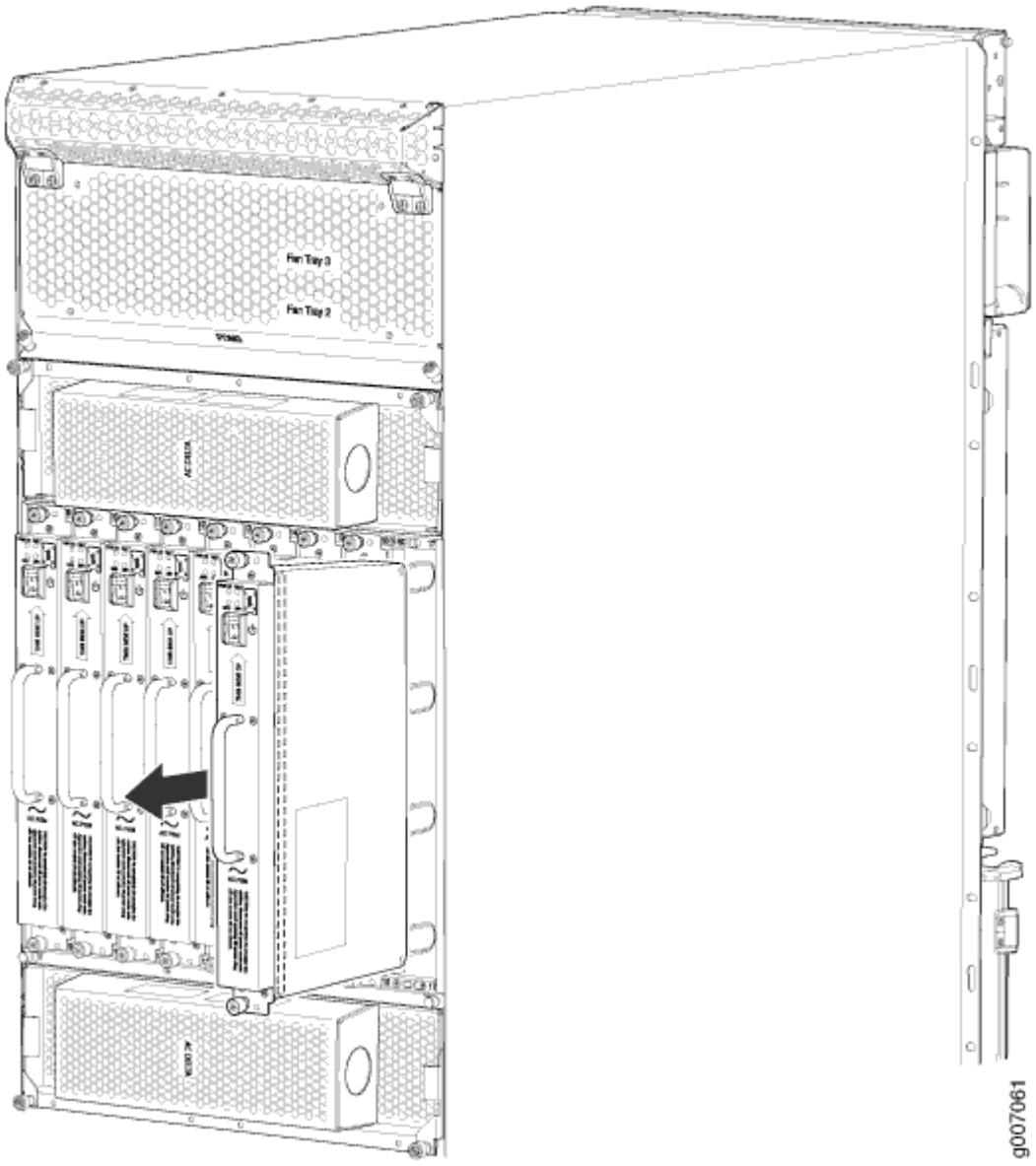


Figure 122: Removing a DC Power Supply Module (-48 V) Before Installing the MX2020 Router

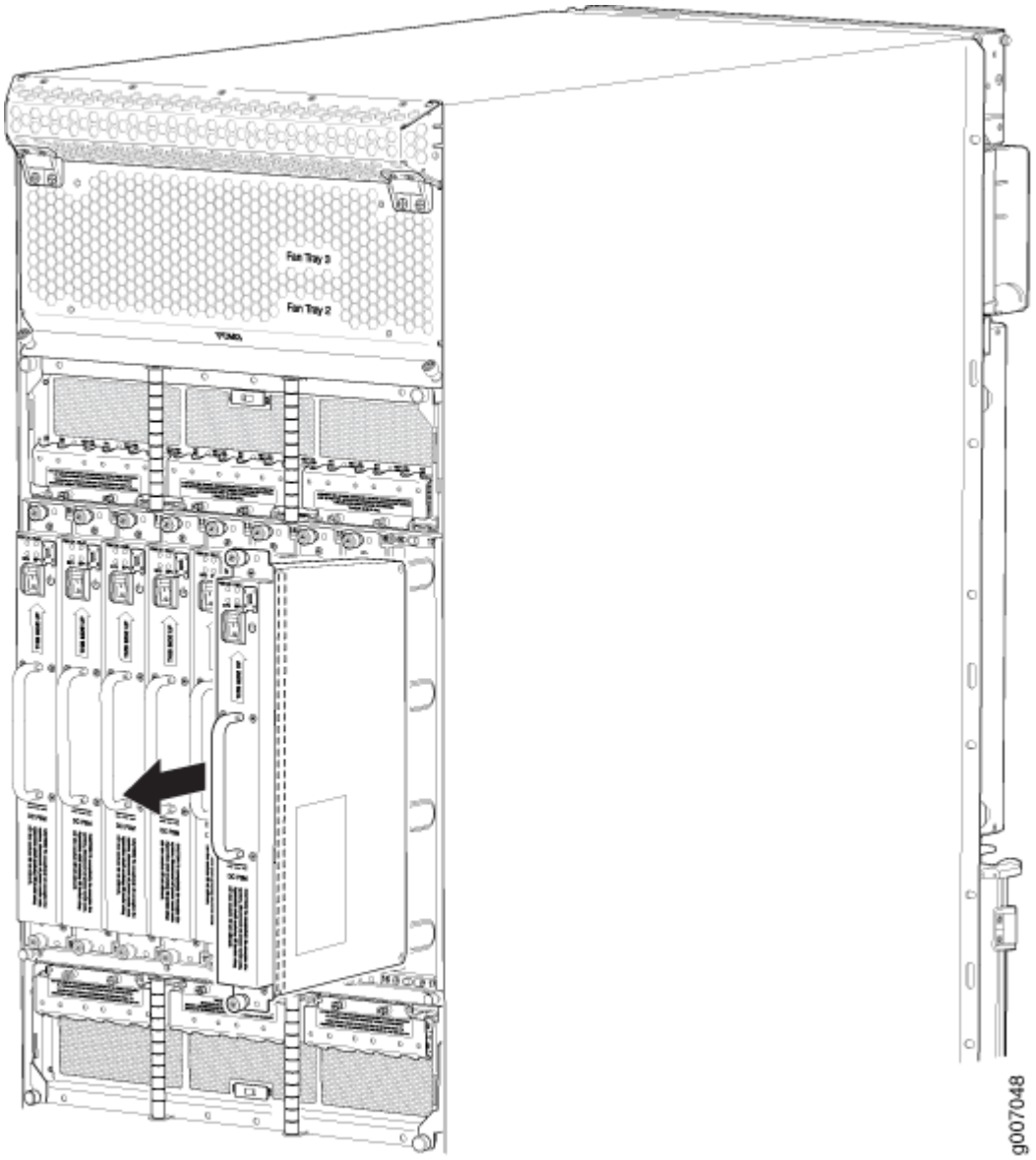


Figure 123: Removing a DC Power Supply Module (240 V China) Before Installing the MX2000 Router

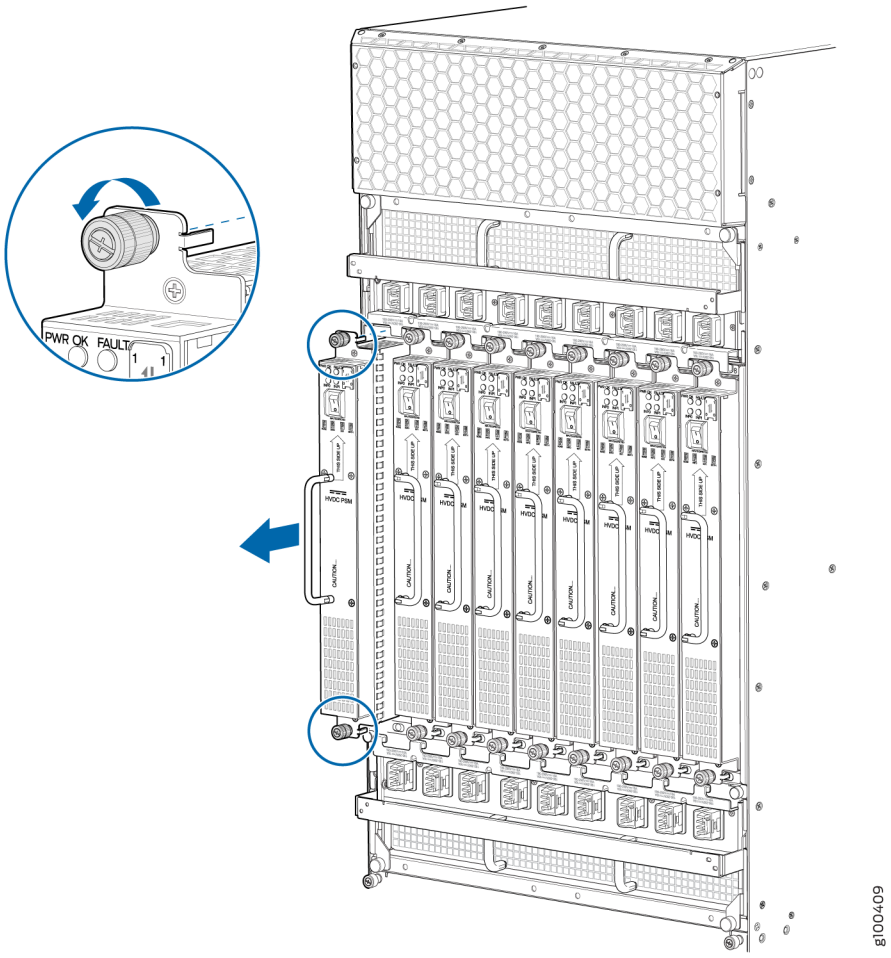
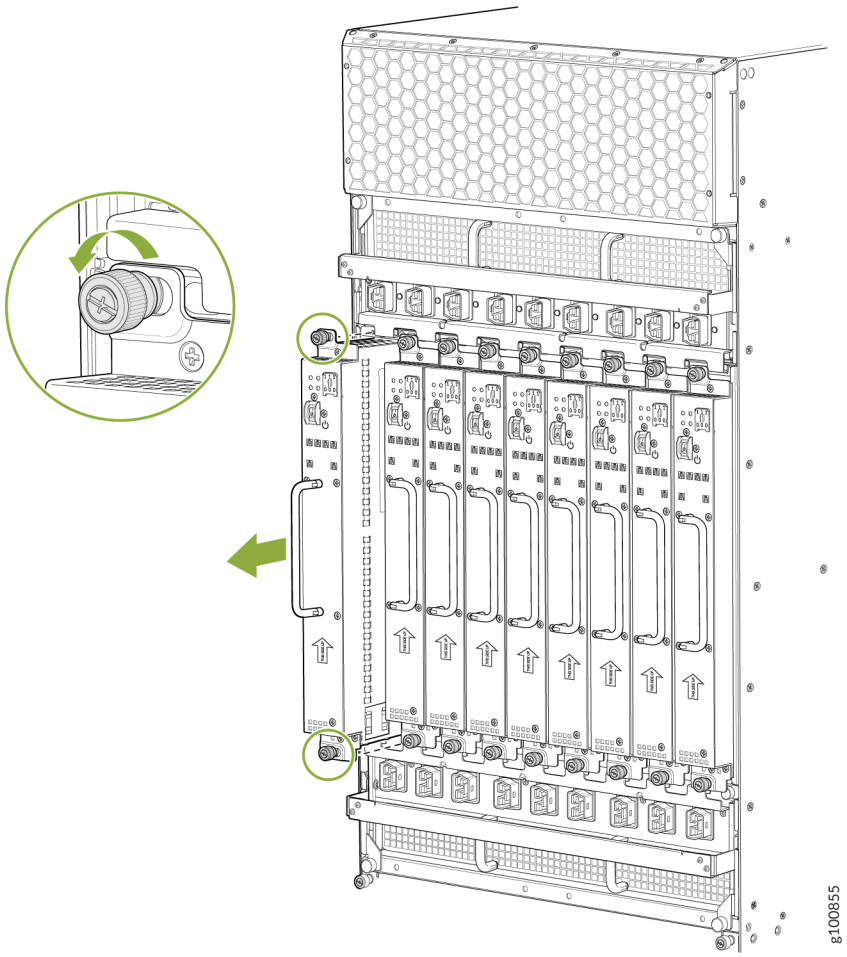


Figure 124: Removing a High-Voltage Universal (HVAC/HVDC) Power Supply Module Before Installing the MX2000 Router



Removing the Fan Trays Before Installing an MX2020 Router

To remove the upper and lower fan tray (see Figure 125 on page 360 and Figure 126 on page 361):

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.
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.

Figure 125: Removing Upper Fan Trays

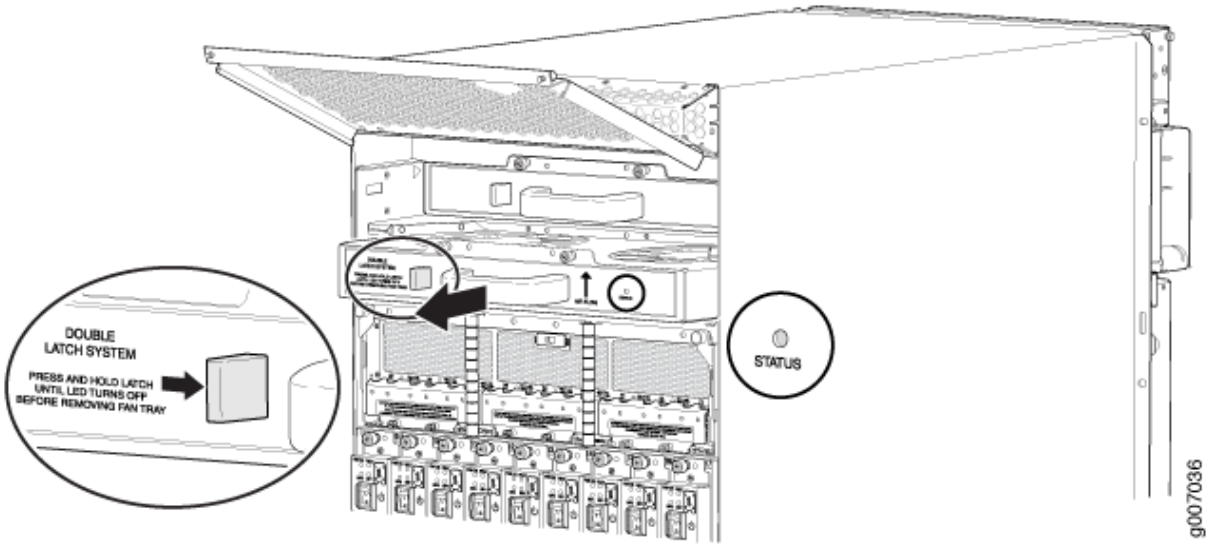
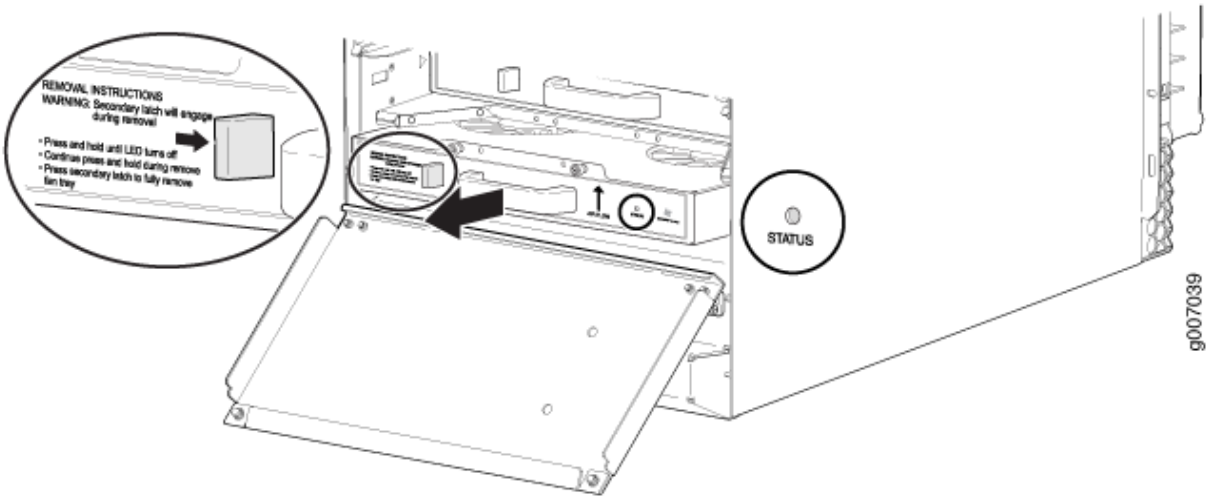


Figure 126: Removing Lower Fan Trays



Removing the SFBs Before Installing an MX2020 Router

To remove the SFBs (see Figure 127 on page 362):

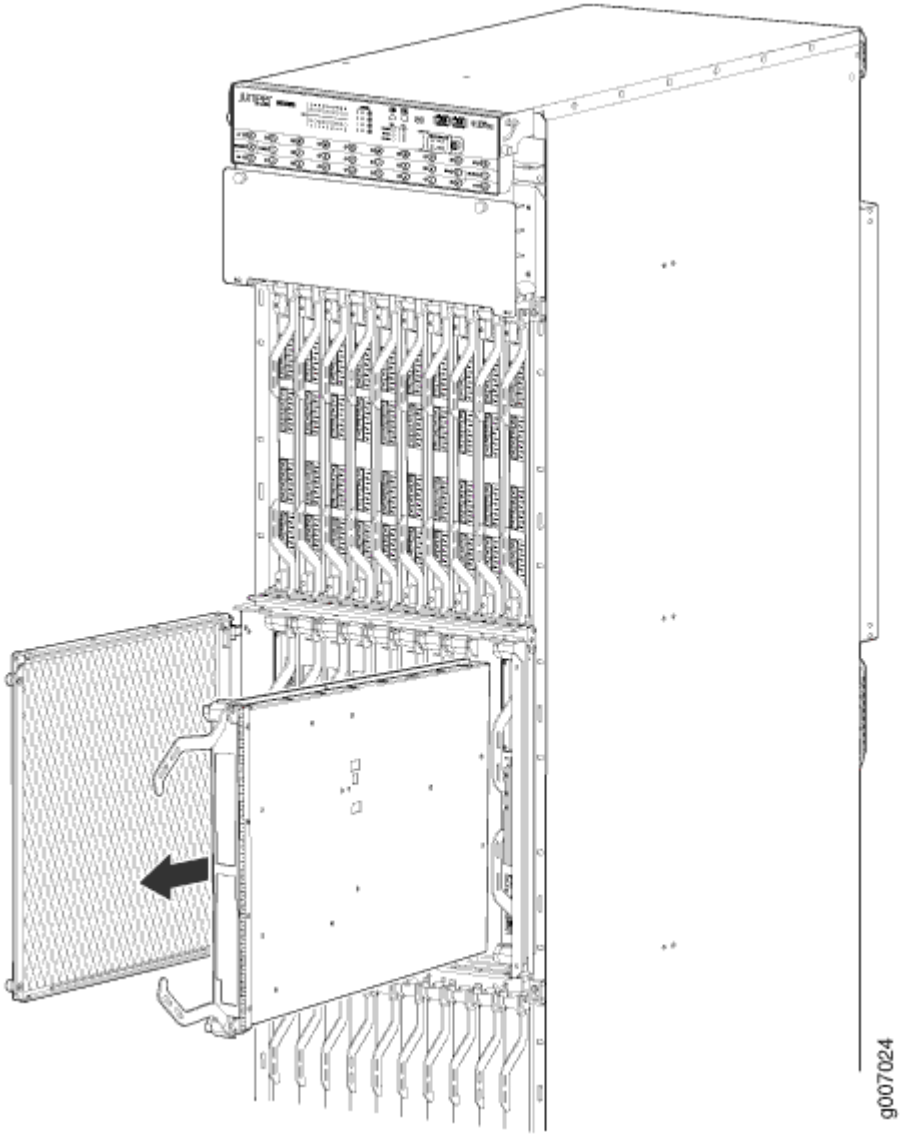
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
3. Open the ejector handles outward simultaneously 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 127: Removing an SFB



Removing the MPCs with Adapter Card Before Installing an MX2020 Router

To remove an MPC with an adapter card (ADC):

1. Have ready an antistatic mat for the MPC with an ADC. Also have ready rubber safety caps for each MPC using an optical interface on the MPC 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 the ejector handles simultaneously to unseat the both the MPC and the ADC.
4. Grasp the handles, and slide the MPC along with the ADC straight out of the card cage halfway.

5. Place one hand around the front of the MPC with the ADC and the other hand under MPC to support it. Slide the MPC along with the ADC 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 ADC is concentrated in the back end. Be prepared to accept the full weight—up to 25.0 lb (11.34 kg)—as you slide the MPC along with the ADC out of the chassis.
>
> When the MPC along with the ADC 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 ADCs 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.

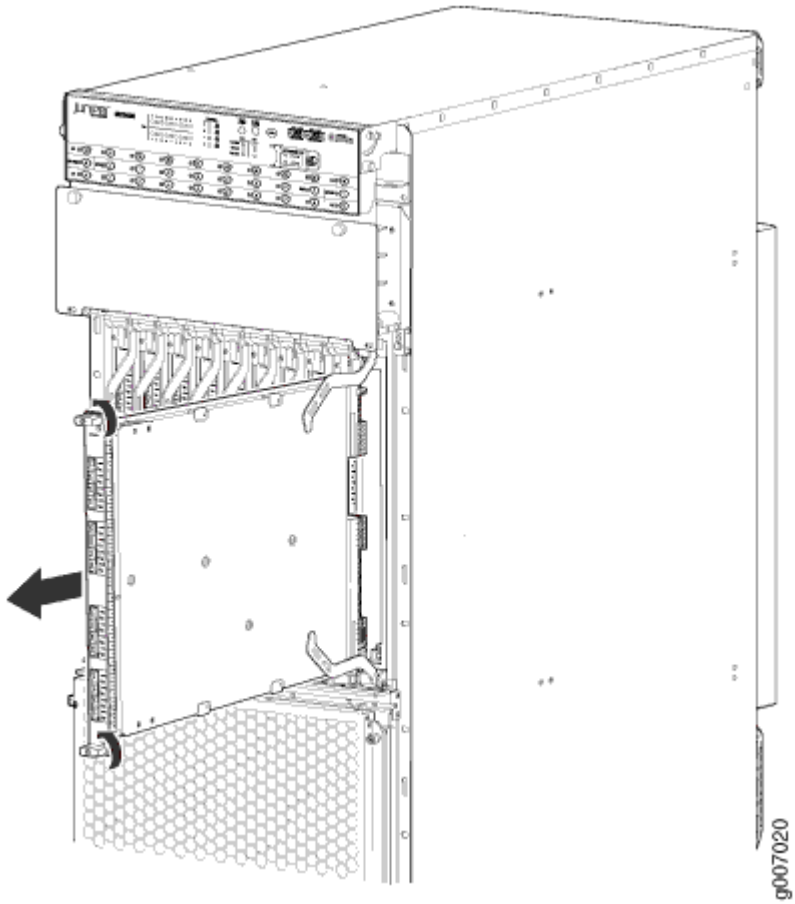
Removing the MPCs without an Adapter Card Before Installing an MX2020 Router

To remove an MPC without an ADC (see Figure 128 on page 364):

1. Have ready an antistatic mat for the MPC. Also have ready rubber safety caps for each MPC that uses an optical interface on the MPC 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. Simultaneously turn both the knobs counterclockwise to unseat the MPC from the ADC.
4. Grasp both knobs, and slide the MPC straight out of the ADC.
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 ADC, 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 ADC.
>
> When the MPC is out of the ADC, 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 128: Removing an MPC without the ADC



Removing the CB-REs Before Installing the MX2020 Router

To remove a CB-RE (see Figure 129 on page 365):

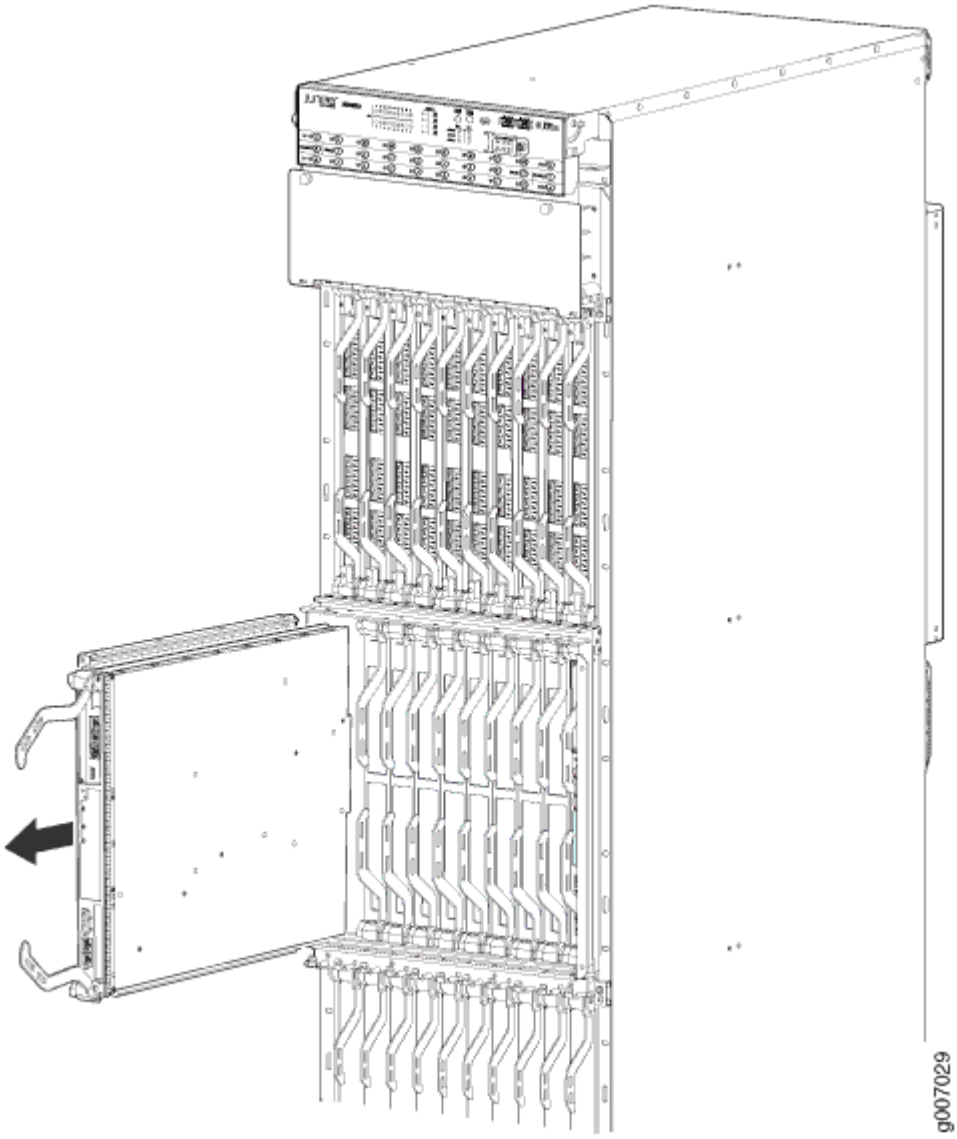
1. Have ready an antistatic mat for the CB-RE. Also have ready rubber safety caps for each SFP that uses an optical interface on the CB-RE that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. 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 129: Removing a CB-RE



RELATED DOCUMENTATION

- Preventing Electrostatic Discharge Damage to an MX2020 Router
- Overview of Preparing the Site for the MX2020 Router | **197**
- Tools Required to Install the MX2020 Router Using a Router Transport Kit | **329**
- Installing the MX2020 Router Using a Router Transport Kit | **382**
- Reinstalling Components in the MX2020 Router After Installing in a Rack | **392**

Installing a MX2020 Router Using a Pallet Jack Overview

Because of the MX2020 router's size and weight—1,515 lb (687.19 kg) depending on the configuration—we strongly recommend that you install the router using a pallet jack with pallet jack attachment.

NOTE: Juniper Networks offers a router transport kit to install the router (see "Installing the MX2020 Router Using a Router Transport Kit" on page 382).

1. Verify that the mounting hardware has been installed.

   See: "Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet" on page 344

2. Remove the router from the shipping crate:

   See: "Overview of Unpacking the MX2020 Router" on page 332

3. Gather the tools required to install the router.

   See: "Tools Required to Install the MX2020 Router Using a Pallet Jack" on page 328

4. Remove the components.

   See: "Removing Components from the MX2020 Router Chassis Before Installing it in a Rack" on page 349

5. Install the MX2020 using the pallet jack attachment.

   See: "Installing the MX2020 Router Using a Pallet Jack with Attachment" on page 369

6. Reinstall the components.

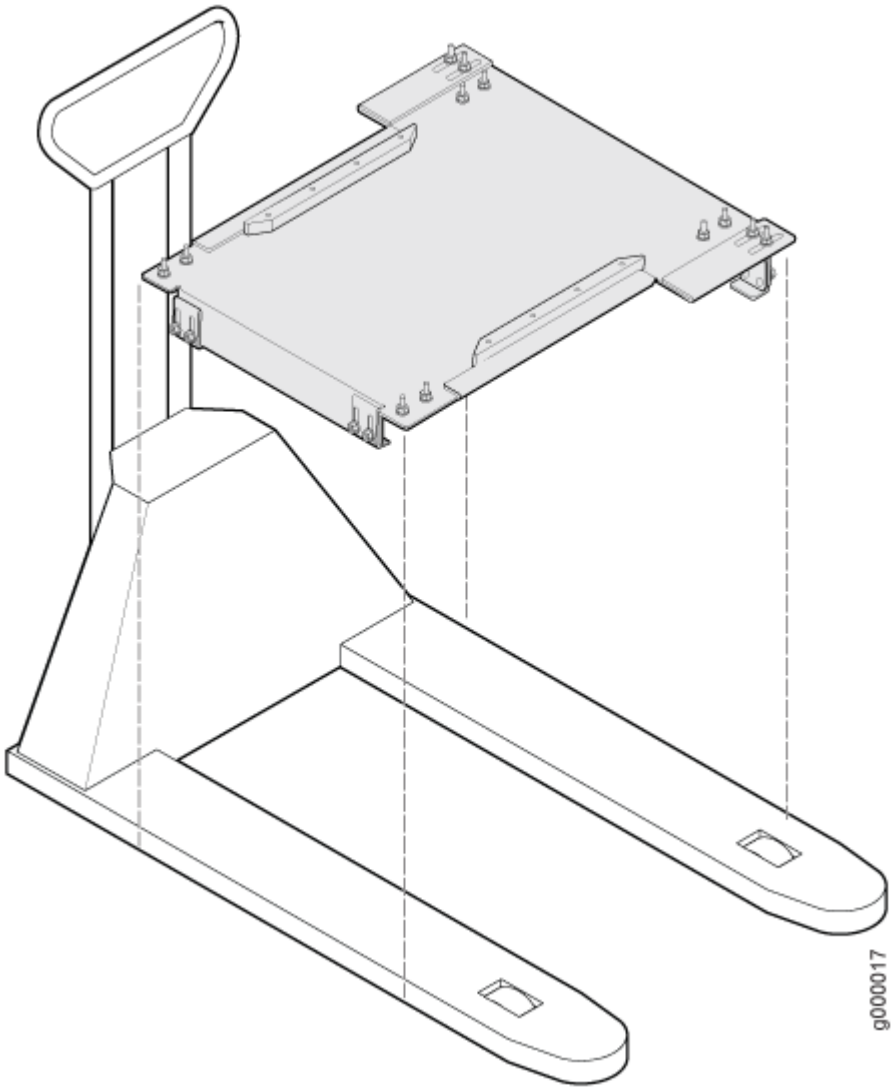
   See: "Reinstalling Components in the MX2020 Router After Installing in a Rack" on page 392

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 130 on page 368).

Figure 130: Installing Pallet Jack Attachment onto Pallet Jack



RELATED DOCUMENTATION

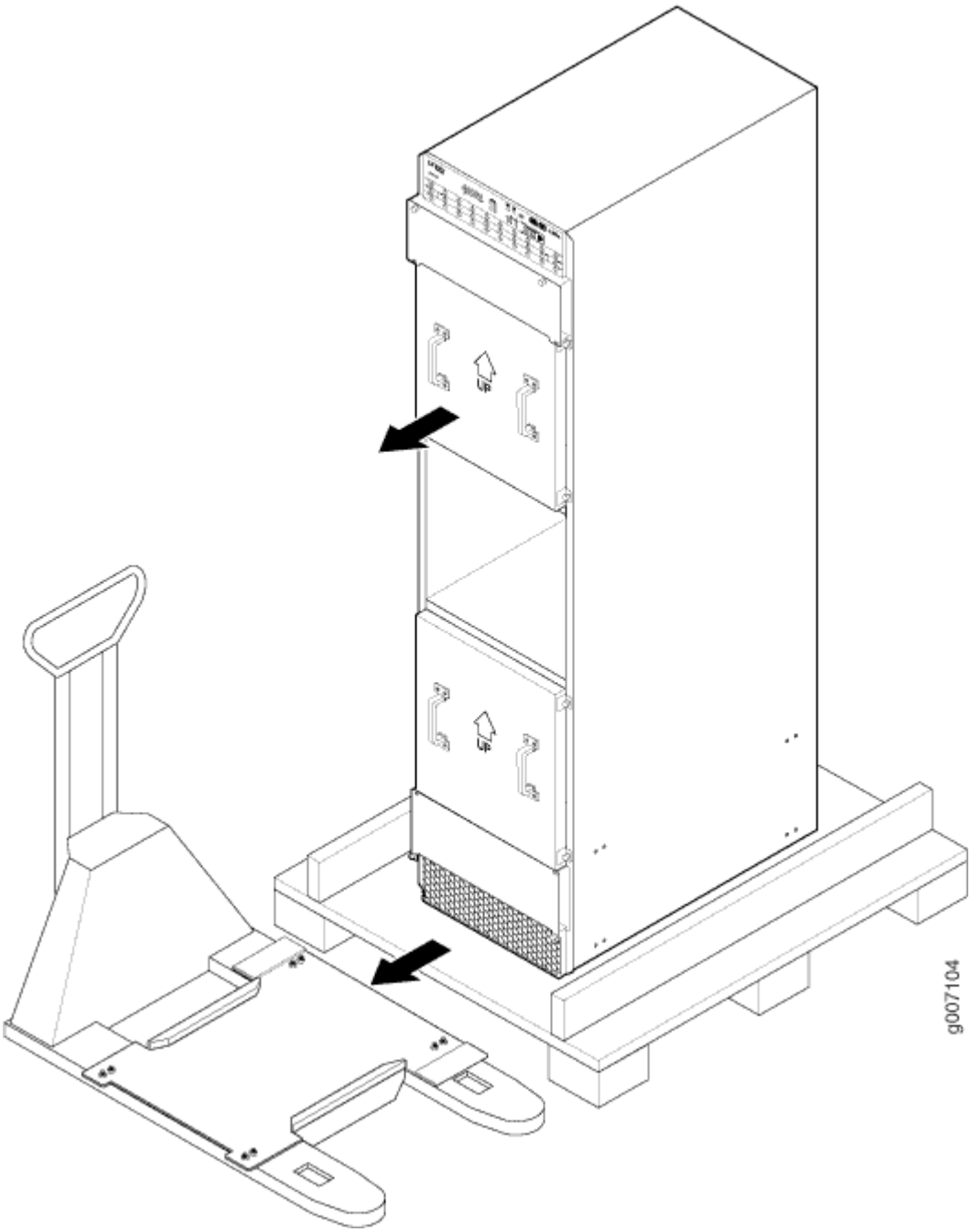
- Overview of Preparing the Site for the MX2020 Router | **197**
- Tools Required to Install the MX2020 Router Using a Pallet Jack | **328**
- Installing the MX2020 Router Using a Pallet Jack with Attachment | **369**

Installing the MX2020 Router Using a Pallet Jack with Attachment

Before installing the router, you must remove all components (see "Removing Components from the MX2020 Router Chassis Before Installing it in a Rack" on page 349). To install the router using a pallet jack with attachment:

1. Ensure that the rack or cabinet is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance.
2. Reinstall the front and rear shipping covers to help guide the chassis during installation.
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 131: Loading the MX2020 Router onto the Pallet Jack



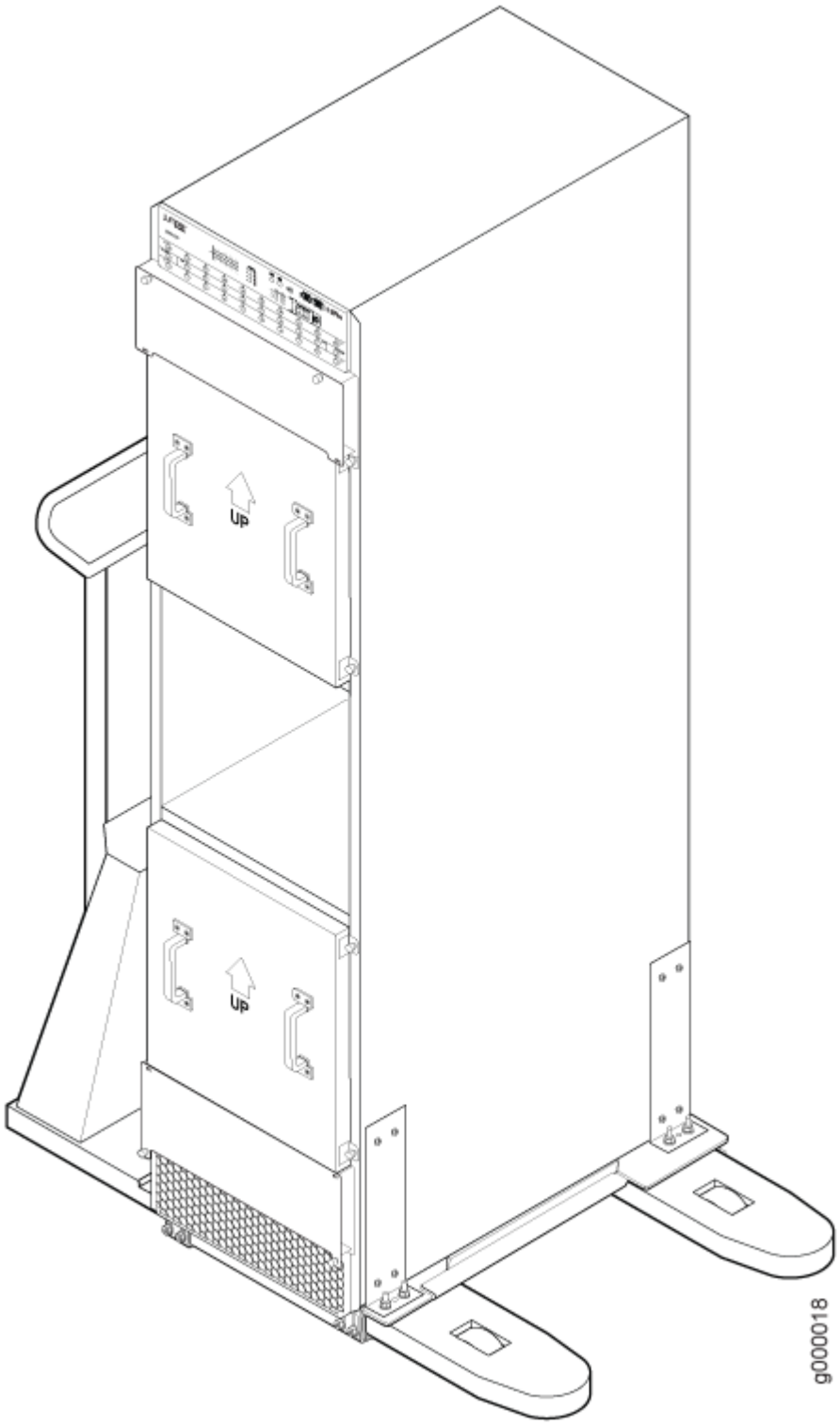
NOTE: Juniper Networks offers a router transport kit to install the router (see "Installing the MX2020 Router Using a Router Transport Kit" on page 382).

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 using existing hardware.
6. On each of the shipping brackets, partially insert screws into the holes to secure the brackets to the chassis. Tighten all screws. These brackets will help prevent the chassis from tilting (see Figure 132 on page 372).

NOTE: There must be a minimum of 45 U of usable rack space when installing the MX2020 router into a 45-U rack.

Figure 132: Securing the MX2020 to the Pallet Jack Attachment



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.

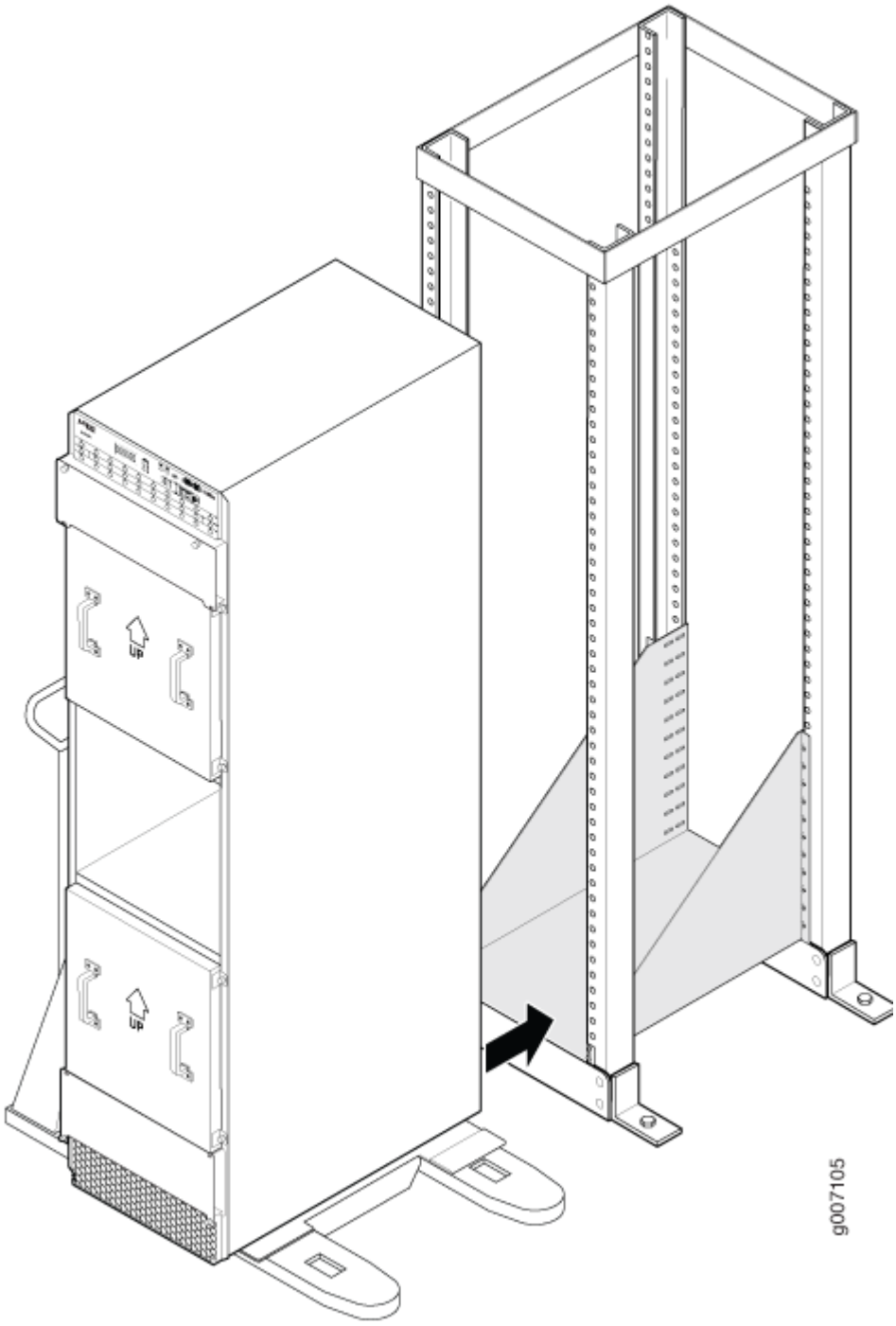
NOTE: An empty MX2020 router weighs approximately 300 lb (136.0 kg).

8. Using the pallet jack, position the router in front of the rack or cabinet, centering it in front of the mounting shelf.

   NOTE: If you are installing the MX2020 router into a network cabinet, make sure that no hardware, device, rack, or cabinet component obstructs the 45-U rack space from access during installation.

9. Using the pallet jack, lift the chassis approximately 0.25 in. (0.6 cm) above the surface of the mounting shelf, and position it as close as possible to the shelf.
10. Remove the shipping brackets that are attached to the pallet jack attachment and chassis, and set them aside.
11. Grasping the handles on the shipping covers, carefully slide the router onto the mounting shelf so that the bottom of the chassis and the mounting shelf overlap by approximately 2 inches. Continue sliding the router until the front-mounting flanges contact the rack rails (depending on your type of installation). The shelf ensures that the holes in the front-mounting flanges of the chassis align with the holes in the rack rails (see Figure 133 on page 374).

Figure 133: Loading the MX2020 Router into the Rack



NOTE: There must be a minimum of 45 U of usable rack space when installing the MX2020 router into a 45-U rack.

12. Move the pallet jack away from the rack.
13. 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.
14. Insert sixteen mounting screws (eight on each side) into the mounting holes to secure the router to the rack.

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2020 Router | **197**

Tools Required to Install the MX2020 Router Using a Pallet Jack | **328**

Installing the Pallet Jack Attachment | **367**

Removing Components from the MX2020 Router Chassis Before Installing it in a Rack | **349**

Reinstalling Components in the MX2020 Router After Installing in a Rack | **392**

Installing a MX2020 Router Using a Router Transport Kit Overview

Because of the MX2020 router's size and weight—1,515 lb (687.19 kg) depending on the configuration—we strongly recommend that you install the router using either the router transport kit or a pallet jack (see "Installing the MX2020 Router Using a Pallet Jack with Attachment" on page 369 for more information on installing the router with the pallet jack.

1. Gather the tools required to install the router. See:

   "Tools Required to Install the MX2020 Router Using a Router Transport Kit" on page 329

2. Install the router transport kit. See:

   "Installing the MX2020 Router Using a Router Transport Kit" on page 382

3. Secure the router to the router transport platform. See:

   "Securing the MX2020 Router to the Router Transport Platform" on page 378

4. Install the MX2020 using the router transport kit. See:

   "Installing the MX2020 Router Using a Router Transport Kit" on page 382

5. Reinstall the components. See:

   "Reinstalling Components in the MX2020 Router After Installing in a Rack" on page 392

Installing the Router Transport Kit on the MX2020 Router

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

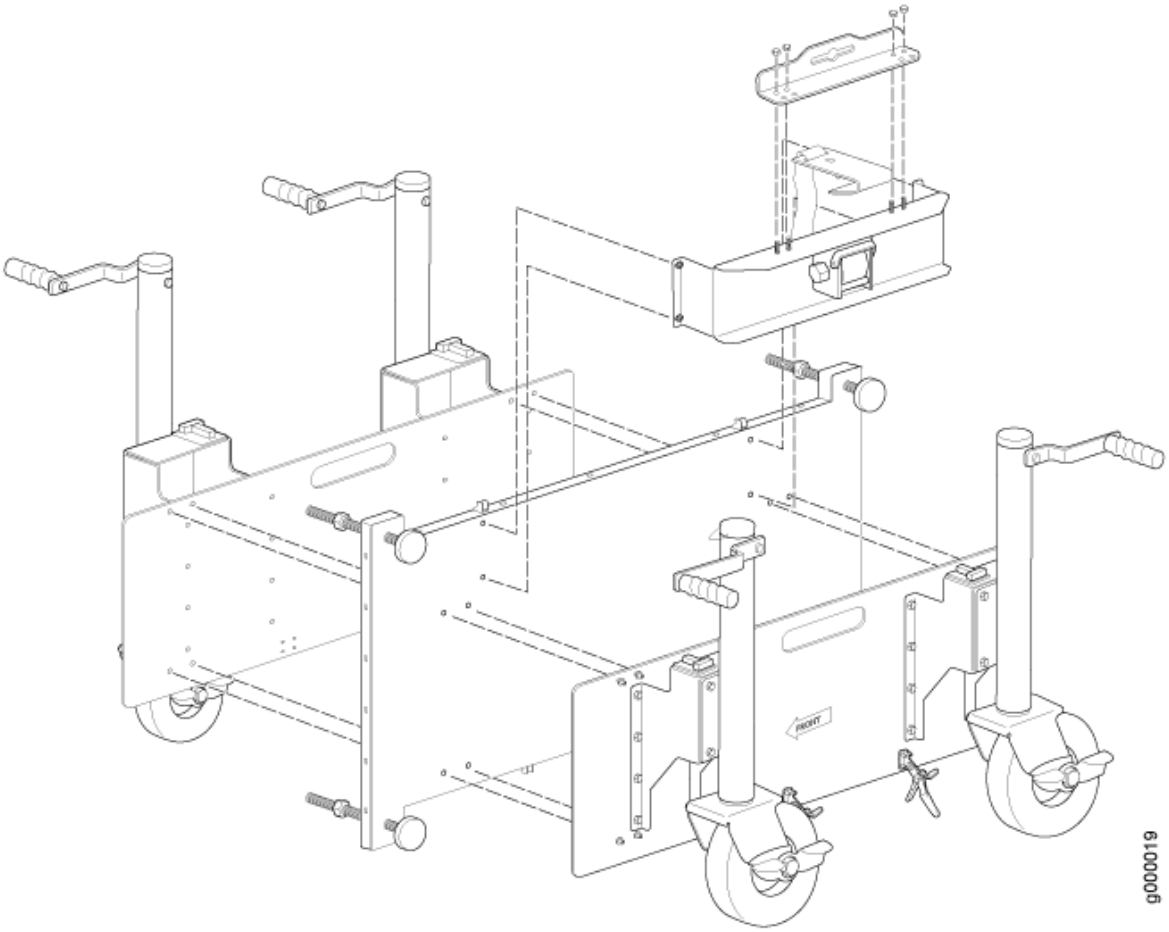
To install the router transport kit:

1. Remove the router transport kit from the shipping crate (see "Unpacking the Router Transport Kit" on page 341).

   NOTE: The router transport kit weighs approximately 138.5 lb (62.82 kg).

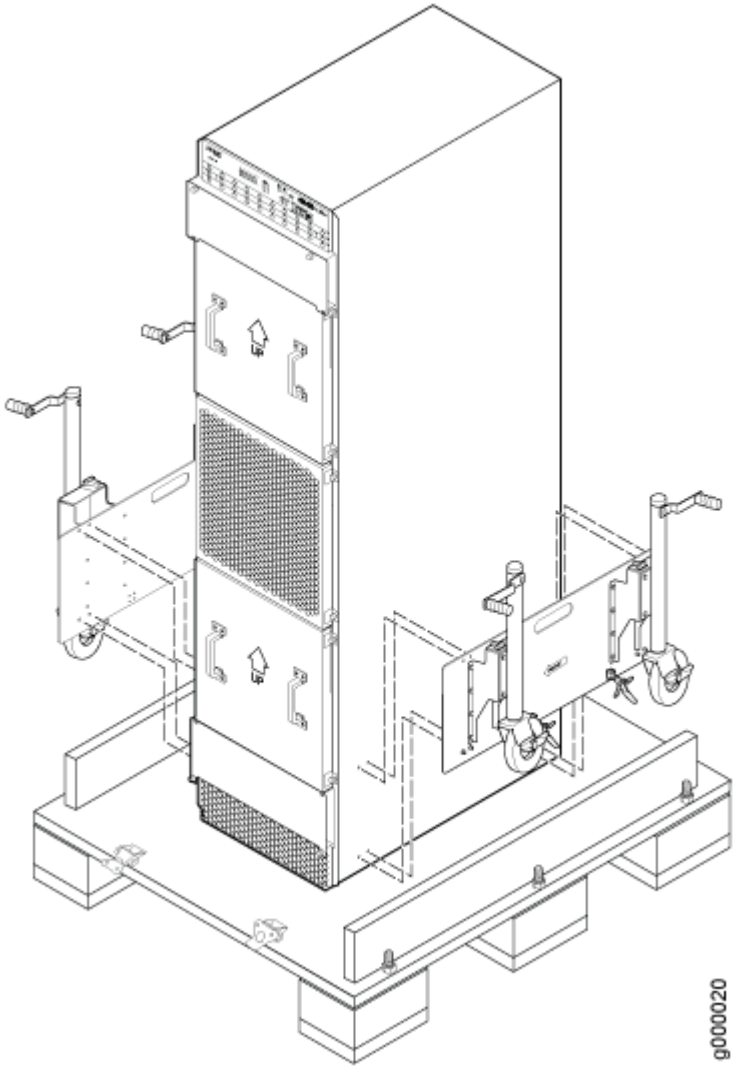
2. Remove the winch strap plate that is secured to the winch mount using a 9/16-in. (14 mm) socket wrench, and set aside.
3. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the winch mount to the router transport kit, and set aside.
4. Using a number 3 Phillips screwdriver, 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 134 on page 377).

Figure 134: 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 them 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 135 on page 378).
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 135 on page 378).
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 135: Installing the Router Transport Kit onto the MX2020



RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2020 Router | 197

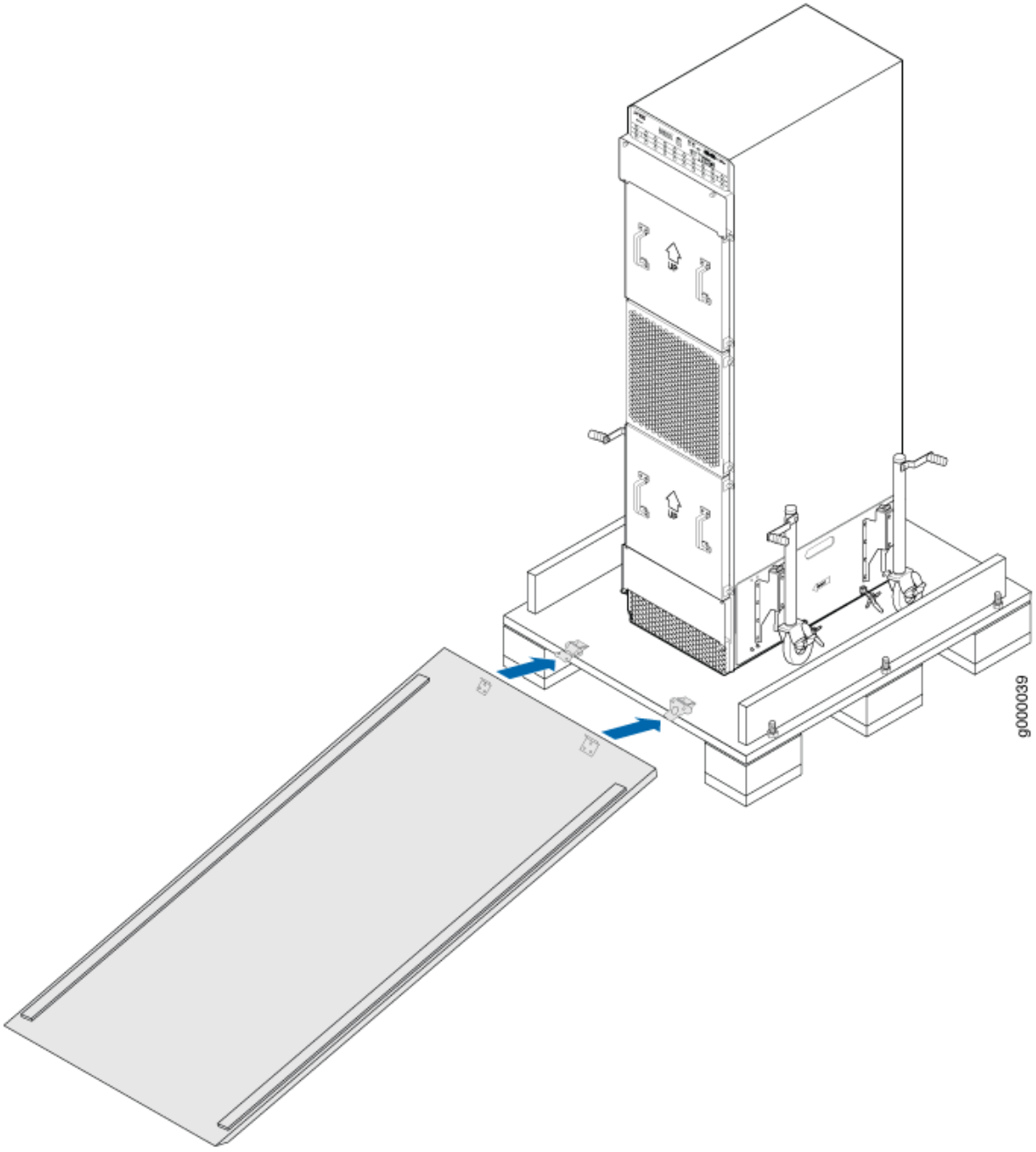
Installing the MX2020 Router Using a Router Transport Kit | 382

Securing the MX2020 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 using the two metal latches (see Figure 136 on page 379).

Figure 136: Securing the Crate Door to the Shipping Crate Platform



NOTE: An empty MX2020 weighs approximately 429.6 lb (194.86 kg).

3. Using a two person team on either side of the chassis, turn the handles on the router transport 4-5 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 will ensure 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.

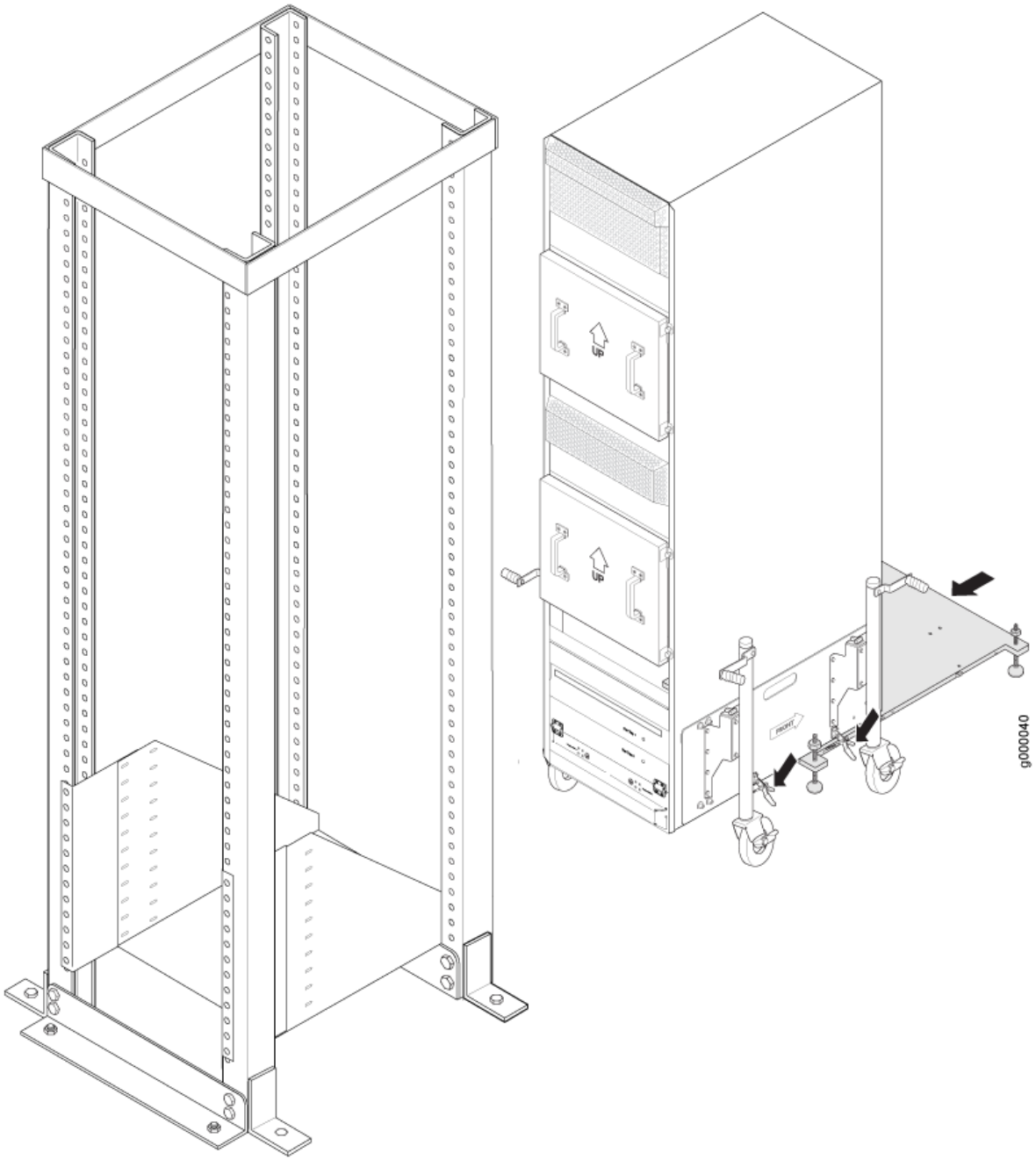
CAUTION: Do not lift the router using the handles on the shipping covers. Use these handles only to help position the router.

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) to a maximum of 4 in. (10.16 cm).

7. Secure the router transport platform to the router transport mounting plates using the four latch locks (see Figure 137 on page 381).

Figure 137: Securing the Router Transport Platform



Installing the MX2020 Router Using a Router Transport Kit

Because of the router's size and weight—up to 1,515 lb (687.19 kg) depending on the configuration—you must use either a pallet jack or router transport kit to install the router.

NOTE: You can purchase a router transport kit from Juniper Networks.

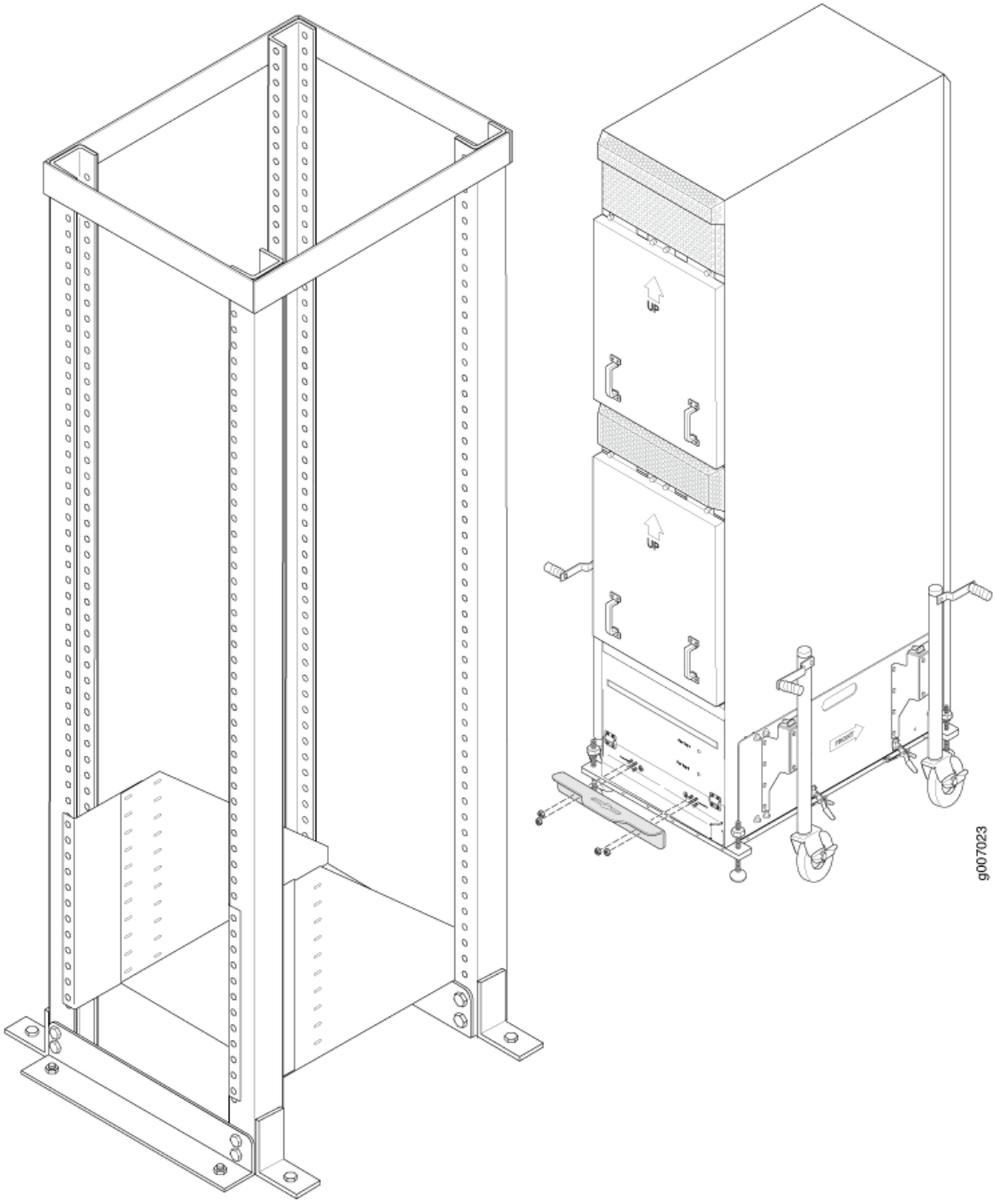
NOTE: Four persons are needed to install the router into a rack.

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 MX2020 using a router transport kit:

1. Install the winch strap plate to the rear of the router using the four captive screws, and tighten (see Figure 138 on page 383).

Figure 138: Installing Winch Strap Plate



2. Using a four person team, transport the router to the rack installation location and center it in front of the mounting shelf. See "MX2020 Moving Requirements and Guidelines Using a Router Transport Kit" on page 220.

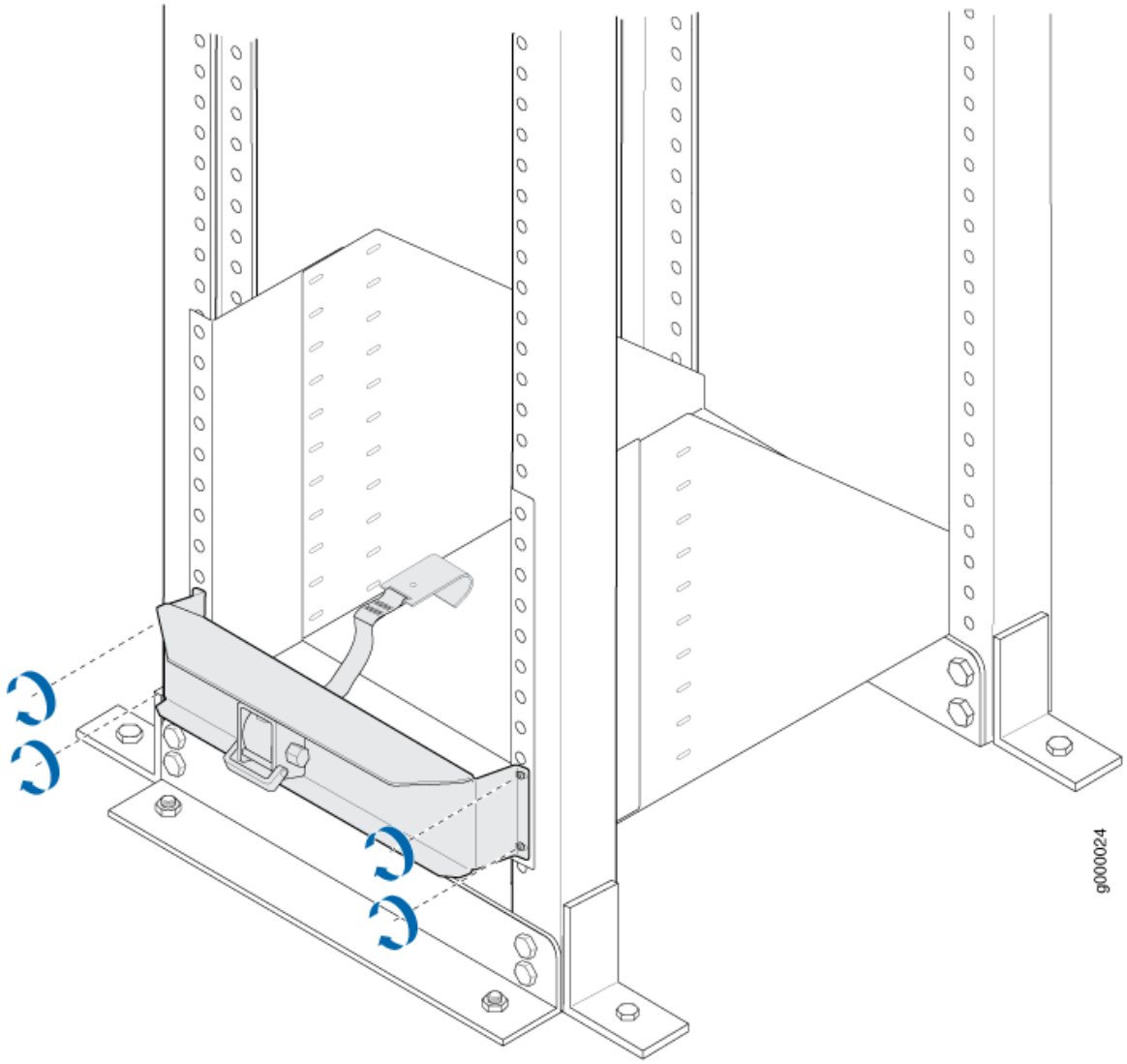
   NOTE: A minimum of 38 in. (96.5 cm) of clearance is required to roll the chassis sideways.

   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 using the captive screws, and tighten (see Figure 139 on page 385).

Figure 139: Installing Winch Mount Bracket to Rack Rails

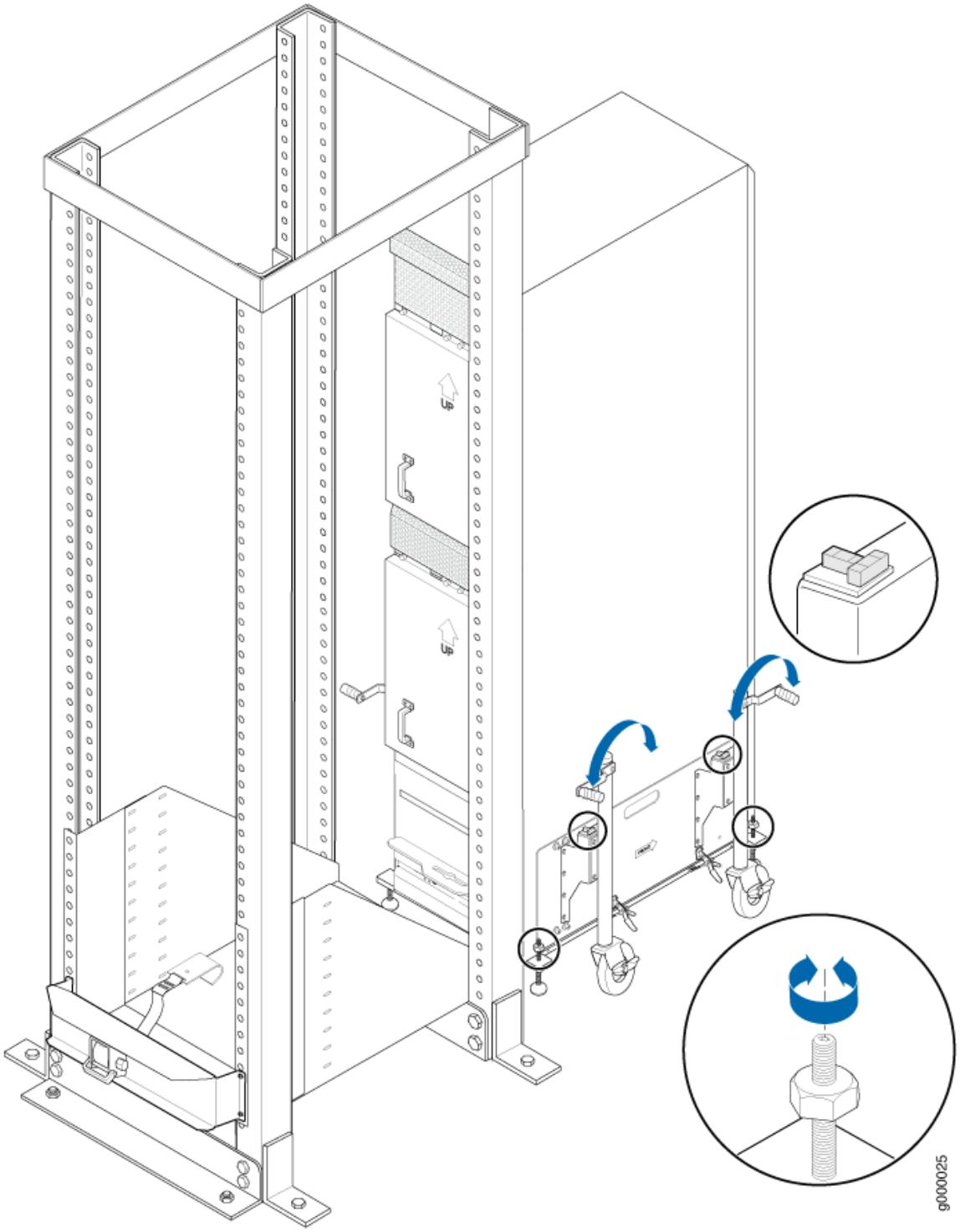


4. Adjust the height of the router by turning the handles clockwise until the router transport platform is aligned with the surface of the mounting shelf and slightly higher than the mounting shelf (see Figure 140 on page 386).

   NOTE: Make sure the bubbles within the T-shaped levels are between the lines, indicating the router is level.

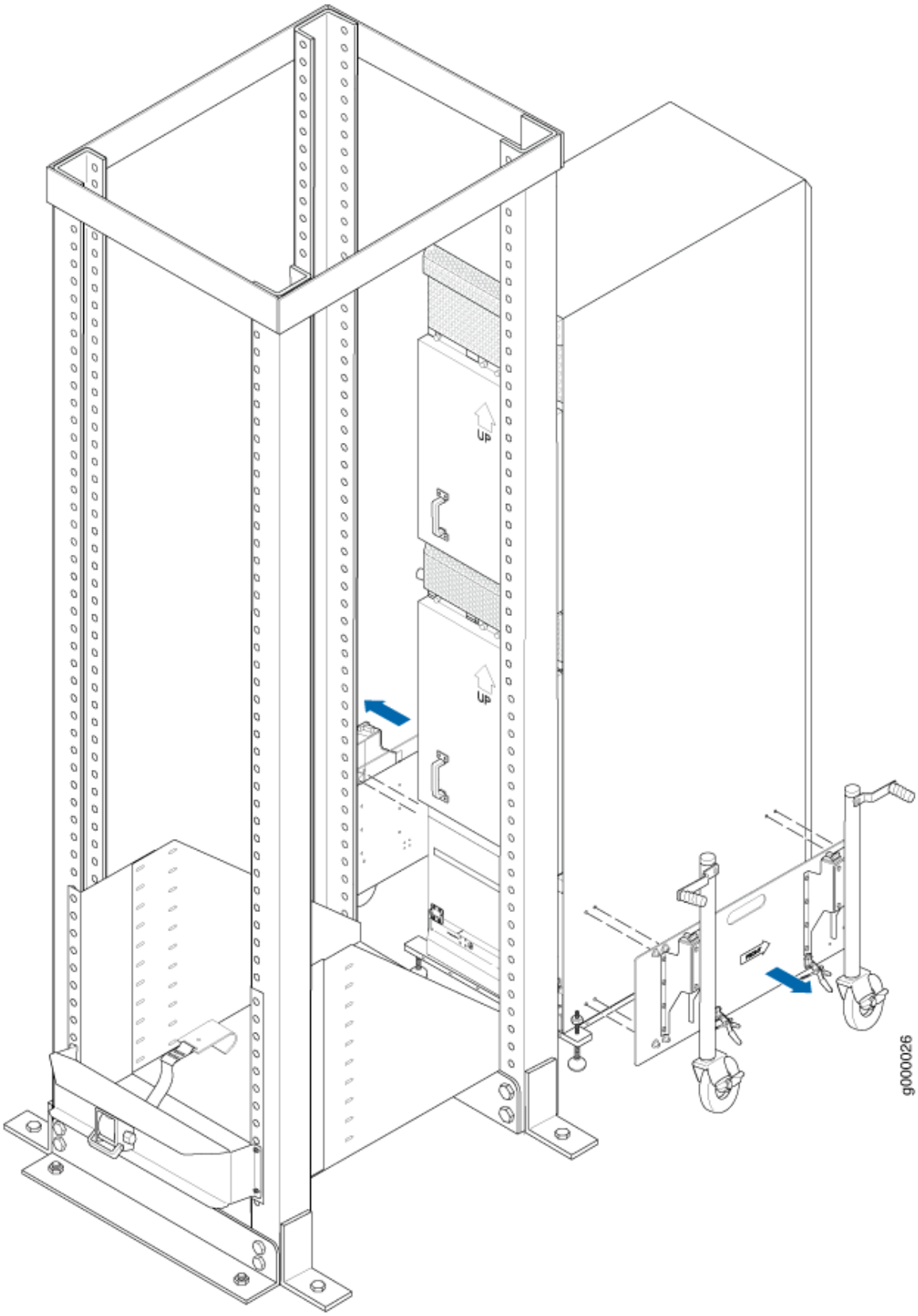
5. Adjust the four leveling mounts on the router transport platform until all four leveling mounts rest firmly on the ground (see Figure 140 on page 386).

Figure 140: Align the MX2020 Router with Rack Mounting Shelf



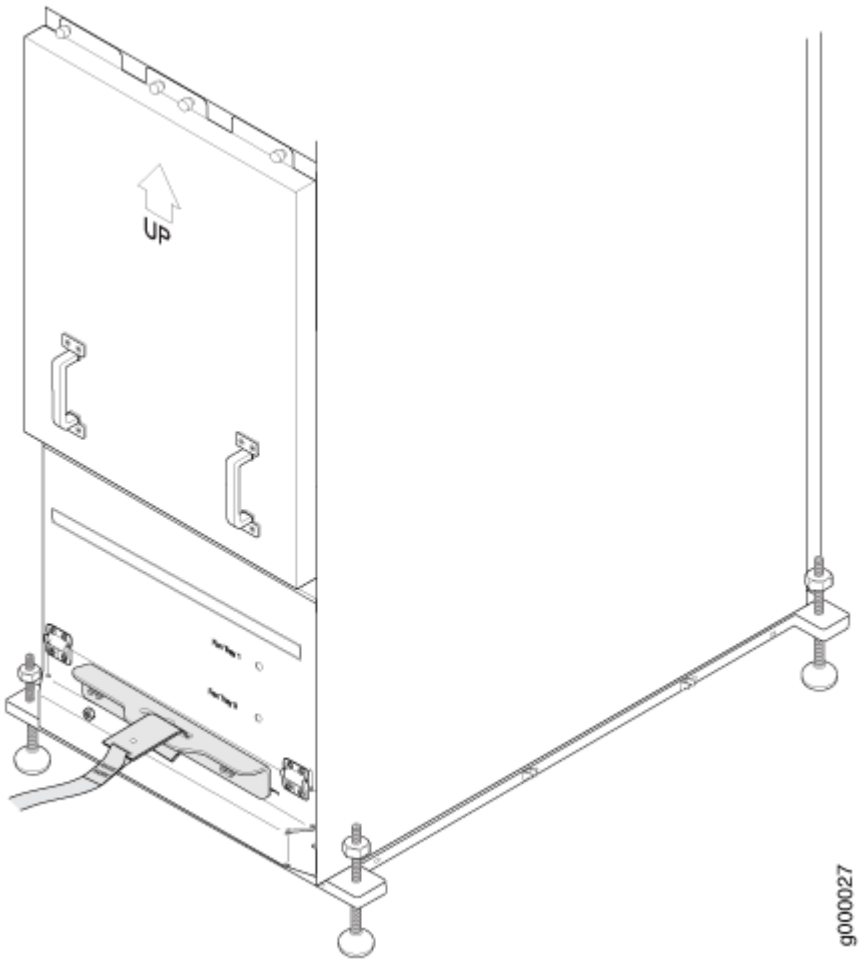
6. Unlock the four toggle latches that secure the router transport platform to the router transport mounting plates and wheel assembly.
7. Lift the wheels up by turning the handles counterclockwise so that the weight of the router is on the router transport platform.
8. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plate and wheel assembly to the chassis, and set them aside (see Figure 141 on page 388).

Figure 141: Remove Router Transport Mounting Plate and Wheel Assembly



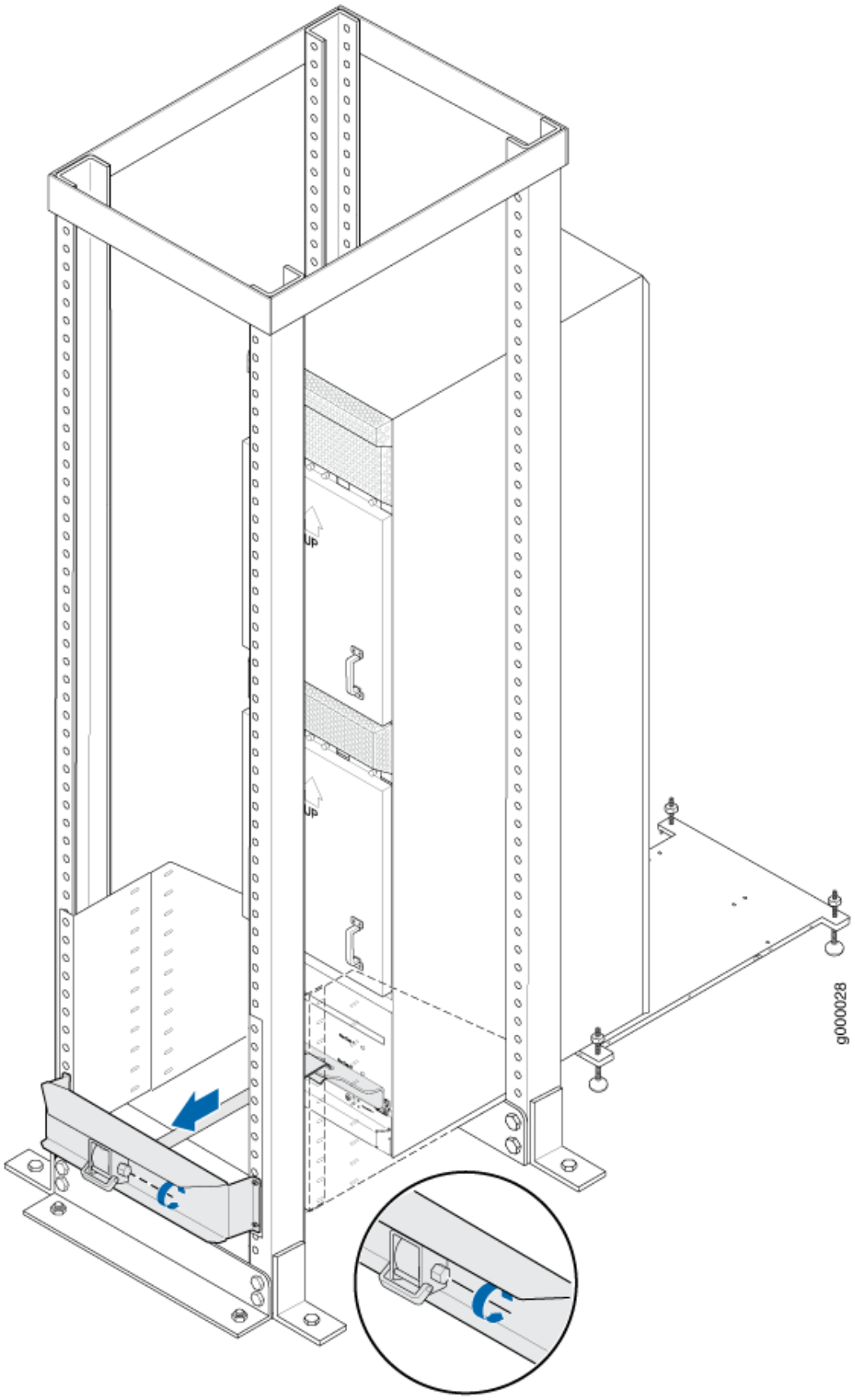
9. Attach the winch strap to the winch strap plate at the rear of the router (see Figure 142 on page 389).

Figure 142: Attaching Winch Strap to Winch Strap Plate



10. Attach a 1-1/8 in. (28.57 mm) socket drive wrench to the winch mechanism and turn clockwise to start pulling the chassis into the rack onto the mounting shelf until the front-mounting flanges contact the rack rails. Ensure that the holes in the front-mounting flanges of the chassis align with the holes in the rack rails (see Figure 143 on page 390).

Figure 143: Pulling the MX2020 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 isn't 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 MX2020 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 sixteen mounting screws (eight 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 aside.

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2020 Router | **197**

Tools Required to Install the MX2020 Router Using a Router Transport Kit | **329**

Installing the Router Transport Kit on the MX2020 Router | **376**

MX2020 Moving Requirements and Guidelines Using a Router Transport Kit | **220**

Removing Components from the MX2020 Router Chassis Before Installing it in a Rack | **349**

Reinstalling Components in the MX2020 Router After Installing in a Rack | **392**

Reinstalling Components in the MX2020 Router After Installing in a Rack

IN THIS SECTION

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 After Installing the MX2020 Router in a Rack

To reinstall the AC, DC, 240 V China, or universal PDMs, follow this procedure for each PDM (see Figure 144 on page 393, and Figure 145 on page 394, Figure 146 on page 395, and Figure 147 on page 396):

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 a 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 zoned for the PDM that is 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 144: Reinstalling an AC Power Distribution Module

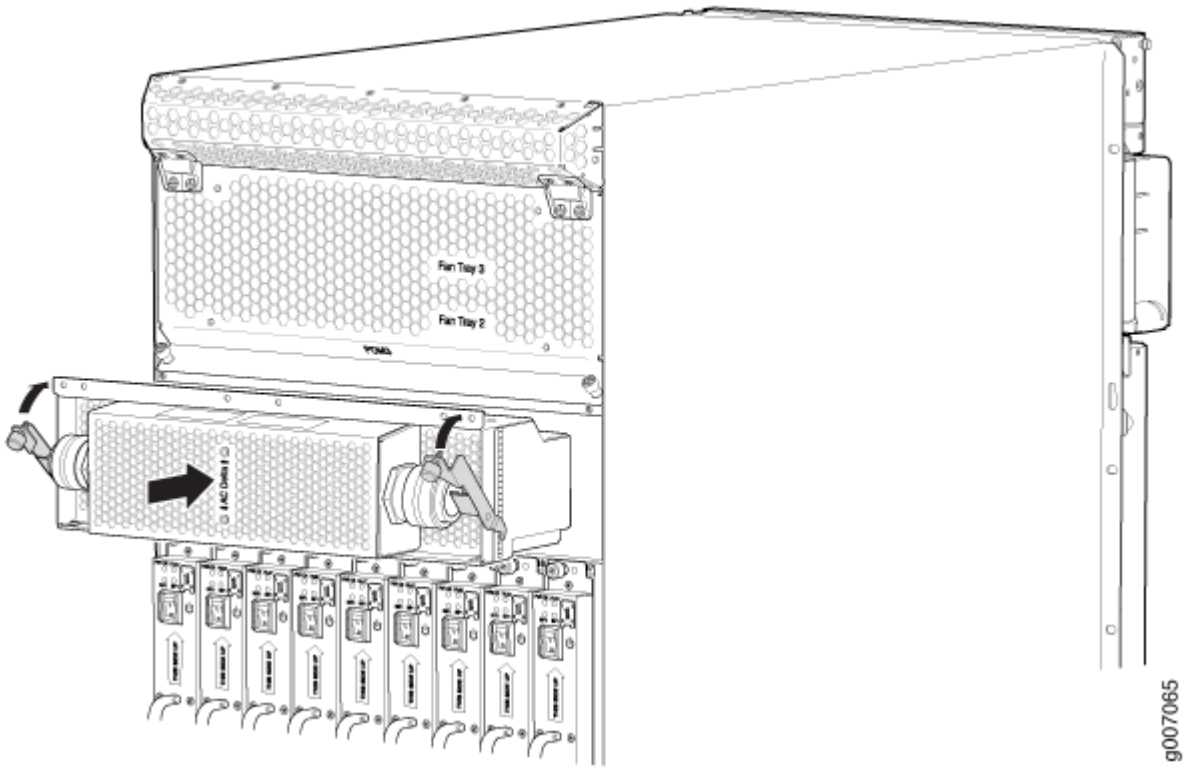


Figure 145: Reinstalling a DC Power Distribution Module (-48 V)

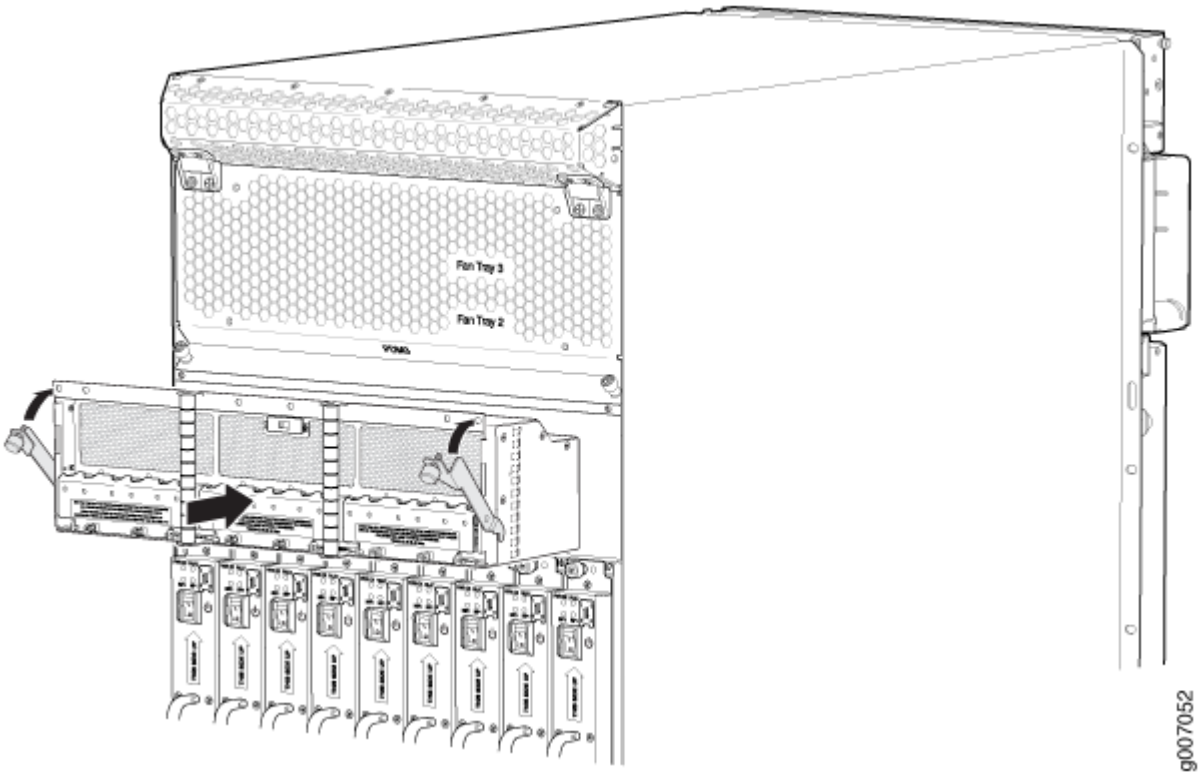


Figure 146: Reinstalling a DC Power Distribution Module (240 V China)

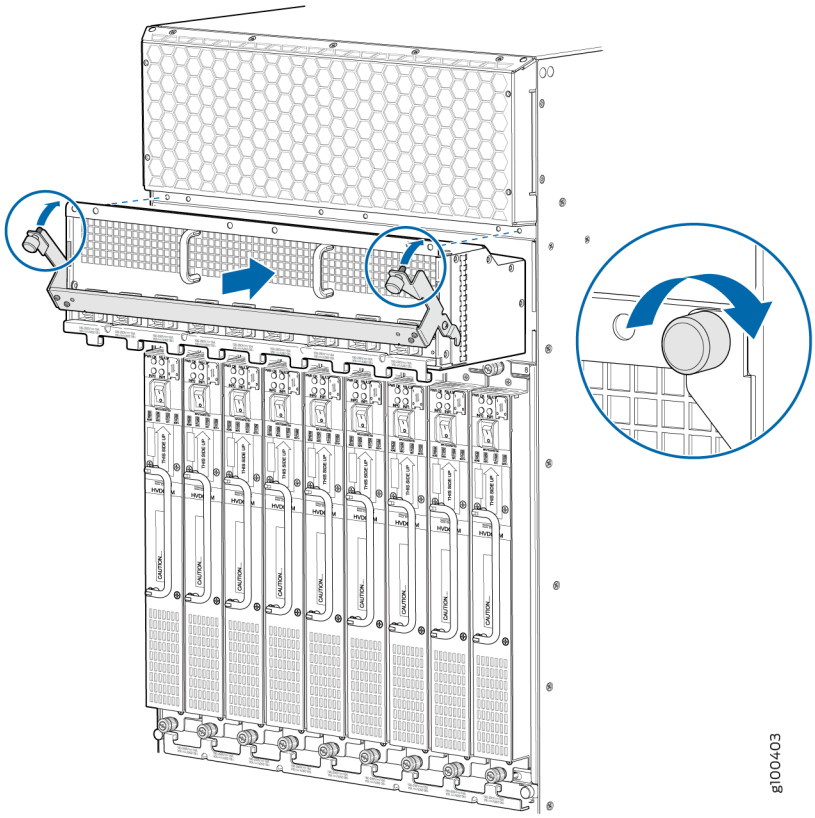
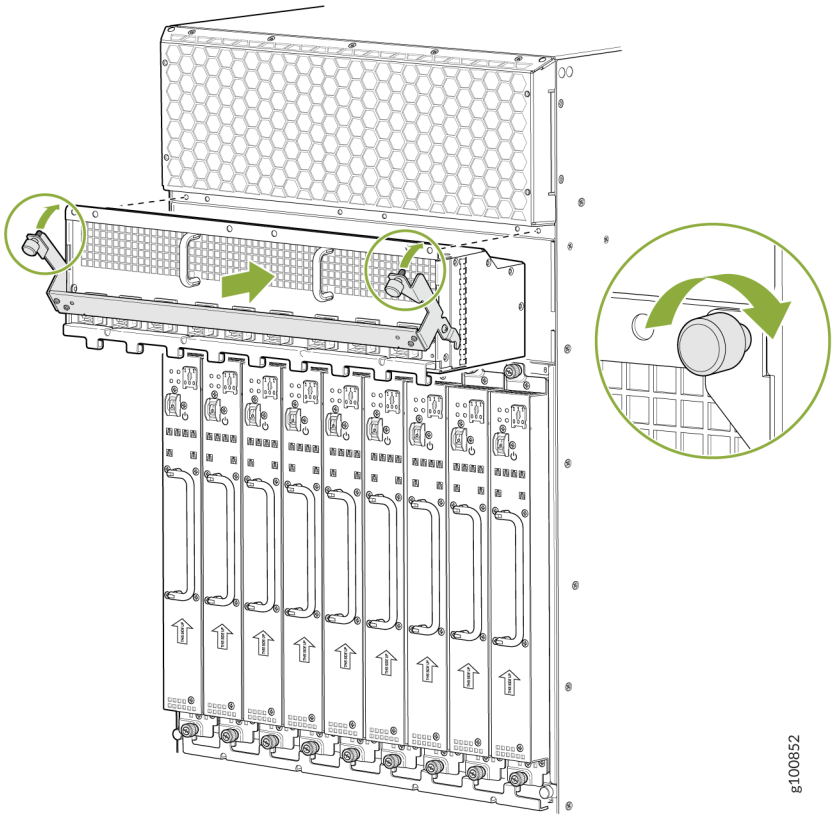


Figure 147: Reinstalling a High-Voltage Universal (HVAC/HVDC) Power Distribution Module



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.

SEE ALSO

Removing the Power Distribution Modules Before Installing an MX2020 Router in a Rack

Reinstalling the Power Supply Modules After Installing the MX2020 Router

To reinstall the AC, DC, 240 V China, or universal (HVAC/HVDC) PSMs, follow this procedure for each PSM (see Figure 148 on page 397, Figure 149 on page 398, Figure 150 on page 399, and Figure 151 on page 400 which shows the installation of the AC or DC PSM.

1. Remove the PSM to be installed out of the ESD bag, and identify the slot where it will be installed; **0** through **8** bottom, or **9** through **17** top.

NOTE: The MX2020 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 148: Reinstalling an AC Power Supply Module

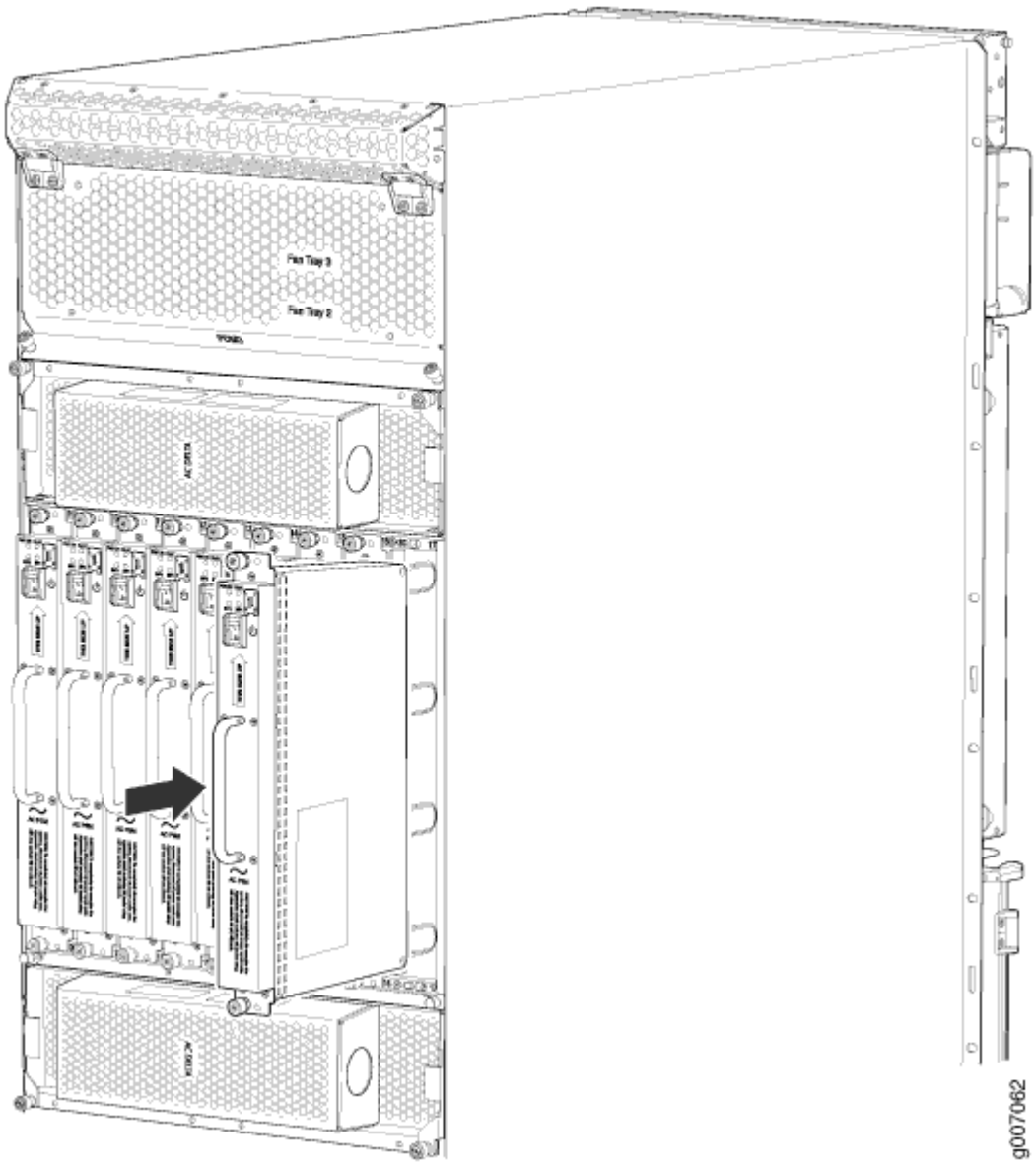


Figure 149: Reinstalling a DC Power Supply Module (-48 V)

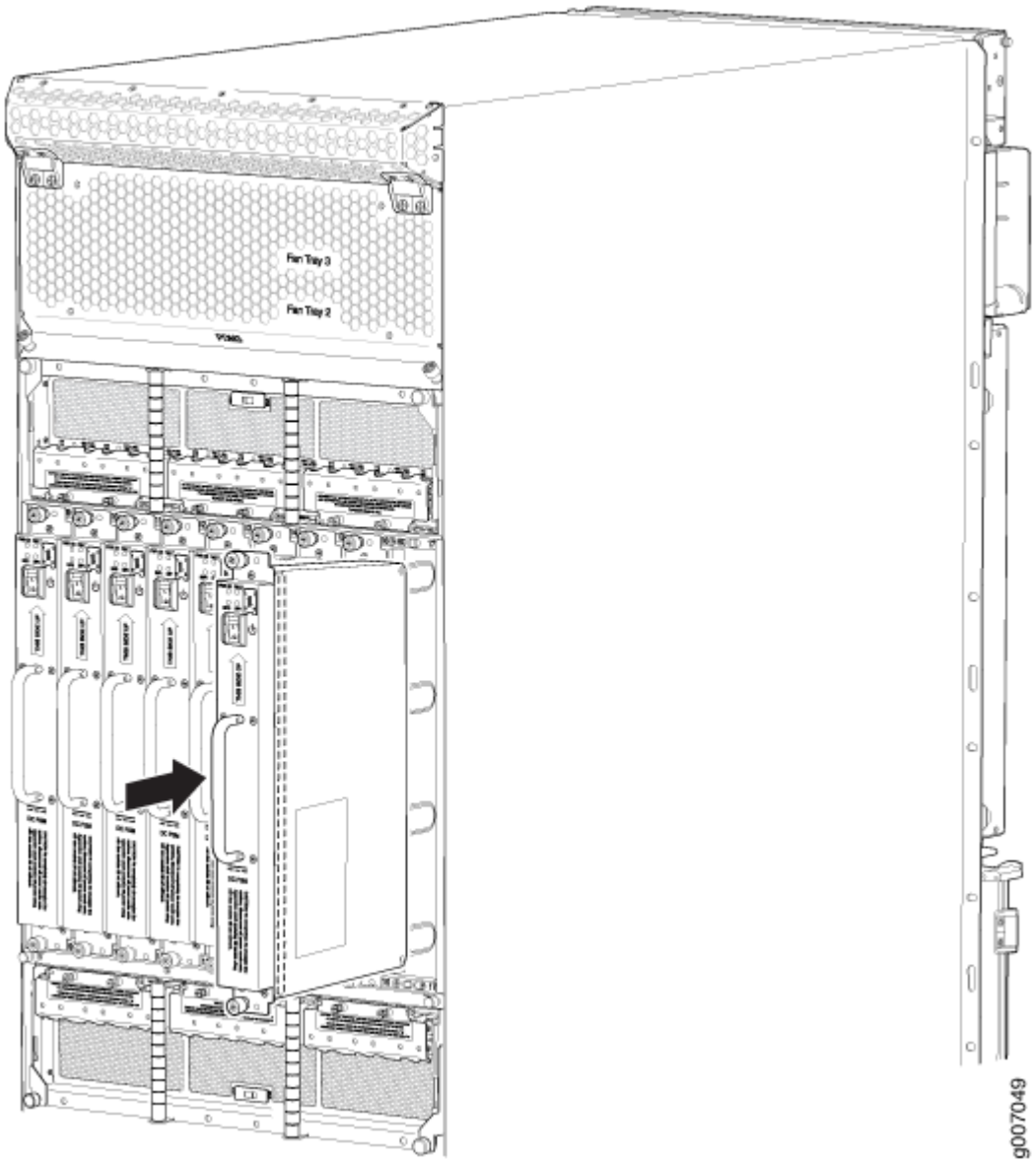


Figure 150: Reinstalling a DC Power Supply Module (240 V China)

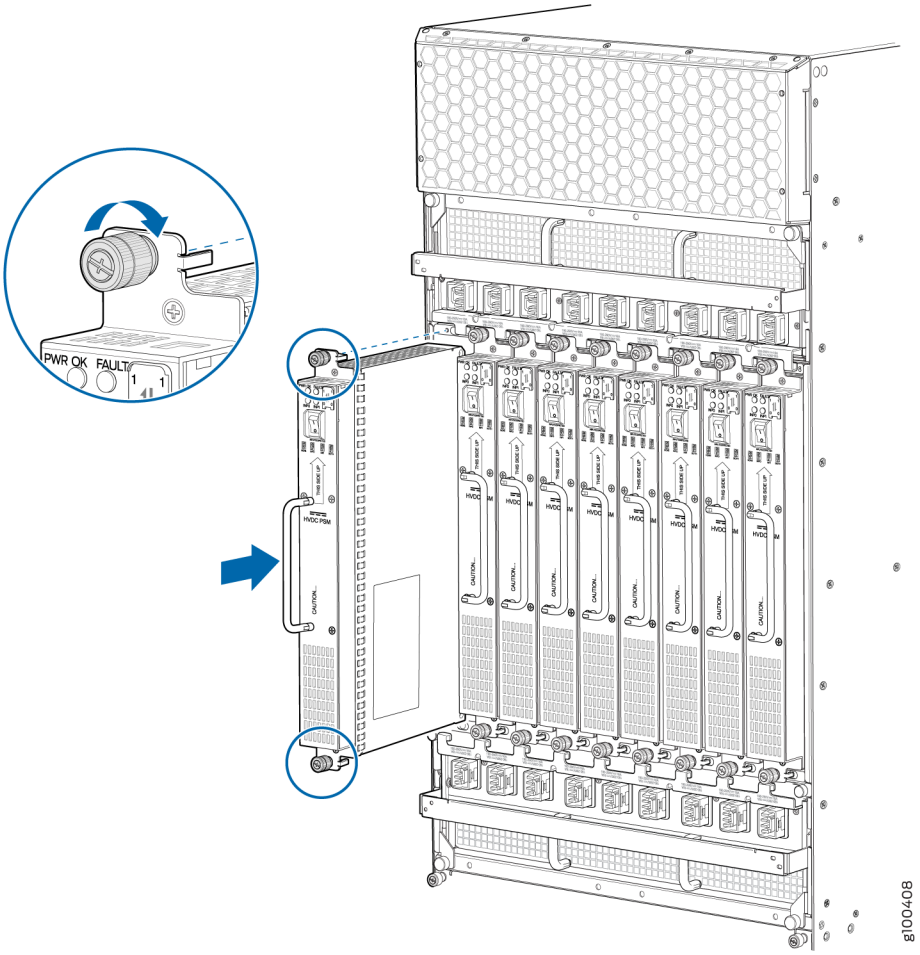
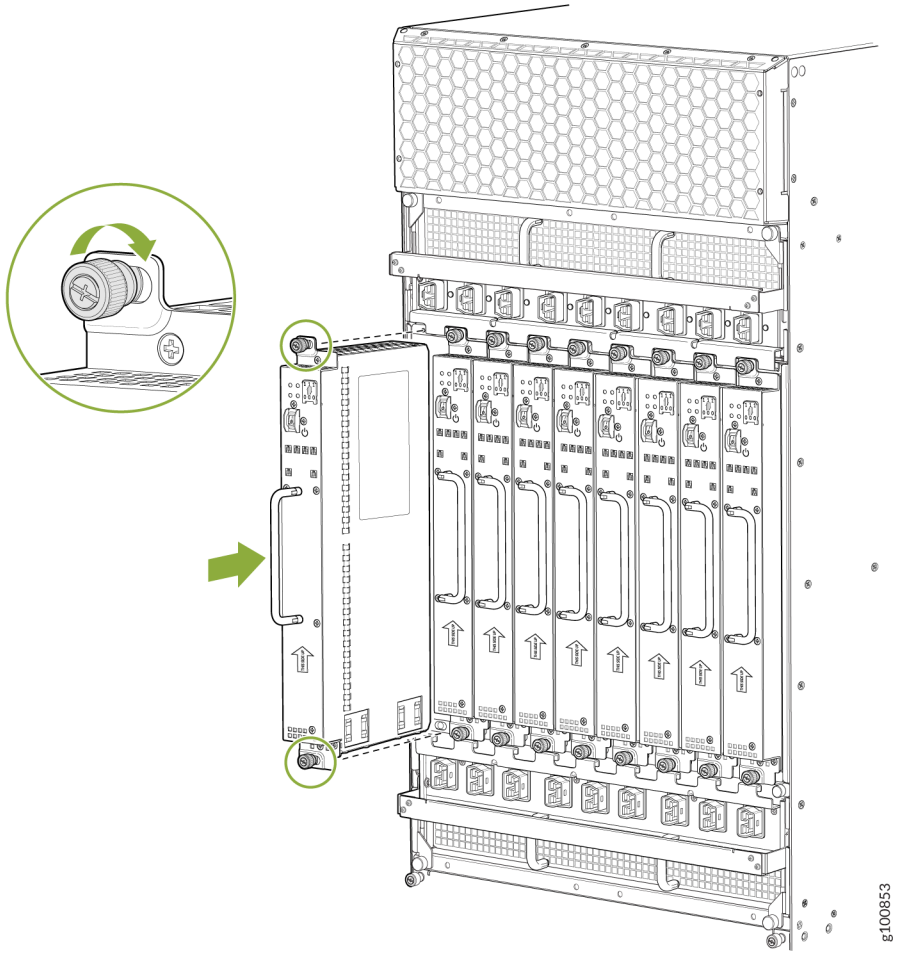


Figure 151: Reinstalling a High-Voltage Universal (HVAC/HVDC) Power Supply Module



Reinstalling the Fan Trays After Installing the MX2020 In a Rack

To reinstall the upper or lower fan trays (see Figure 152 on page 401 and Figure 153 on page 402):

1. Loosen the two captive screws on each side of the fan tray access panel, and open.
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. 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.
7. Close the fan tray access panel, and tighten the captive screws to secure it in place. 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. Reinstall the remaining components into the router.

Figure 152: Installing Upper Fan Trays

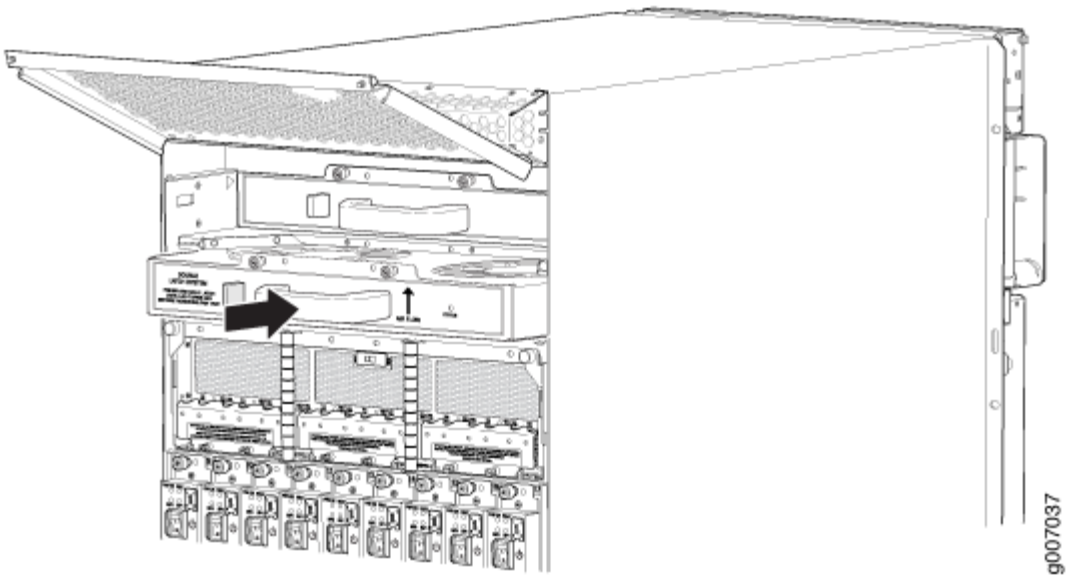
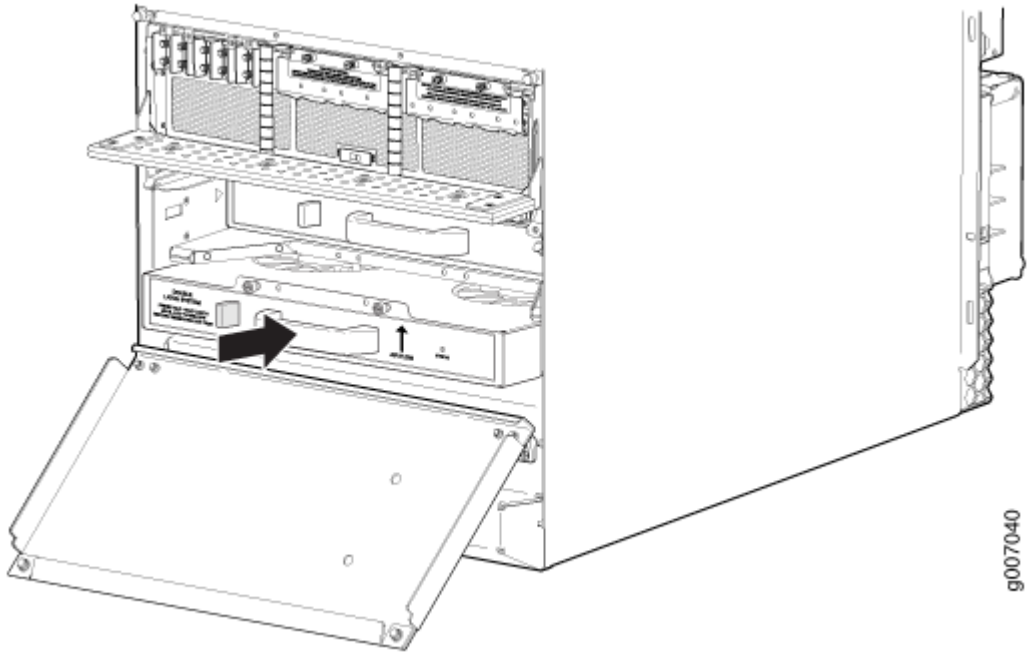


Figure 153: Installing Lower Fan Trays



Reinstalling the SFBs After Installing the MX2020 Router in a Rack

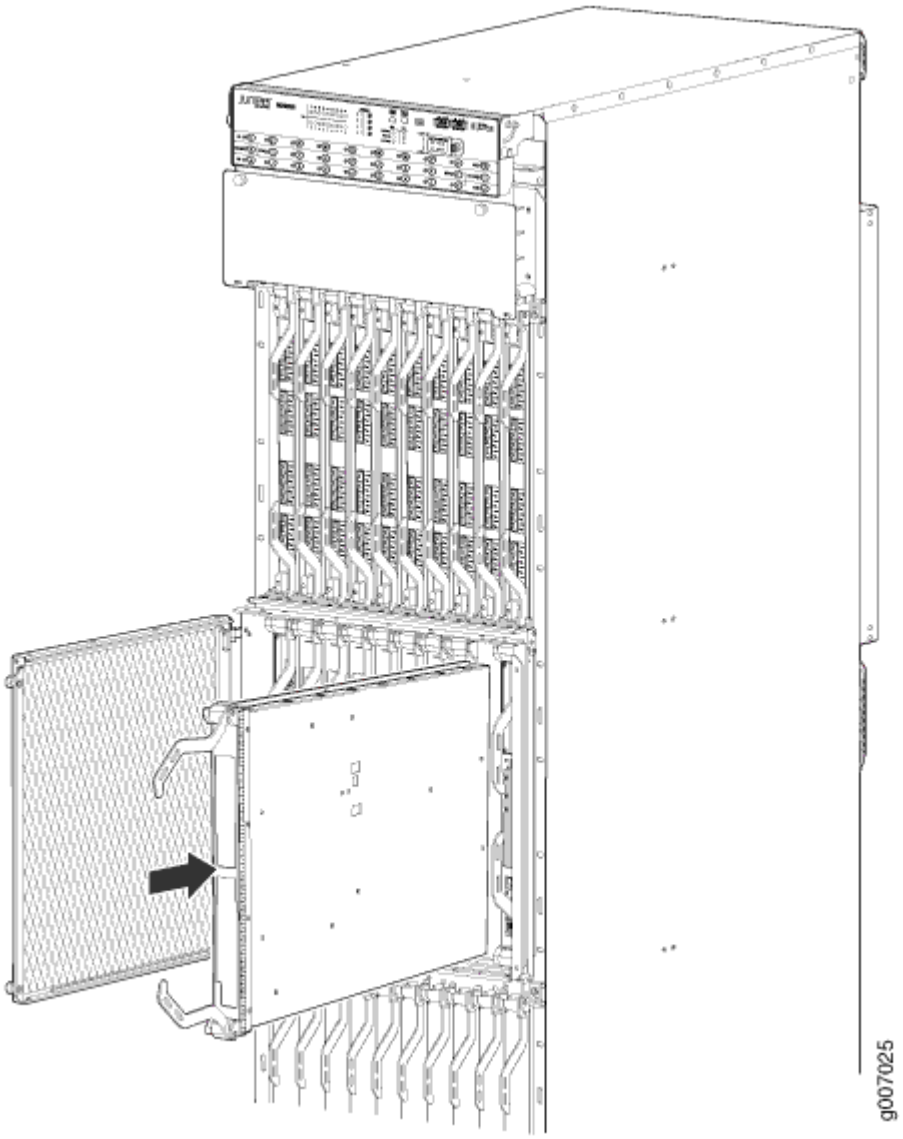
To reinstall an SFB (see Figure 154 on page 403):

> ⚠ **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 154: Reinstalling an SFB



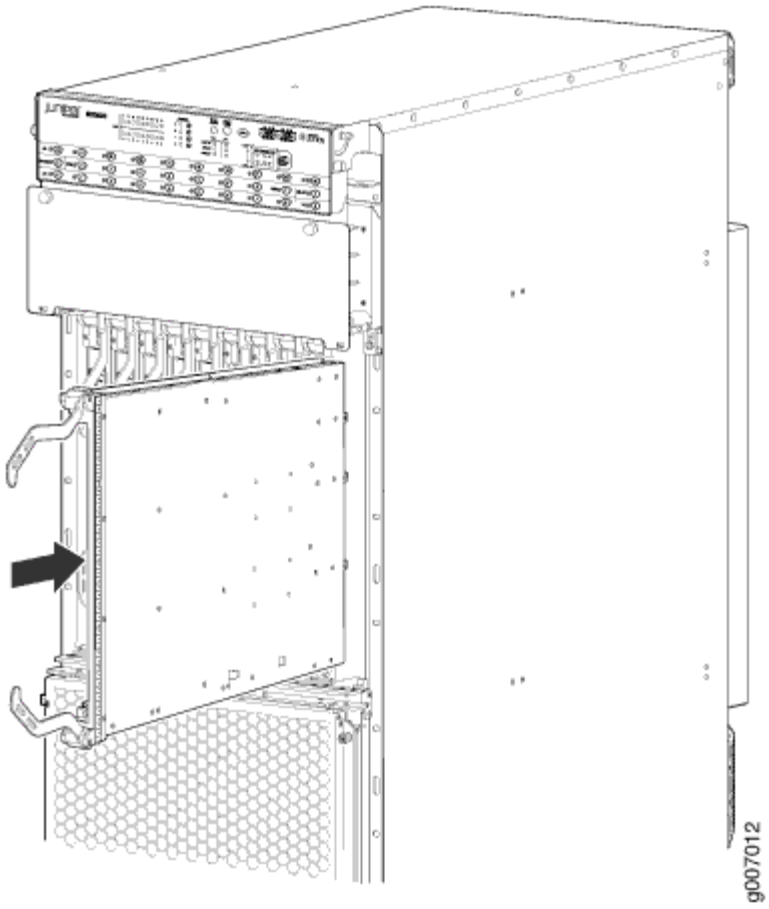
Reinstalling the Adapter Card After Installing the MX2020 Router in a Rack

To reinstall an ADC (see Figure 155 on page 404):

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 ADC 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 ADC.
4. Ensure that the ADC is right-side up, with the text on the faceplate facing upward.

5. Lift the ADC into place, and carefully align first the bottom, then the top of the ADC with the guides inside the card cage.
6. Slide the ADC all the way into the card cage until you feel resistance.
7. Grasp both ejector handles, and gently close them inward simultaneously until the ADC is fully seated.

Figure 155: Reinstalling an ADC



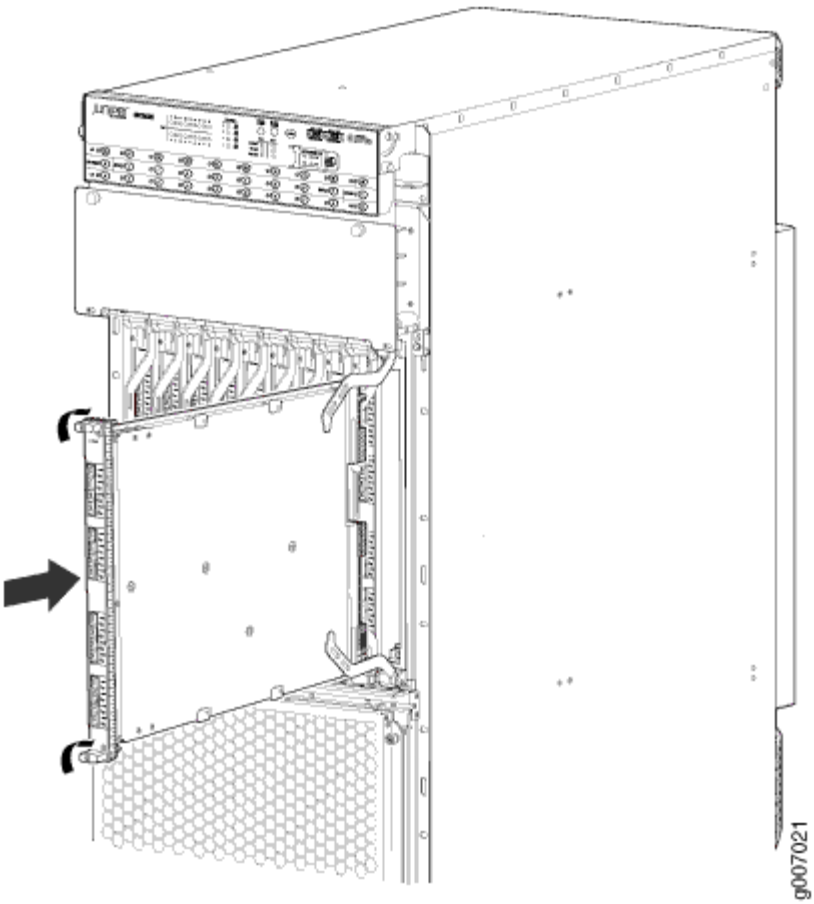
Reinstalling MPCs After Installing the MX2020 Router in a Rack

To reinstall an MPC (see Figure 156 on page 405):

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 ADC 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, then the top of the MPC with the guides inside the ADC.
7. Slide the MPC all the way into the ADC until you feel resistance.
8. Turn both knobs and rotate them simultaneously clockwise until the MPC is fully seated into the ADC.

Figure 156: Reinstalling an MPC



SEE ALSO

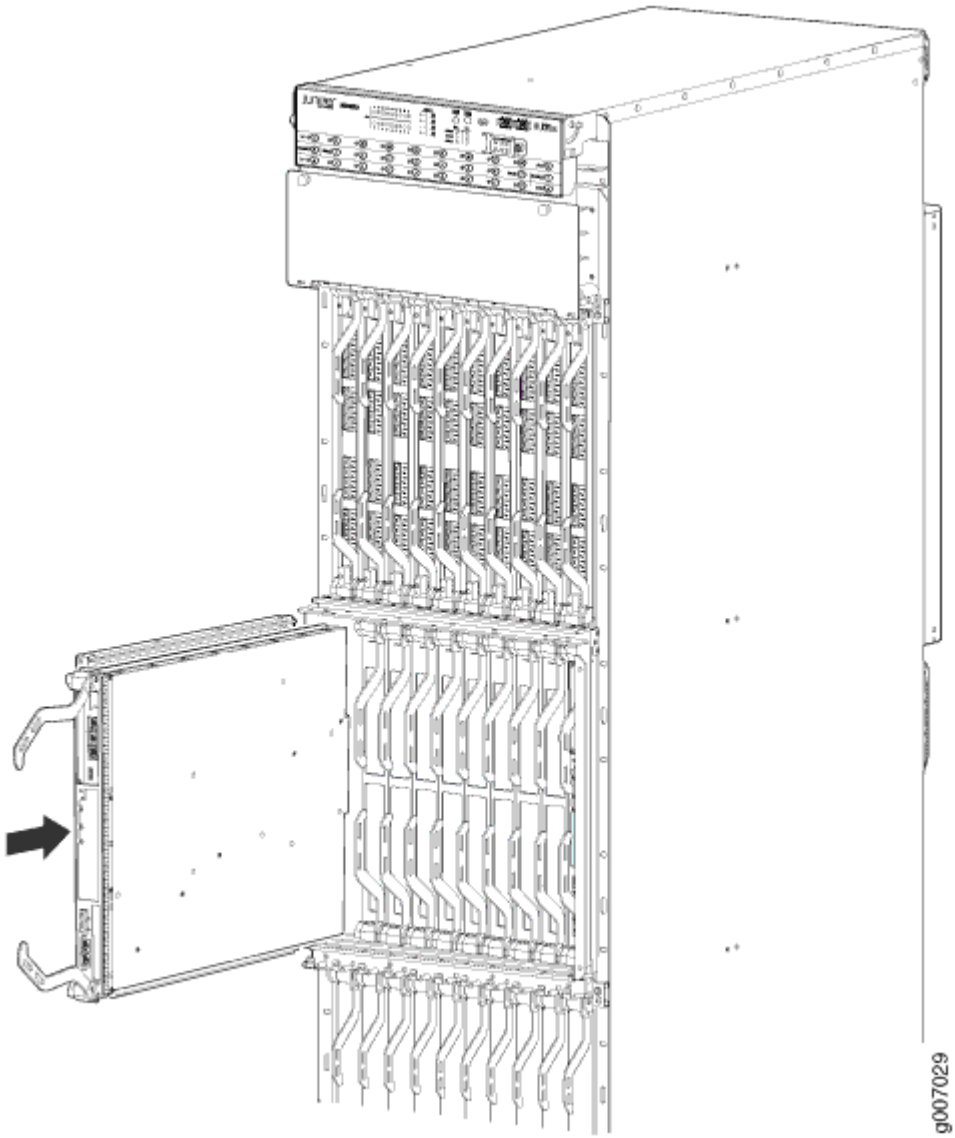
- Removing the MPCs without an Adapter Card Before Installing an MX2020 Router with a Pallet Jack
- Removing the MPCs with Adapter Card Before Installing an MX2020 Router with a Pallet Jack

Reinstalling the CB-REs After Installing the MX2020 Router in a Rack

To reinstall a CB-RE (see Figure 157 on page 407):

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 157: Reinstalling a CB-RE



SEE ALSO

Removing the CB-REs Before Installing the MX2020 Router with a Pallet Jack

RELATED DOCUMENTATION

Overview of Preparing the Site for the MX2020 Router | **197**

Tools Required to Install the MX2020 Router Using a Pallet Jack | **328**

CHAPTER 19

Connecting the MX2020 to Ground

IN THIS CHAPTER

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

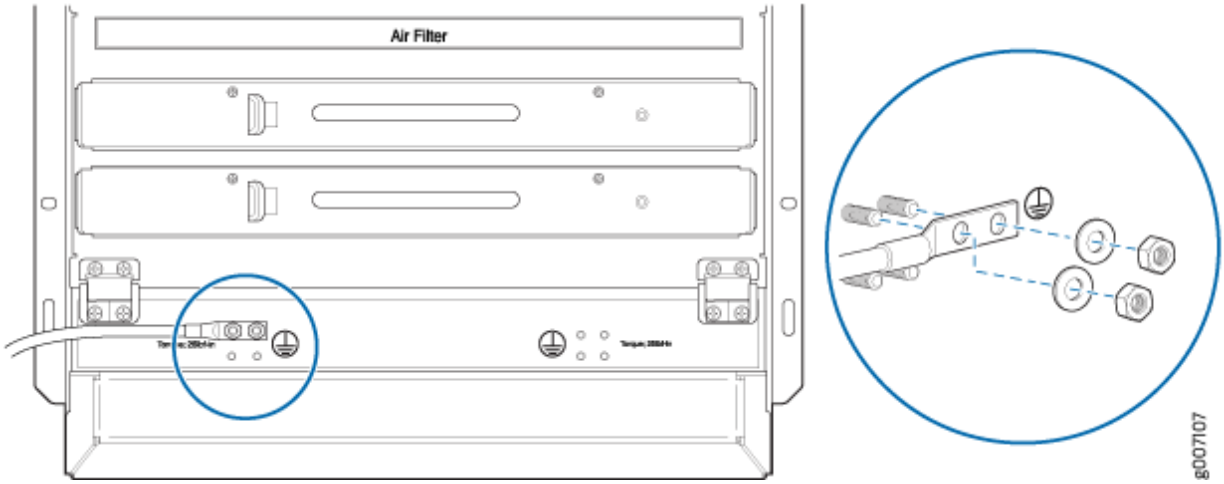
NOTE: You must install the MX2020 router in a restricted-access location and ensure the chassis is properly grounded at all times. The chassis has a 2-hole protective grounding terminal provided on the chassis, see Figure 158 on page 410. Under all circumstances, use this grounding connection to ground 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 158 on page 410):

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 158: Connecting the Grounding Cable



RELATED DOCUMENTATION

MX2000 Router Grounding Specifications

Prevention of Electrostatic Discharge Damage

CHAPTER 20

Providing Power to the MX2020

IN THIS CHAPTER

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*.

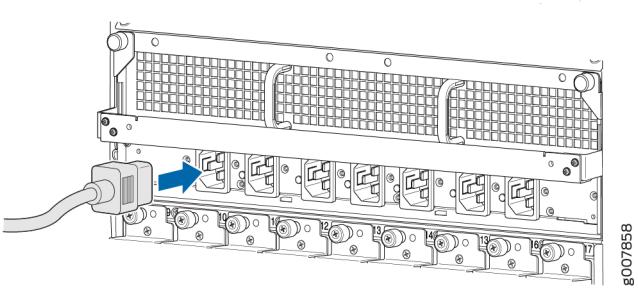
To connect an AC power cord to a single-phase seven-feed or nine-feed AC power distribution module (PDM):

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 159 on page 413. 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 159: 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

Removing an MX2000 Single-Phase AC Power Distribution Module | **515**

MX2000 Single-Phase AC Power Distribution Module Electrical Specifications

Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router

MX2000 AC Power Cord Specifications

MX2000 AC Power System Electrical Specifications

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

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

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*.

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 160 on page 416). Loosen the input terminal or grounding point screw, insert each wire into the grounding point input terminal, and tighten the screw (see Table 105 on page 417 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:

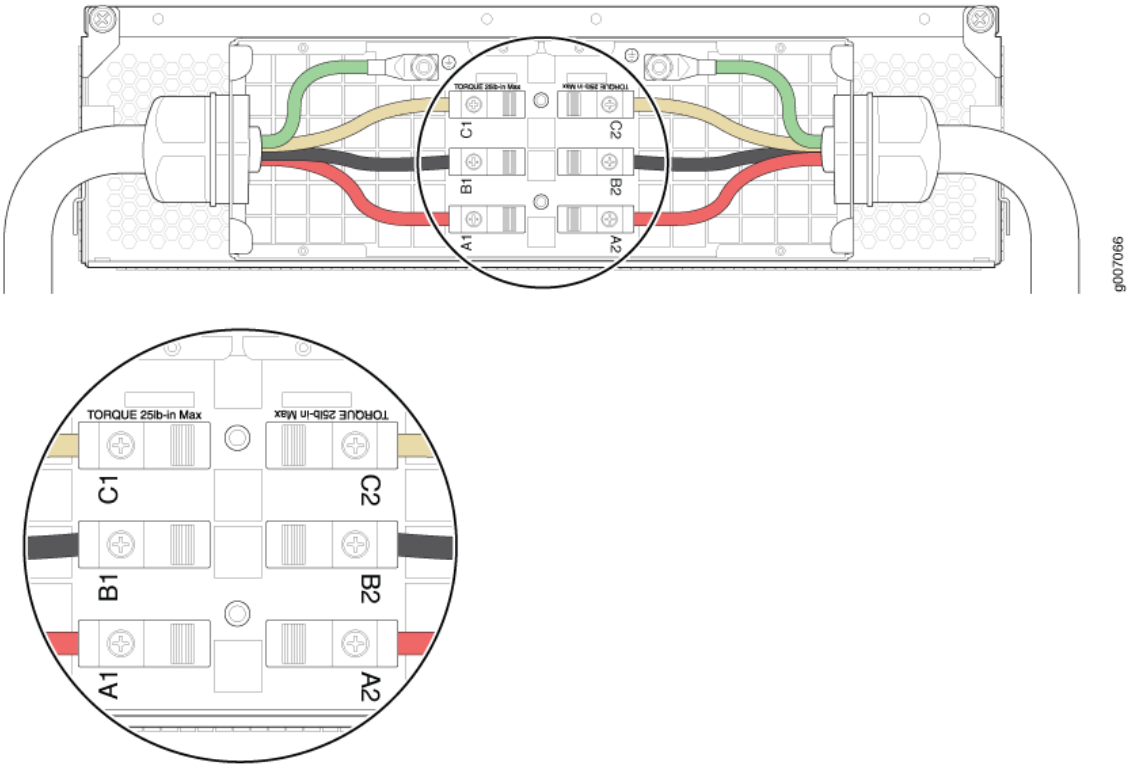
    a. Insert the grounding wire into the grounding point labeled **GND**.

    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 160: 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 105: 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*
- *MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs*
- *Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on MX2000 Routers*
- *Powering On a Three-Phase AC-Powered MX2000 Router*
- *MX2000 AC Power System Electrical Specifications*
- *MX2000 AC Power Cord Specifications*
- *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*.

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 161 on page 420). Loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw (see Table 106 on page 421 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**.

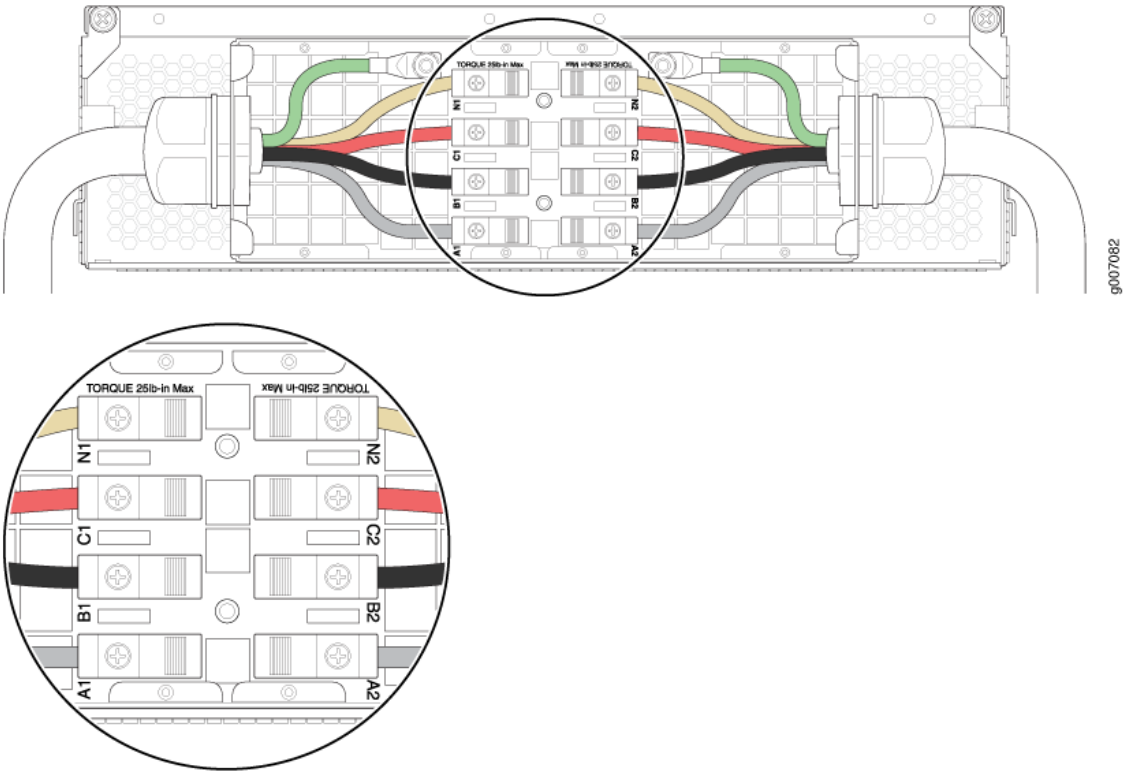
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    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 161: 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 106: 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*
- *MX2000 Three-Phase Delta AC Power Distribution Module Description*
- *MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs*
- *Powering On a Three-Phase AC-Powered MX2000 Router*
- *MX2000 AC Power System Electrical Specifications*
- *MX2000 AC Power Cord Specifications*
- *Prevention of Electrostatic Discharge Damage*

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 162 on page 423 shows the mapping for the MX2010 and Figure 163 on page 424 shows the mapping for the MX2020. The arrangement matches the internal components of the PDM. Table 107 on page 425 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1** (MX2010 and MX2020). Table 108 on page 425 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1** (MX2020 only).

Figure 162: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2010)

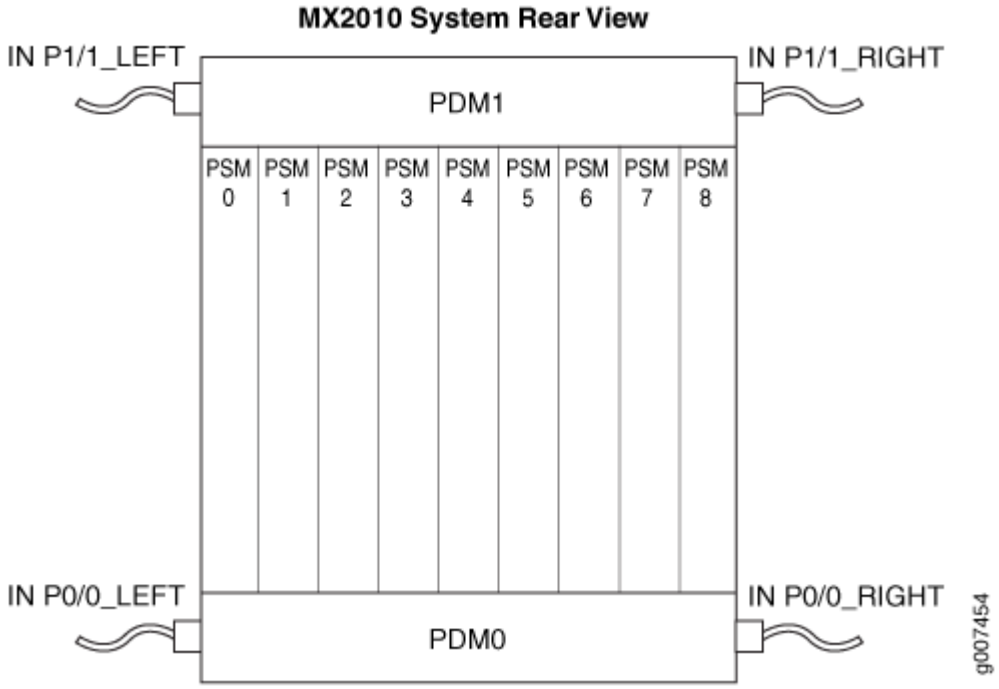


Figure 163: Mapping AC Power Distribution Module Input to AC Power Supply Modules (MX2020)

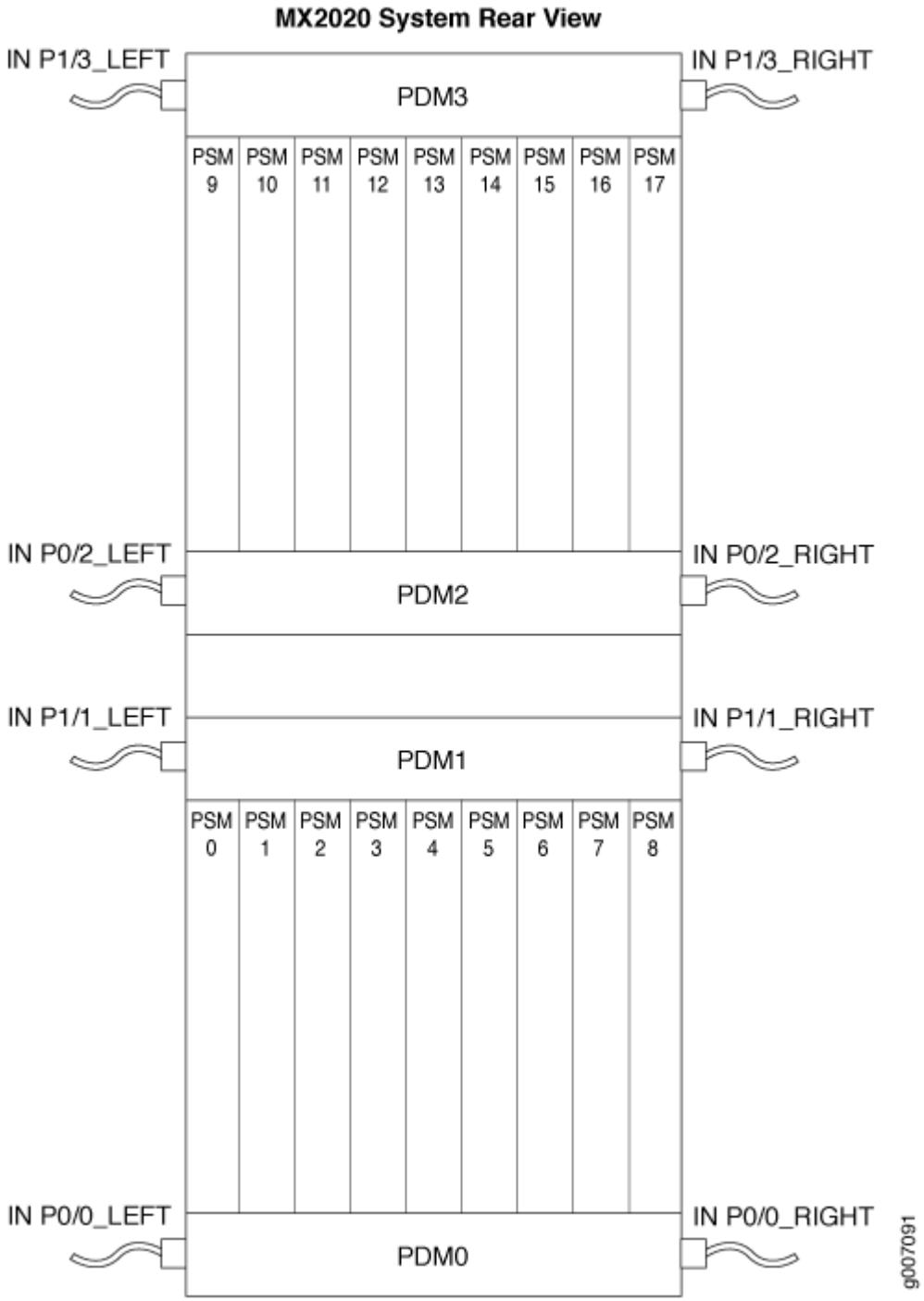


Table 107: Input AC Power Mapping for PDM0 and PDM1

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 108: 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

Installing MX2020 AC Power Supply Modules

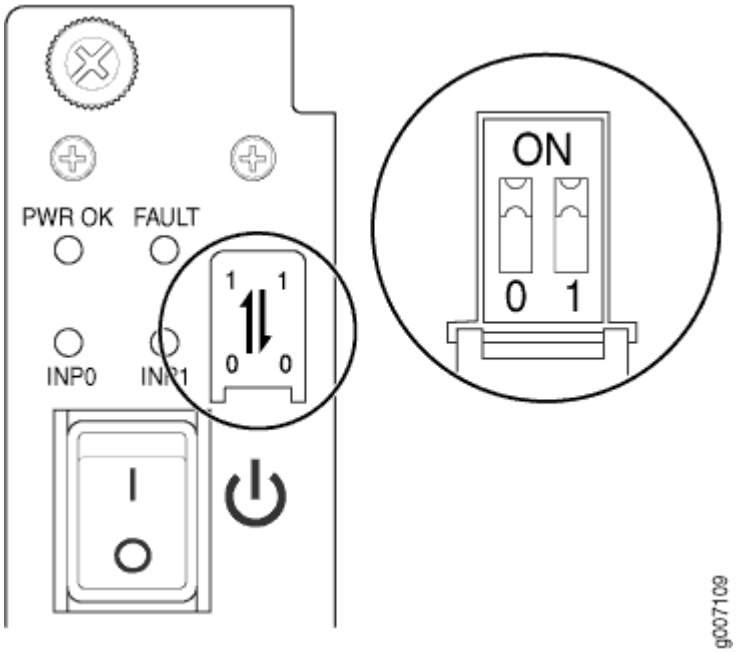
To install an MX2020 AC PSM:

1. Verify that the power switch on the PSM is 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 164 on page 427).

   In addition, a PSM failure triggers the alarm LED on the craft interface.

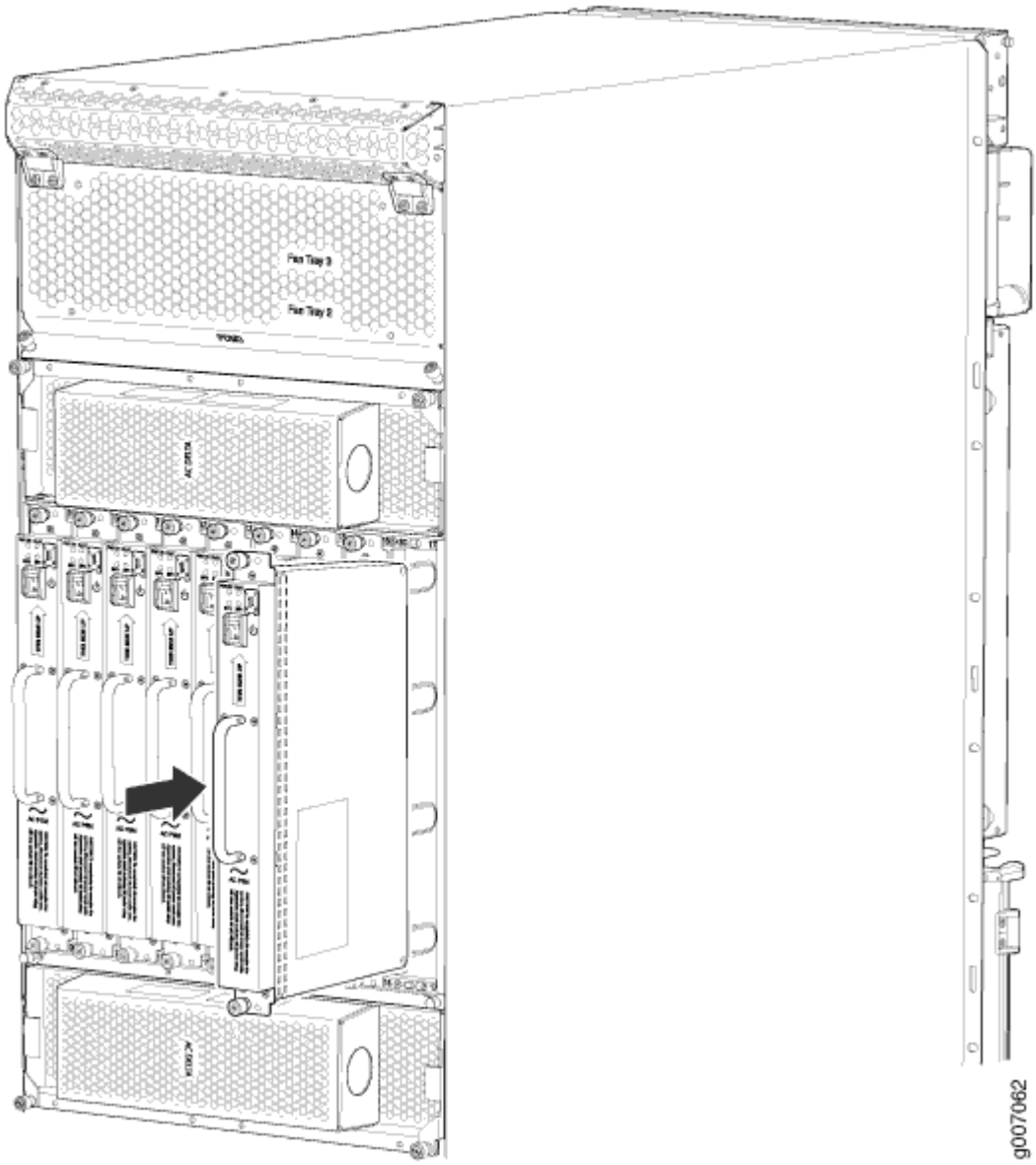
   NOTE: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed **0**. Power will be drawn from feed **1** only if feed **0** fails.

Figure 164: Selecting AC 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 165 on page 428). 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 165: MX2020 Router with AC Power Supply Modules Installed



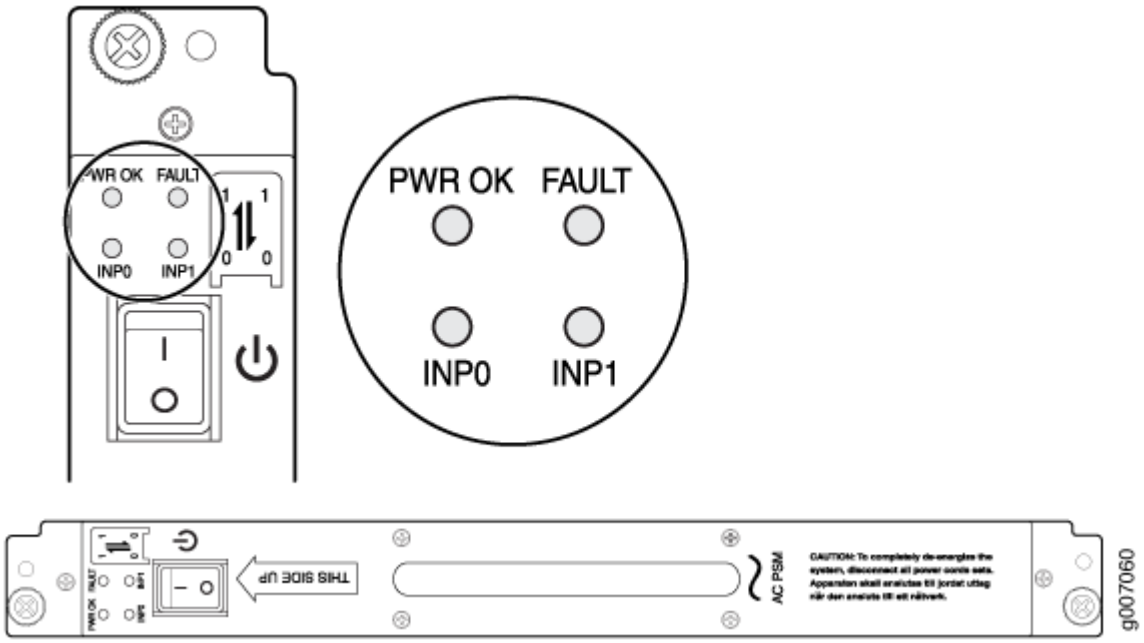
4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 166 on page 429).

   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 AC Power Supply Module LEDs" on page 175 for information on MX2020 AC PSM LEDs.
8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 166: MX2020 AC Power Supply Module Front View



NOTE: Each PSM slot not occupied by a AC PSM must be covered by a PSM blank panel.

RELATED DOCUMENTATION

- Preventing Electrostatic Discharge Damage to an MX2020 Router
- Powering On the AC-Powered MX2020 Router

Installing MX2000 Router DC Power Supply Modules (-48 V)

To install an MX2000 DC PSM (-48 V):

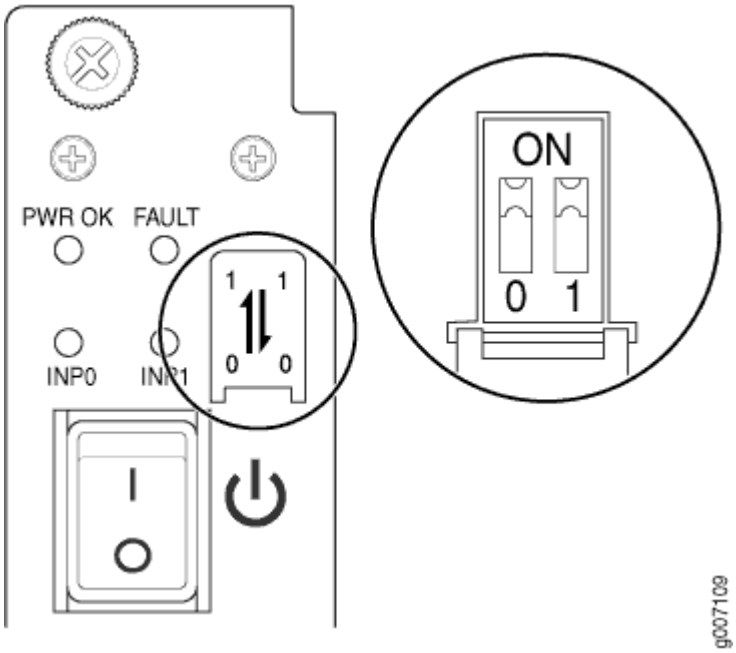
1. Verify that the power switches on all PSMs are in the off (**O**) position.

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 167 on page 430).

   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 167: 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 168 on page 431 (MX2020) and Figure 169 on page 432) (MX2010), or Figure 170 on page 433 (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 168: Installing an MX2020 Router DC Power Supply Module Installed

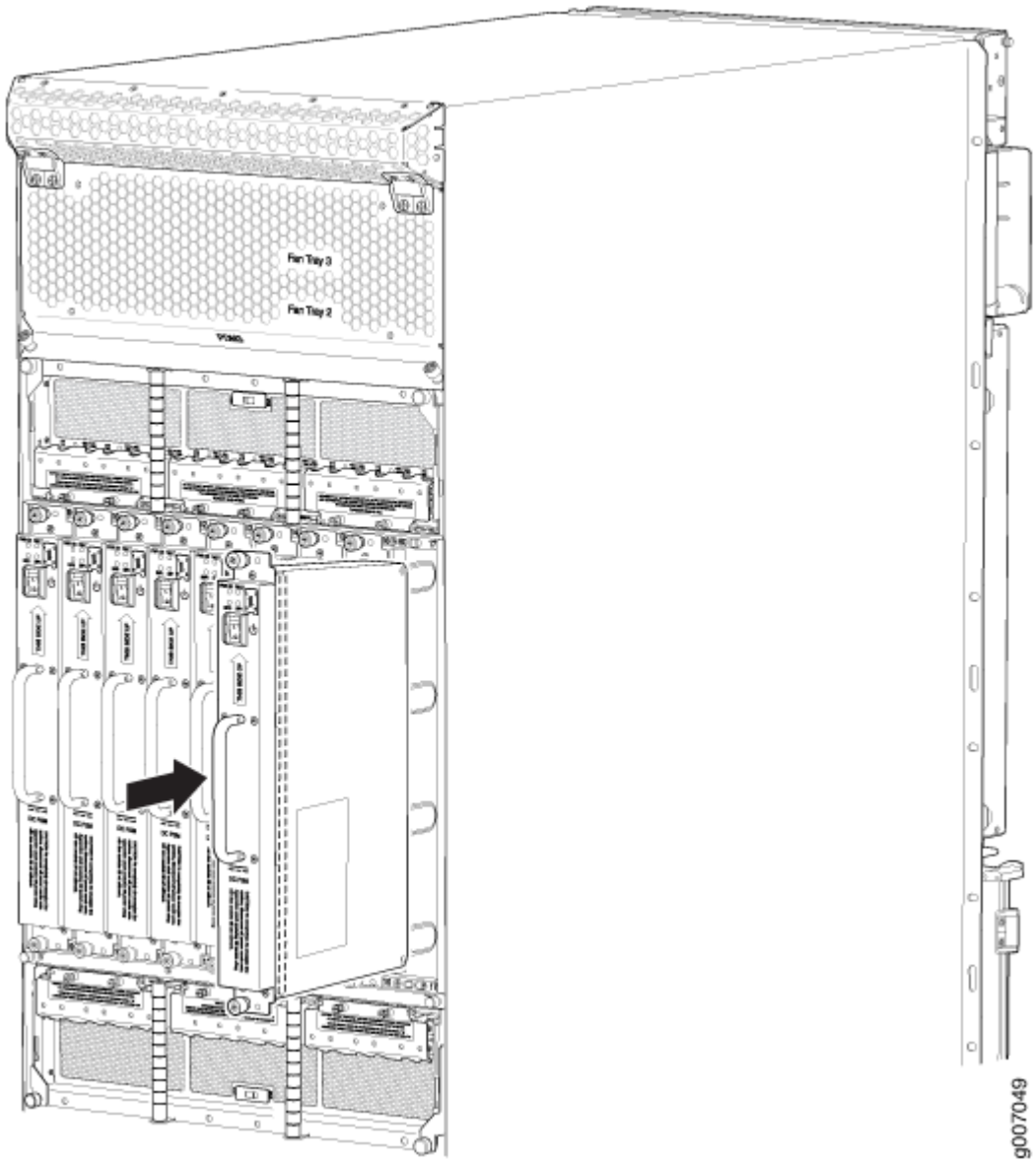


Figure 169: Installing an MX2010 Router DC Power Supply Module

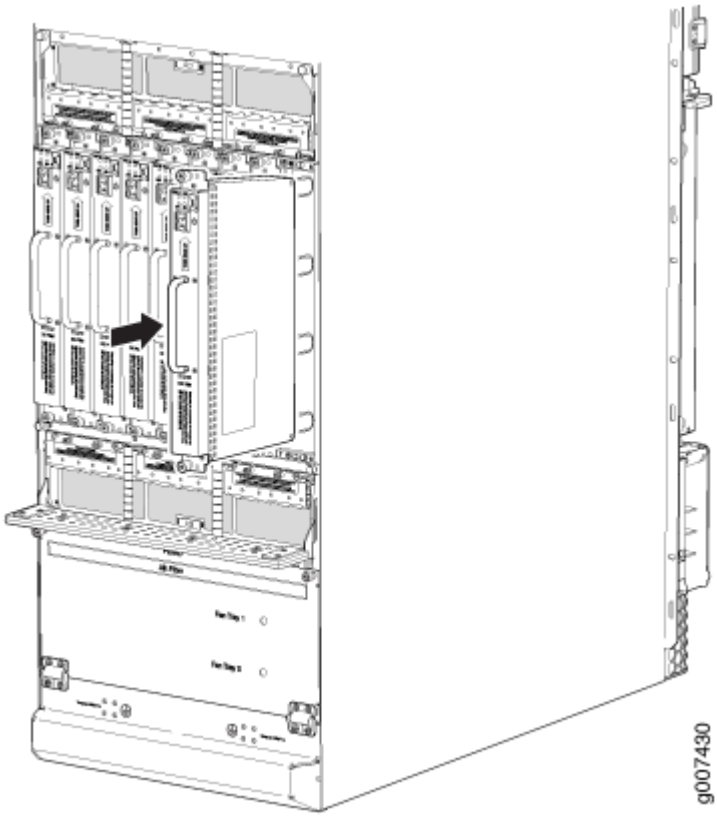
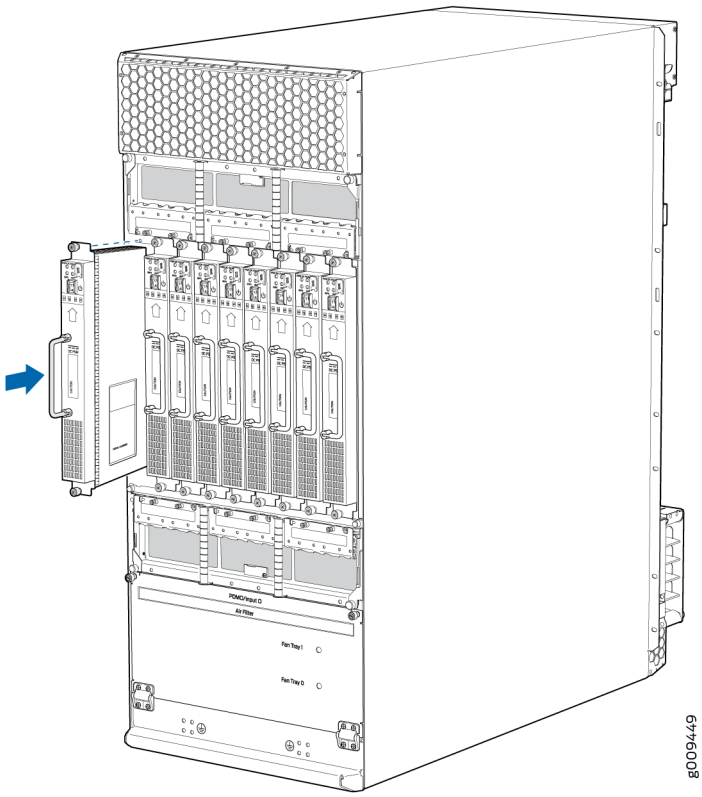


Figure 170: Installing an MX2008 Router DC Power Supply Module

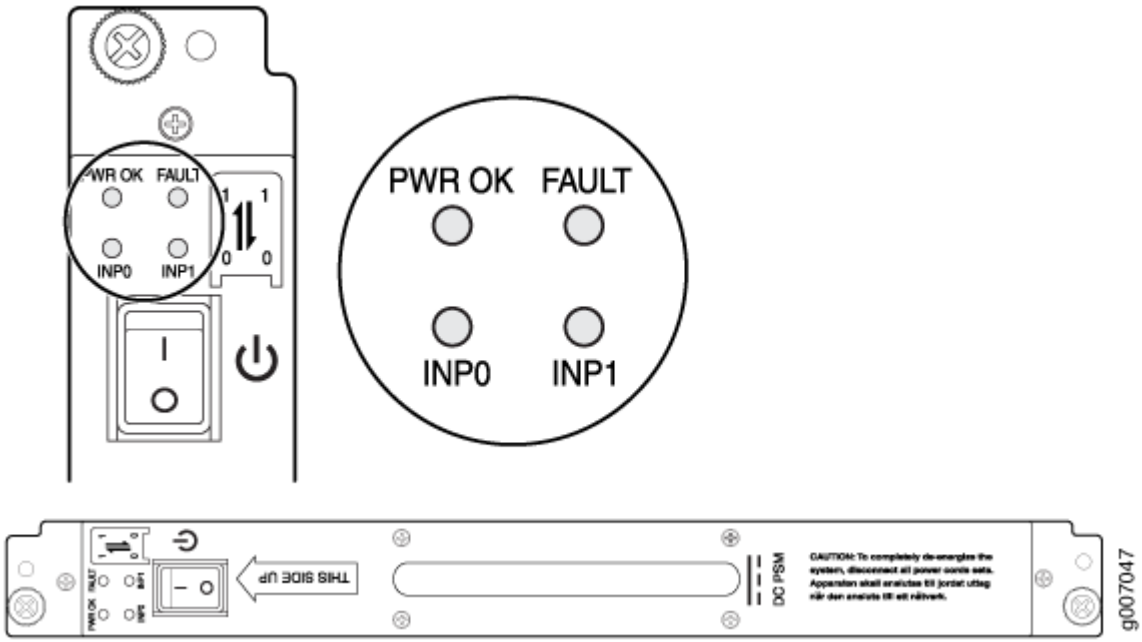


4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 171 on page 434).

   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" on page 187, *MX2010 DC Power Supply Module LEDs*, 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 171: 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

Replacing an MX2020 DC Power Supply Module (-48 V) | **544**

Replacing an MX2010 DC Power Supply Module (-48 V)

Replacing an MX2008 DC Power Supply Module (-48 V)

Installing MX2000 Router DC Power Supply Modules (240 V China) or High-Voltage Universal (HVAC/HVDC) Power Supply Modules

To install an MX2000 DC PSM (240 V China) or 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. On the DC PSM (240 V China) 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). On the universal HVAC/HVDC PSM 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 172 on page 435 and Figure 173 on page 436).

   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 172: Selecting DC Power (240 V China) Subsystem Feed Redundancy

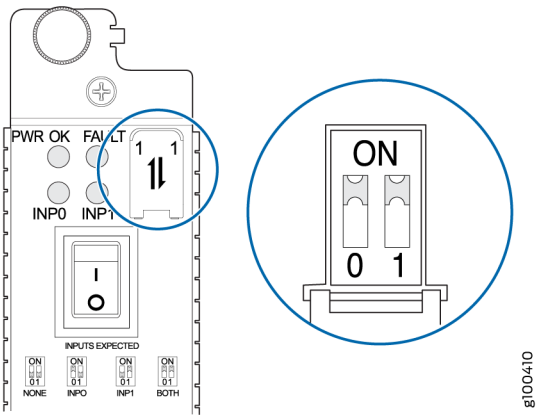
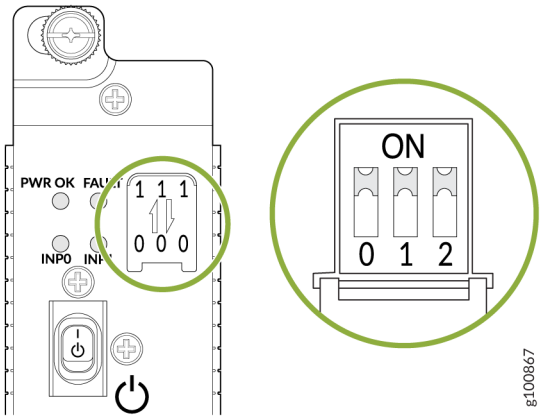


Figure 173: Selecting Input Feed on the Universal (HVAC/HVDC) Power Supply Module



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 174 on page 437 and Figure 175 on page 438). 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 174: Installing an MX2020, MX2010, MX2008 Router DC Power Supply Module (240 V China)

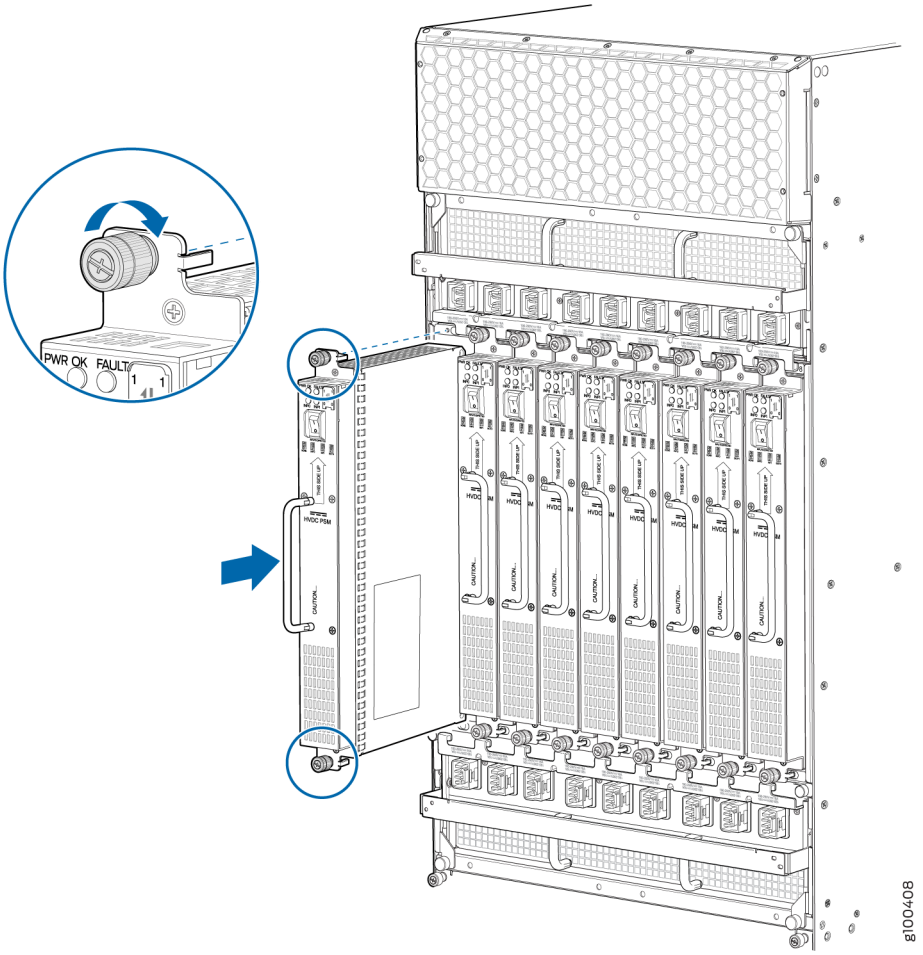
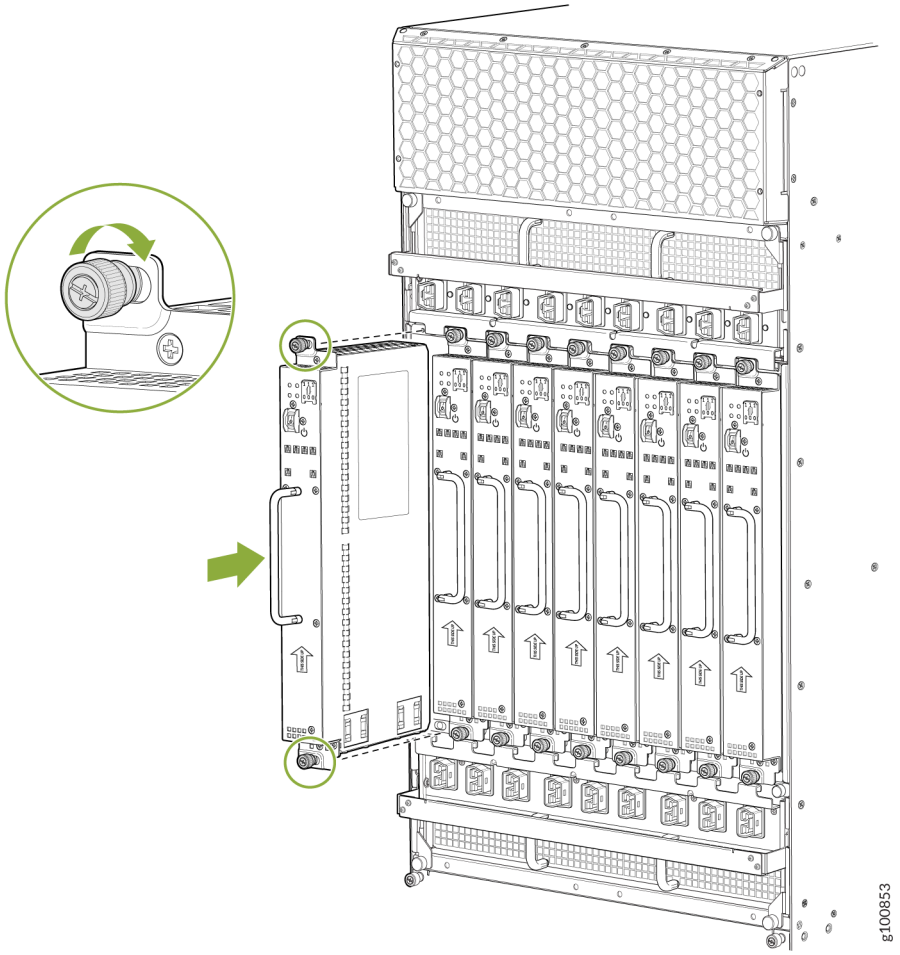


Figure 175: Installing an MX2020, MX2010, MX2008 Router High-Voltage Universal (HVAC/HVDC) PSM



4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 176 on page 439 and Figure 177 on page 439).

   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. For the DC PSM (240 V China) see "MX2020 DC Power Supply Module LEDs" on page 187, *MX2010 DC Power Supply Module LEDs*, or *MX2008 DC Power Supply Module LEDs* for information on PSM LED behavior. For the universal HVAC/HVDC

PSM, see "MX2020 High-Voltage Universal Power Supply Module LEDs" on page 193, for information on PSM LED behavior.

8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 176: MX2000 DC Power Supply Module Front View (240 V China)

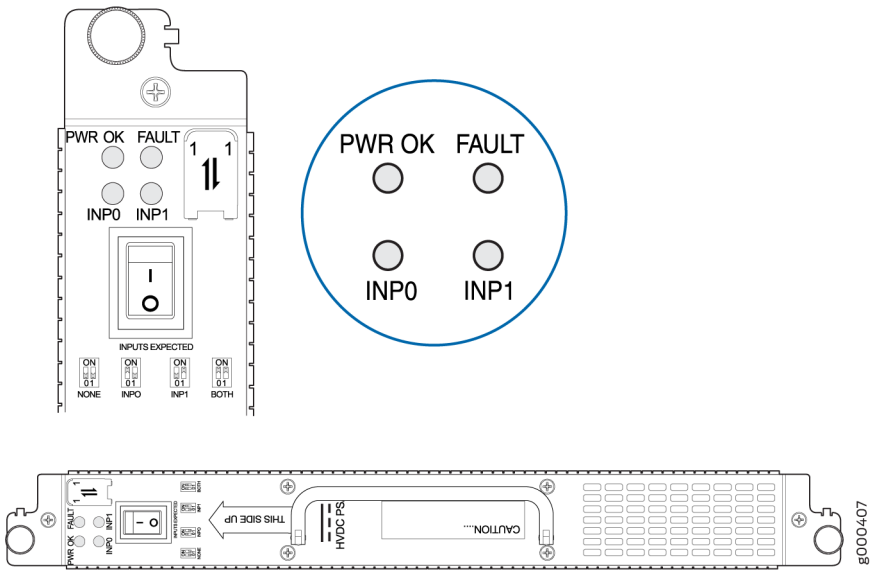
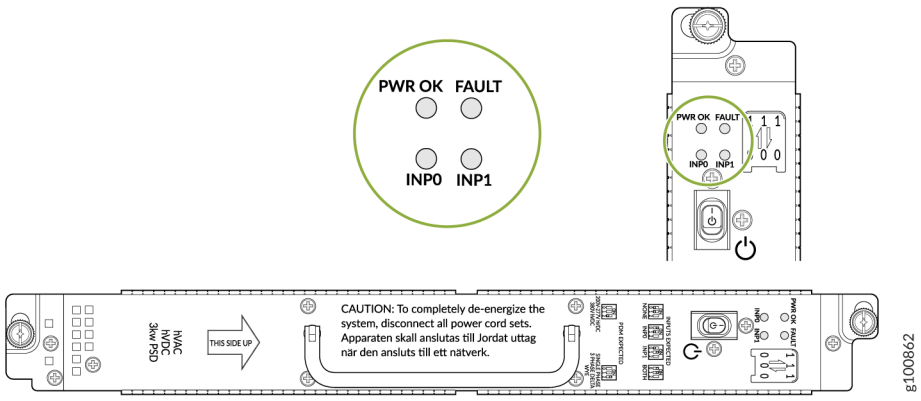


Figure 177: MX2000 High-Voltage Universal (HVAC/HVDC) Power Supply Module Front View



NOTE: Each PSM slot not occupied by a (240 V China) DC PSM or universal (HVAC/HVDC) PSM must be covered by a PSM blank panel.

RELATED DOCUMENTATION

- *Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router*
- *Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router*
- *Replacing an MX2000 DC Power Supply Module (240 V China)*
- *Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module*

Connecting Power to a DC-Powered MX2020 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 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 may 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) or DC PDM 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:

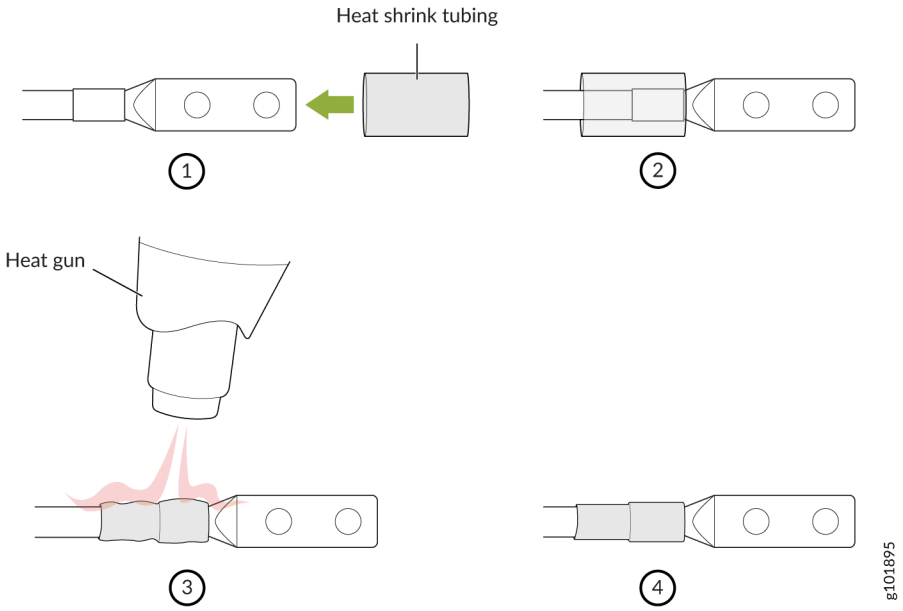
   a. Slide the tubing over the portion of the cable where it is attached to the lug barrel. Ensure that tubing covers the end of the wire and the barrel of the lug attached to it.

   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 178 on page 442 is a representational image that shows the steps to install heat-shrink tubing.

NOTE: Do not overheat the tubing.

Figure 178: 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 the split washer, and then with the nut (see Figure 179 on page 444). 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 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.

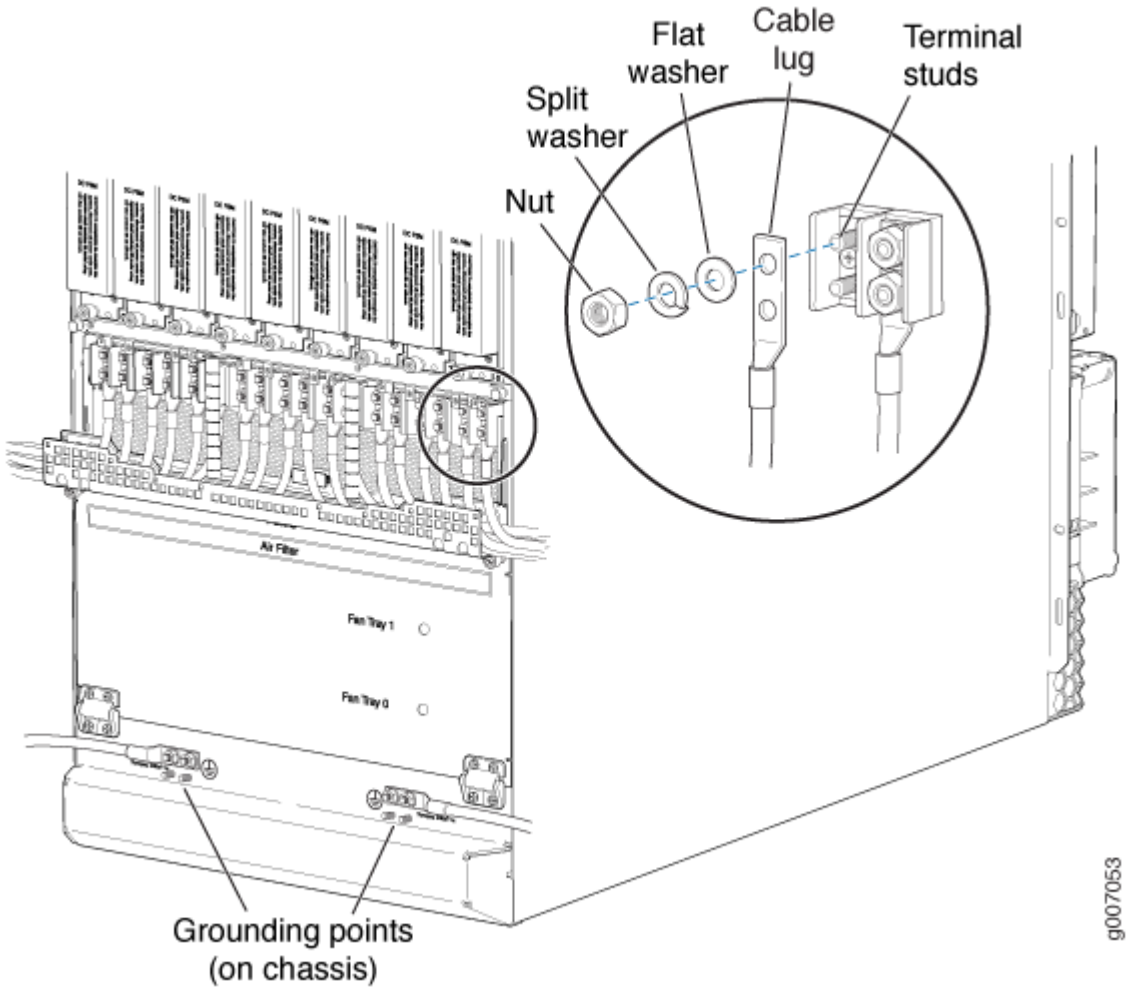
> **NOTE**: The DC PDMs in slots **PDM0/Input0**, **PDM2/Input0**, **PDM1/Input1**, and **PDM3/Input1** can be powered by dedicated power feeds derived from feed **A**, or feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system to balance the power draw.

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 screw driver 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 179: Connecting DC Power to the MX2020 Router



RELATED DOCUMENTATION

- DC Power Cable Specifications for the MX2020 Router | **305**
- Preventing Electrostatic Discharge Damage to an MX2020 Router
- Powering On the DC-Powered (-48 V) MX2020 Router | **452**

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*.

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).

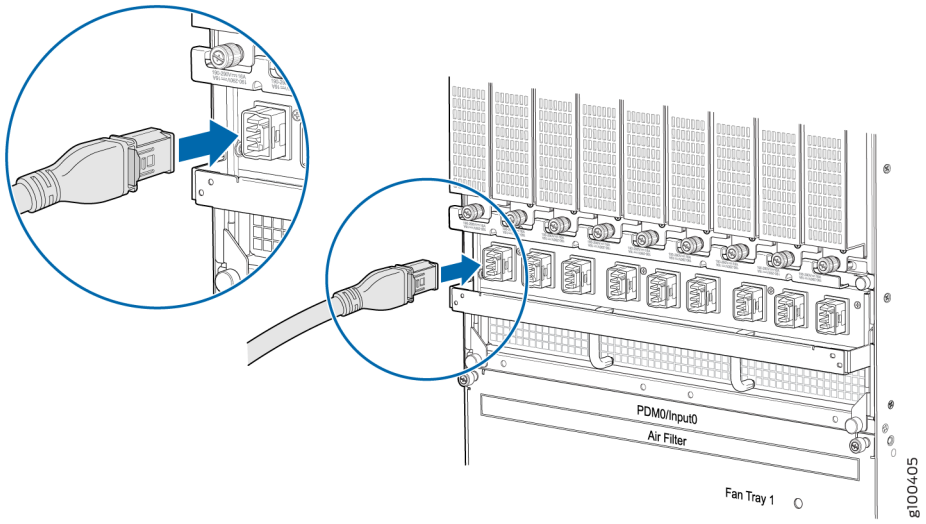
To connect the DC (240 V China) source power cables (CBL-PWR-240V-CH) to the router:

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 180: Connecting Power



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*.

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" on page 292.
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

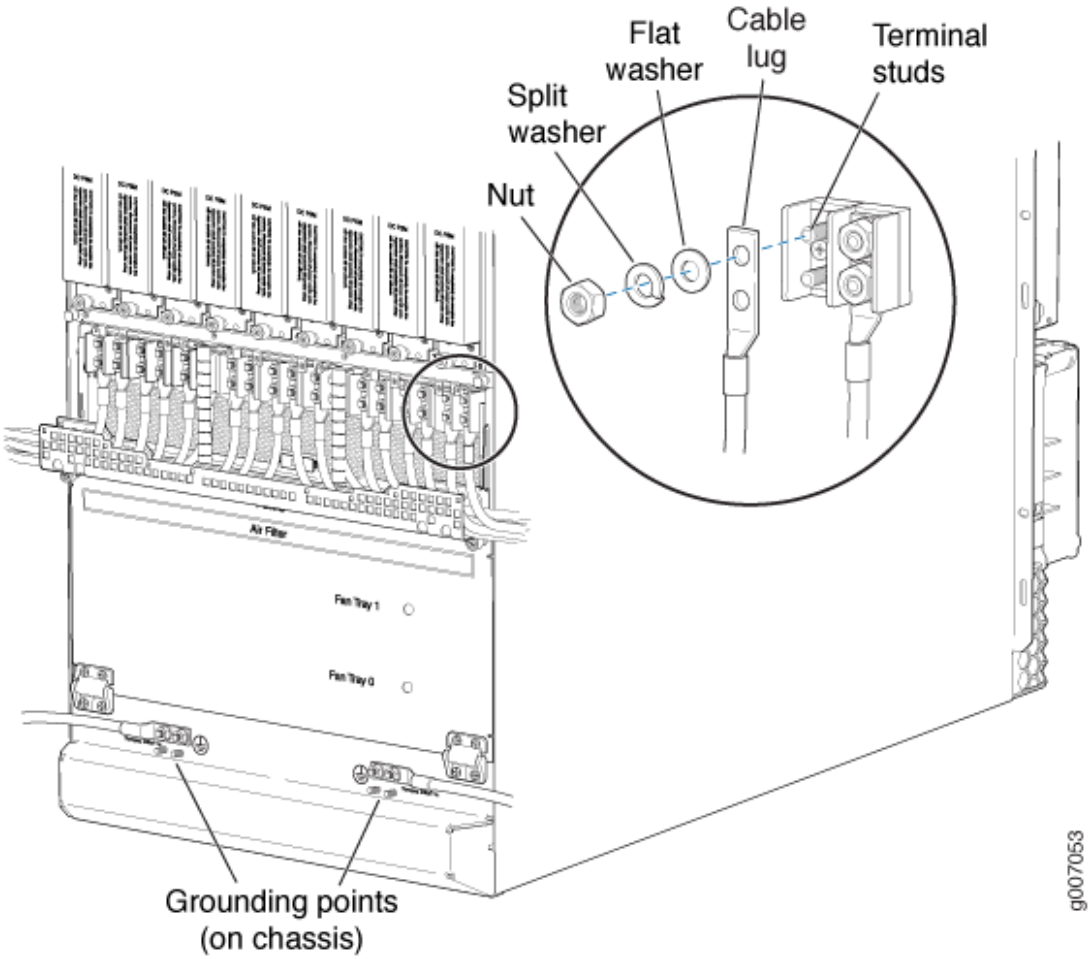
nut (see Figure 181 on page 447). Do not overtighten the nut. (Use a 7/16-in. [11 mm)] torque-controlled driver or socket wrench.)

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 181: 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" on page 292.

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*.

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 182: Connecting Power

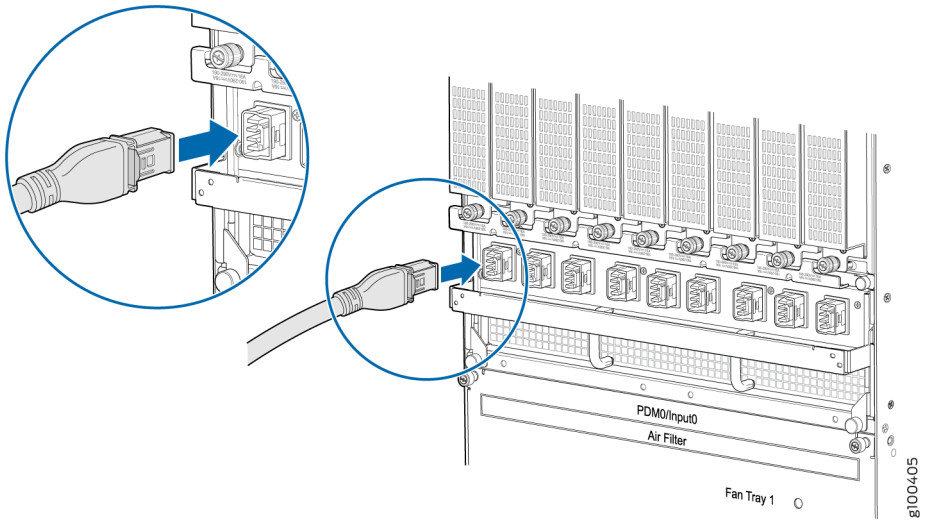
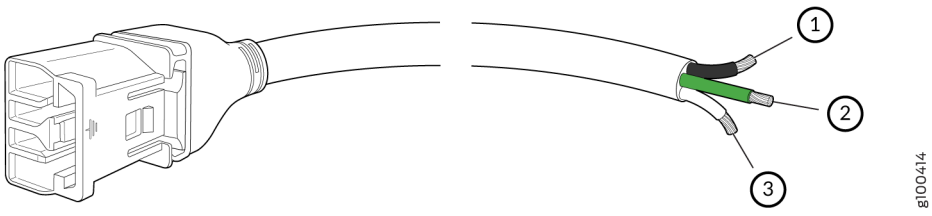


Figure 183: Unplugging the 240 V China Power Cord an MX2000 Router

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 184 on page 450.

Figure 184: 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.

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*.

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.

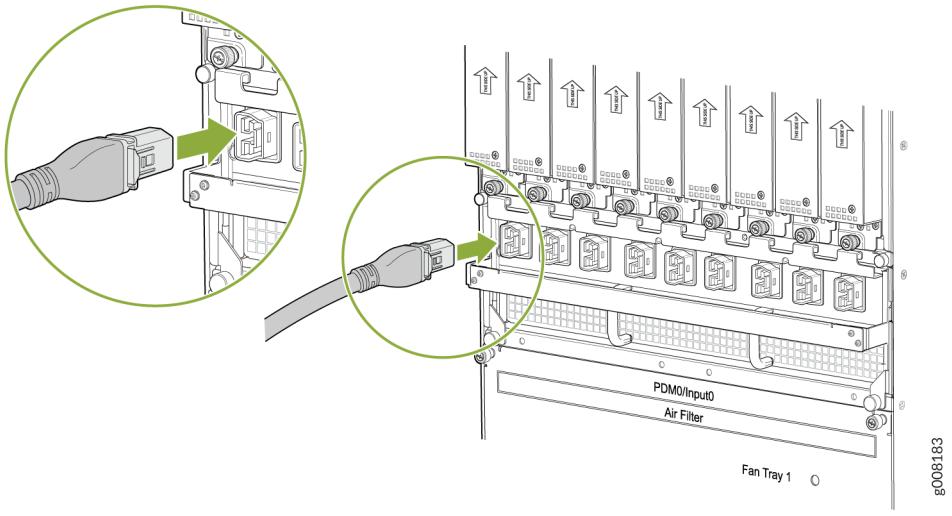
To connect the DC or AC source power cables to the router:

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 185: Connecting Power to the Universal (HVAC/HVDC) PDM



4. Connect the power cords for the remaining PDMs.

Powering On the DC-Powered (-48 V) MX2020 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 appropriate terminal: the positive (+) source cable to the return terminal labeled (**RTN**) and the negative (–) source cable to the input terminal labeled (**–48V**), on the PDMs.

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 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 MX2020 Router.

13. Verify the MX2020 router power up, system initialization, and status, see "Initially Configuring the MX2020 Router" on page 475.

RELATED DOCUMENTATION

Connecting the MX2020 Router to Management and Alarm Devices | 459

Preventing Electrostatic Discharge Damage to an MX2020 Router

Replacing an MX2020 DC Power Supply Module (-48 V) | 544

Replacing an MX2000 DC Power Supply Module (240 V China)

Replacing an MX2000 DC Power Distribution Module (-48 V)

Replacing an MX2000 DC Power Distribution Module (240 V China)

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 MX2020 Router.

13. Verify the MX2020 router power up, system initialization, and status, see "Initially Configuring the MX2020 Router" on page 475.

RELATED DOCUMENTATION

- Preventing Electrostatic Discharge Damage to an MX2020 Router
- *Replacing an MX2000 DC Power Supply Module (240 V China)*
- *Replacing an MX2000 DC Power Distribution Module (240 V China)*

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

Maintaining and Verifying the Status of the MX2010 Router Components

Initially Configuring the MX2020 Router | **475**

Maintaining and Verifying the Status of the MX2020 Router Components | **840**

MX2000 Three-Phase Delta AC Power Distribution Module Description

MX2000 Three-Phase Wye AC Power Distribution Module Description

Connecting the MX2000 Series Router to a Console or Auxiliary Device

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

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

Preventing Electrostatic Discharge Damage to an MX2010 Router

Preventing Electrostatic Discharge Damage to an MX2020 Router

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*.

13. Verify the MX2000 router power up, system initialization, and status, see "Initially Configuring the MX2020 Router" on page 475, *Initially Configuring the MX2010 Router*, 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*

CHAPTER 21

Connecting the MX2020 to the Network

IN THIS CHAPTER

Connecting the MX2020 Router to Management and Alarm Devices

IN THIS SECTION

Connecting the MX2020 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 the power to the management device.

2. Plug one end of the Ethernet cable (Figure 187 on page 460 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 186 on page 460 shows the port. Table 109 on page 460 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 186: Out-of-Band Management Port

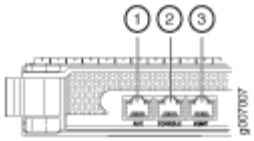


Figure 187: Out-of-Band Management Cable Connector

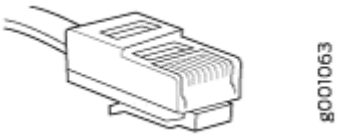


Table 109: Out-of-Band Management Port on the MX2020 CB-RE

Function No.	Label	Description
3	**MGMT**	Dedicated management channel for device maintenance. It is also used for system administrators to monitor and manage the MX2020 remotely.

SEE ALSO

Connecting the MX2020 Router to a Console or Auxiliary Device | **465**

Connecting an MX2020 Router to an External Alarm-Reporting Device | **467**

Connecting the MX2020 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 CB-RE interface. To use a laptop, modem, or other auxiliary device, connect it to

the **AUX** port on the CB-RE 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 separate cables.

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

- RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)
- RJ-45 to USB-A adapter (JNP-CBL-RJ45-USBA)
- RJ-45 to USB-C adapter (JNP-CBL-RJ45-USBC)

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

WARNING: The MX2020 router must be adequately grounded before powering on the console or auxiliary devices, (see *MX2000 Router Grounding Specifications*).

To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.
2. Plug the RJ-45 end of the serial cable (see Figure 189 on page 462) into the **AUX** port or **CONSOLE** port on the CB-RE interface. Figure 188 on page 462 shows the ports. Table 110 on page 462 describes the auxiliary and console ports.
3. Plug the DB-9 socket 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 188: Console and Auxiliary Ports

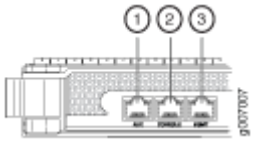


Figure 189: Console and Auxiliary Cable Connector

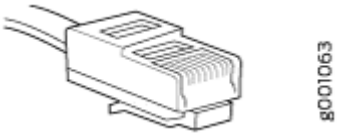


Table 110: Console and Auxiliary Ports on the MX2020 CB-RE

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 MX2020 router.

SEE ALSO

Connecting the MX2020 Router to a Network for Out-of-Band Management | **464**

Connecting an MX2020 Router to an External Alarm-Reporting Device | **467**

Connecting an MX2020 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 190 on page 463). 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 111 on page 463). They accept wire of any gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2); the wire which 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 190 on page 463).

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 190: Alarm Relay Contacts

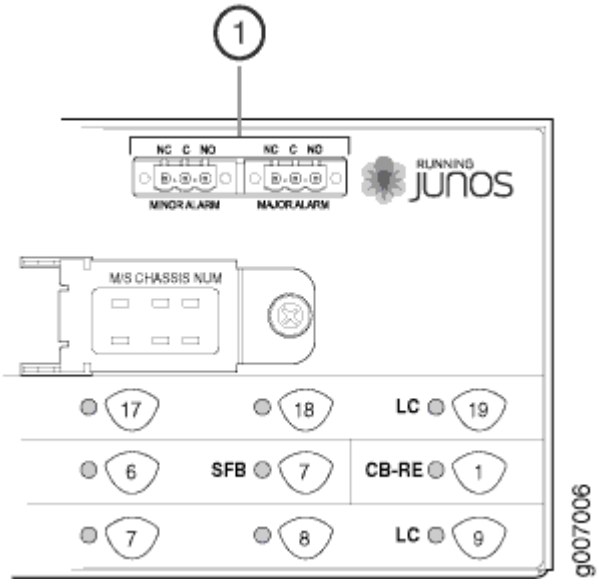


Table 111: Alarm Relay Contacts

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.

SEE ALSO

Connecting the MX2020 Router to a Console or Auxiliary Device | 465

Connecting the MX2020 Router to a Network for Out-of-Band Management | 464

RELATED DOCUMENTATION

Tools and Parts Required for MX2020 Router Connections | 331

Connecting MPC or MIC Cables to the MX2020 Router | 471

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

Connecting the MX2020 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 the power to the management device.
2. Plug one end of the Ethernet cable (Figure 192 on page 465 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 191 on page 464 shows the port. Table 112 on page 465 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 191: Out-of-Band Management Port

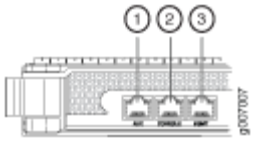


Figure 192: Out-of-Band Management Cable Connector

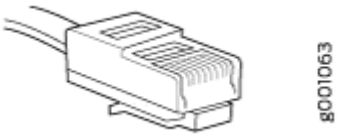


Table 112: Out-of-Band Management Port on the MX2020 CB-RE

Function No.	Label	Description
3	**MGMT**	Dedicated management channel for device maintenance. It is also used for system administrators to monitor and manage the MX2020 remotely.

RELATED DOCUMENTATION

Connecting the MX2020 Router to a Console or Auxiliary Device | **465**

Connecting an MX2020 Router to an External Alarm-Reporting Device | **467**

Connecting the MX2020 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 CB-RE interface. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the CB-RE 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 separate cables.

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

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

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

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

WARNING: The MX2020 router must be adequately grounded before powering on the console or auxiliary devices, (see *MX2000 Router Grounding Specifications*).

To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.
2. Plug the RJ-45 end of the serial cable (see Figure 194 on page 467) into the **AUX** port or **CONSOLE** port on the CB-RE interface. Figure 193 on page 466 shows the ports. Table 113 on page 467 describes the auxiliary and console ports.
3. Plug the DB-9 socket 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 193: Console and Auxiliary Ports

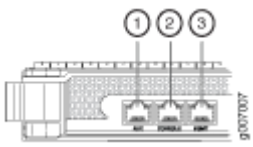


Figure 194: Console and Auxiliary Cable Connector

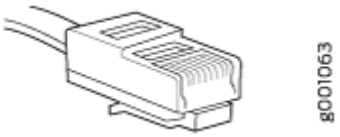


Table 113: Console and Auxiliary Ports on the MX2020 CB-RE

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 MX2020 router.

RELATED DOCUMENTATION

Connecting the MX2020 Router to a Network for Out-of-Band Management | **464**

Connecting an MX2020 Router to an External Alarm-Reporting Device | **467**

Connecting an MX2020 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 195 on page 468). 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 114 on page 468). They accept wire of any gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2); the wire which 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 195 on page 468).

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 195: Alarm Relay Contacts

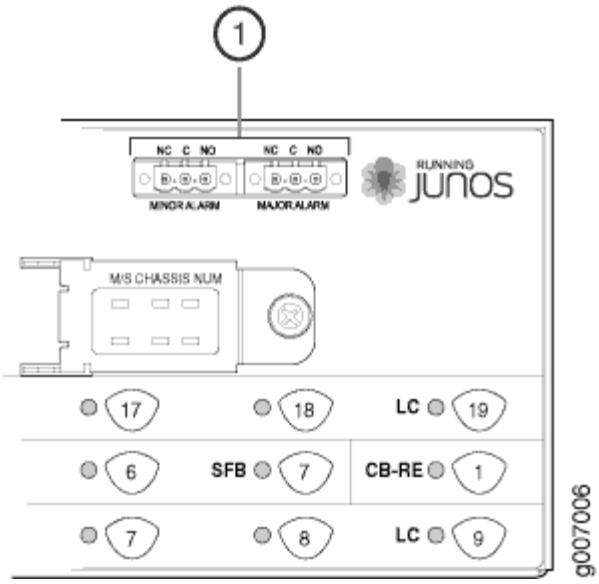


Table 114: Alarm Relay Contacts

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

Connecting the MX2020 Router to a Console or Auxiliary Device | **465**

Connecting the MX2020 Router to a Network for Out-of-Band Management | **464**

Connecting the Alarm Relay Wires to the MX2020 Craft Interface

To connect the alarm relay wires between a router and an alarm-reporting device (see Figure 196 on page 469):

1. Prepare the required length of replacement wire with gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2).
2. Insert the replacement wires into the slots in the front of the block (see Table 115 on page 470). 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 196: Alarm Relay Contacts

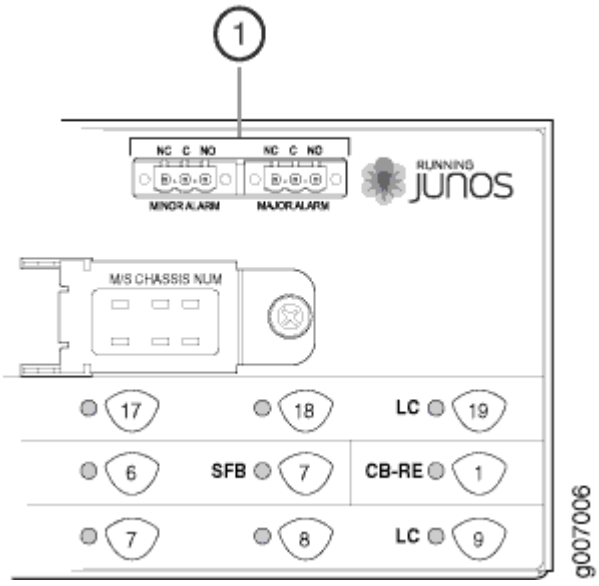


Table 115: Connecting Alarm Relay Contacts

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), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

RELATED DOCUMENTATION

- Installing the MX2020 Craft Interface | 751
- Removing the MX2020 Craft Interface | 750
- Maintaining and Verifying the Status of the MX2020 Craft Interface | 759

Disconnecting the Alarm Relay Wires from the MX2020 Craft Interface

To disconnect the alarm relay wires from the router and an alarm-reporting device (see Figure 197 on page 471):

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 116 on page 471).

Figure 197: Alarm Relay Contacts

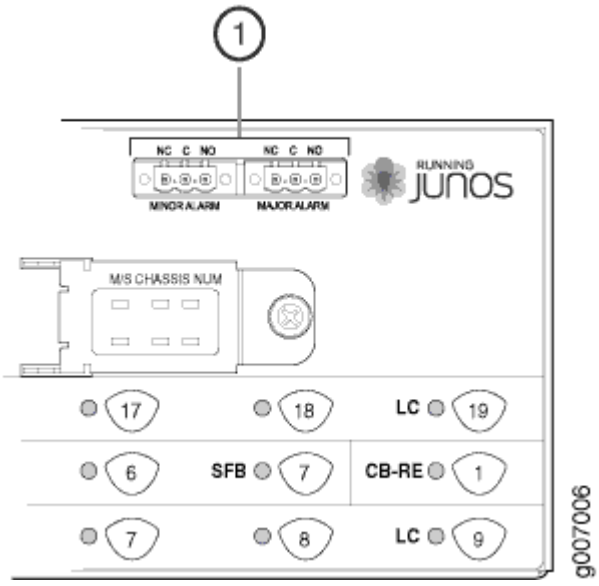


Table 116: Alarm Relay Contacts on the Craft Interface

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.

RELATED DOCUMENTATION

- Installing the MX2020 Craft Interface | **751**
- Removing the MX2020 Craft Interface | **750**
- Maintaining and Verifying the Status of the MX2020 Craft Interface | **759**

Connecting MPC or MIC Cables to the MX2020 Router

To connect the MPCs or MICs to the network (see Figure 198 on page 473 and Figure 199 on page 474):

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 198: Attaching a Cable to a MPC

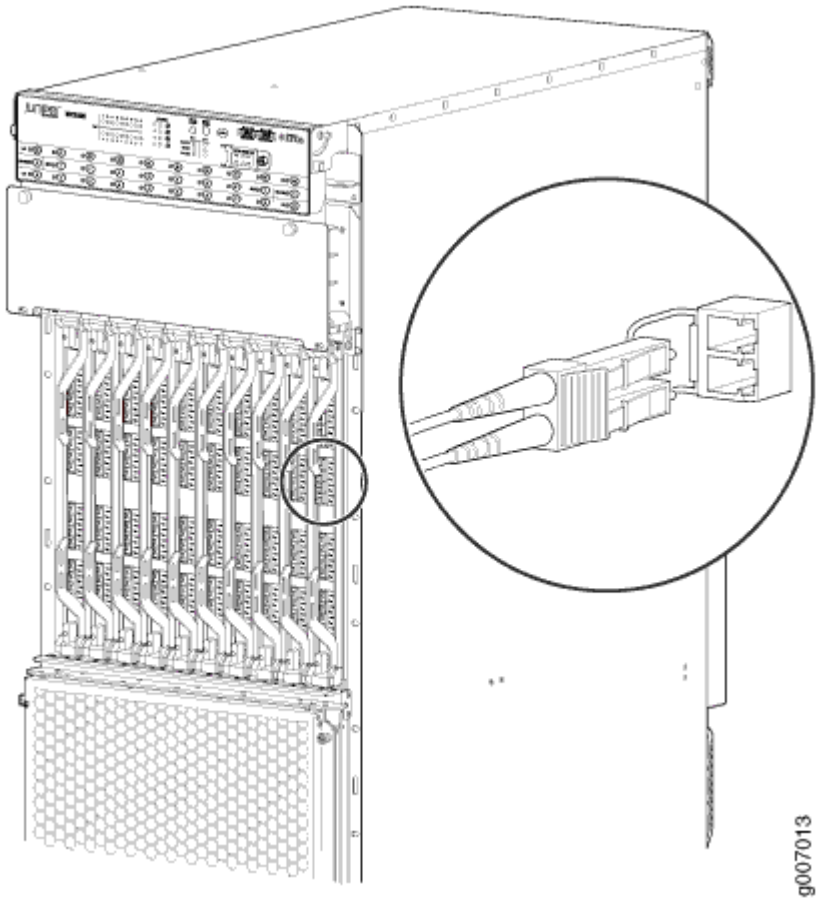
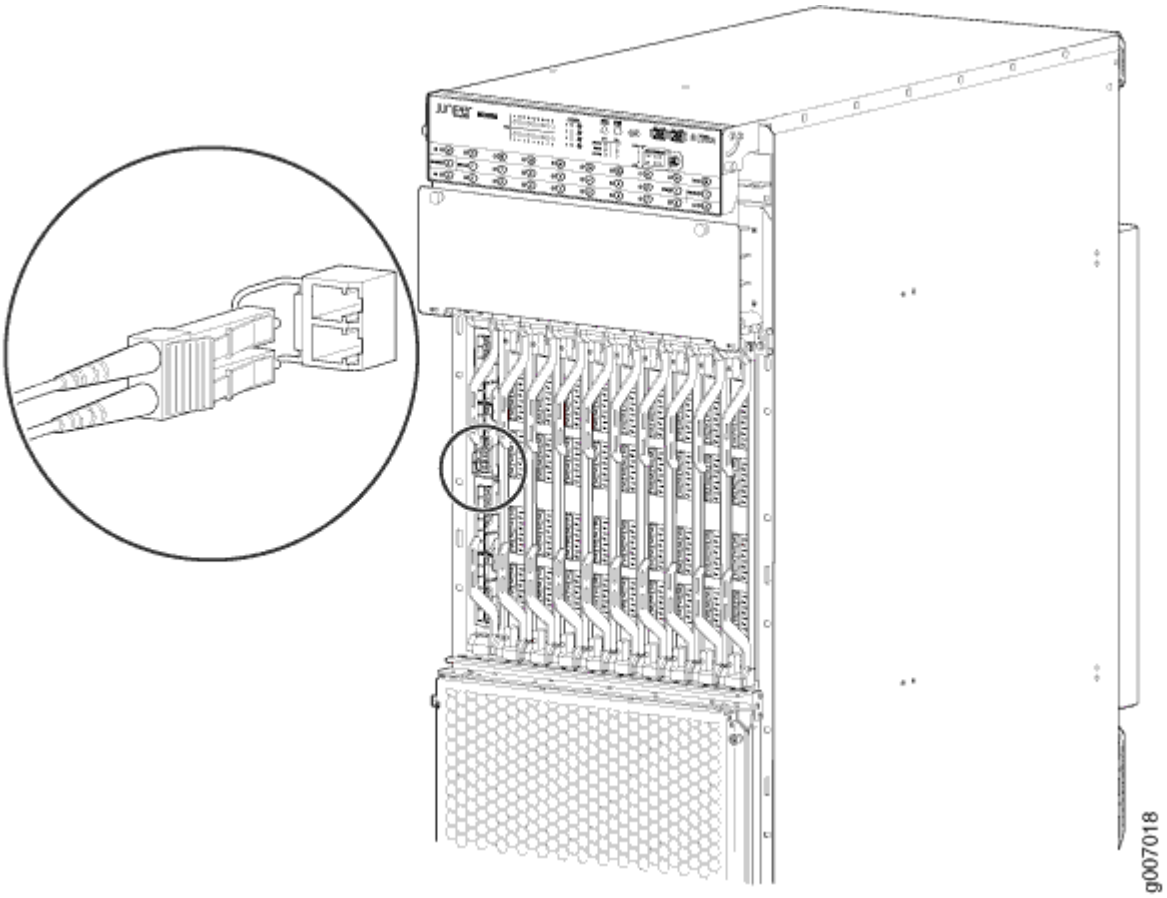


Figure 199: Attaching a Cable to a MIC



RELATED DOCUMENTATION

- Connecting the MX2020 Router to Management and Alarm Devices | **459**
- Tools and Parts Required for MX2020 Router Connections | **331**
- Grounding the MX2020 Router

CHAPTER 22

Configuring the Junos OS Software

IN THIS CHAPTER

Initially Configuring the MX2020 Router

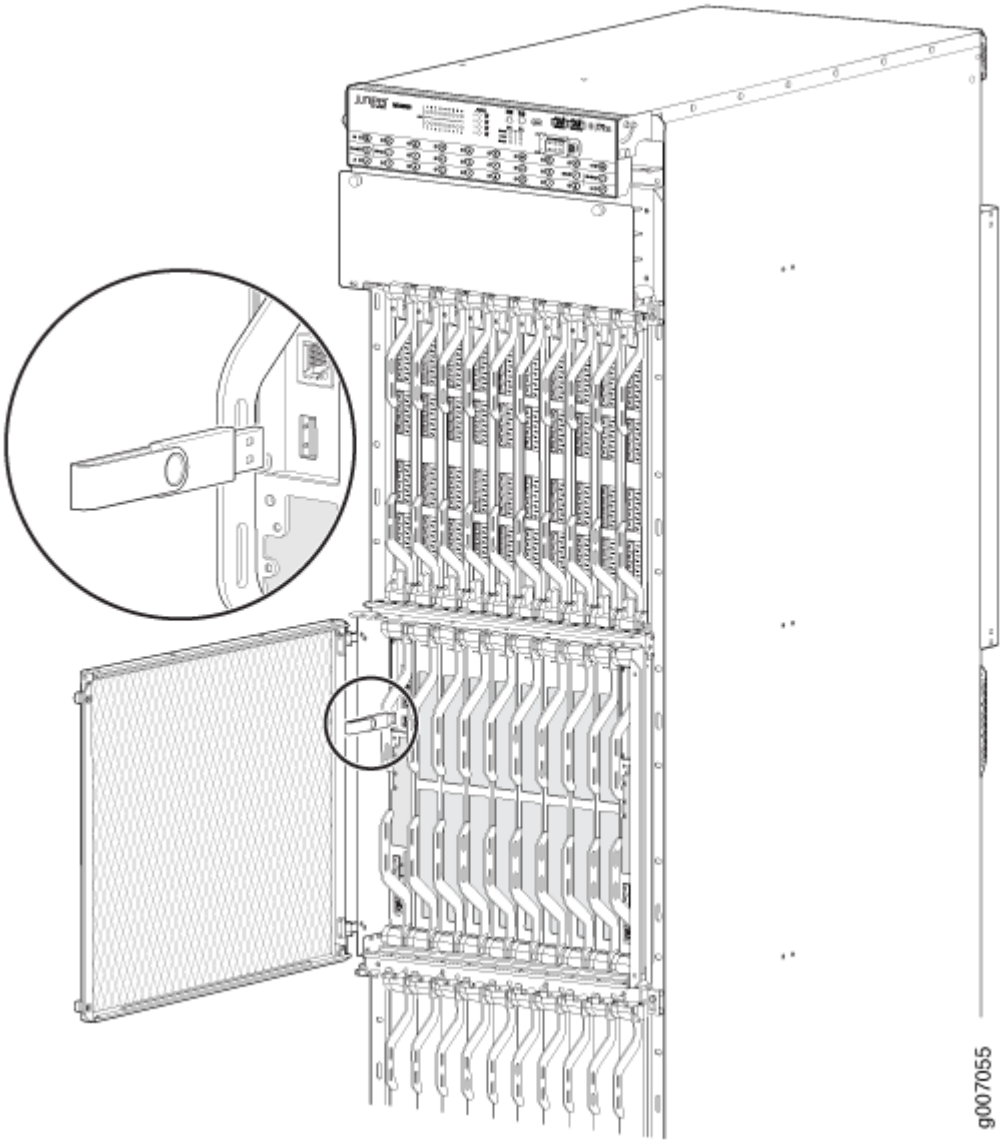
The MX2020 router is shipped with the Junos OS preinstalled and ready to be configured when the MX2020 router is powered on. There are three copies of the software: one on a CompactFlash card in the CB-RE, one on a solid state drive (SSD) in the CB-RE, and one on a USB flash drive that can be inserted into the slot in the CB-RE faceplate (see Figure 200 on page 476).

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 command-line interface (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 200: 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 either a clear-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 the 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 routing platform 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 platform does not function properly. If the router boots from an alternate boot device, the Junos OS displays a message indicating this when you log in to the router.

RELATED DOCUMENTATION

Powering On the AC-Powered MX2020 Router

Powering On the DC-Powered (-48 V) MX2020 Router | 452

PART 4

Installing, Replacing, and Maintaining MX2020 Router Components

CHAPTER 23

Required Tools and Parts

IN THIS CHAPTER

Tools and Parts Required for Replacing MX2020 Hardware Components

To replace hardware components, you need the tools and parts listed in Table 117 on page 483.

Table 117: 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) tightening torque 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 117: 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) tightening torque 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) tightening torque 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). **NOTE**: This does not apply to the DC PDM (240 V China).
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 117: 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 filters	Phillips (+) screwdrivers, numbers 1 and 2
Middle card cage air filter	Phillips (+) screwdrivers, numbers 1 and 2
Air filter (lower)	Phillips (+) screwdrivers, numbers 1 and 2

RELATED DOCUMENTATION

- MX2020 Field-Replaceable Units | 55
- Replacing the MX2020 Craft Interface
- Replacing an MX2020 Fan Tray | 588
- Replacing the MX2020 Air Filters

Tools and Parts Required to Remove Components from an MX2020 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
- Router transport kit—recommended (optional)
- Phillips (+) screwdrivers, numbers 1, 2, and 3
- Rubber safety cap for fiber-optic interfaces or cable
- Wire cutters

RELATED DOCUMENTATION

Packing the MX2020 Router for Shipment

Contact Customer Support

CHAPTER 24

Installing, Removing, and Maintaining Power Components

IN THIS CHAPTER

Replacing an MX2000 Three-Phase Delta AC Power Distribution Module

IN THIS SECTION

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.

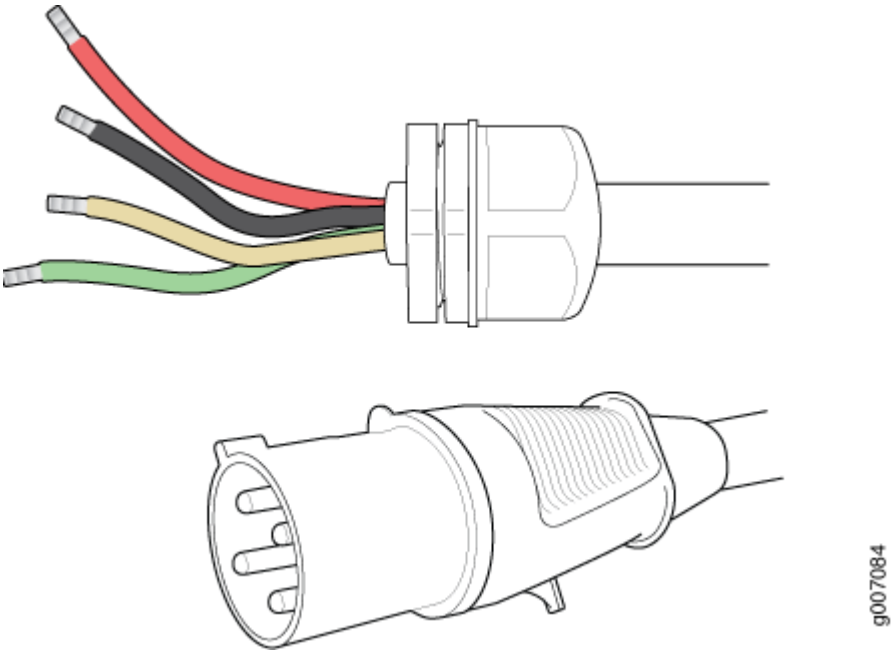
NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker to the **ON** position.

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 201 on page 489) from the power source.

Figure 201: 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 202 on page 490), 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:

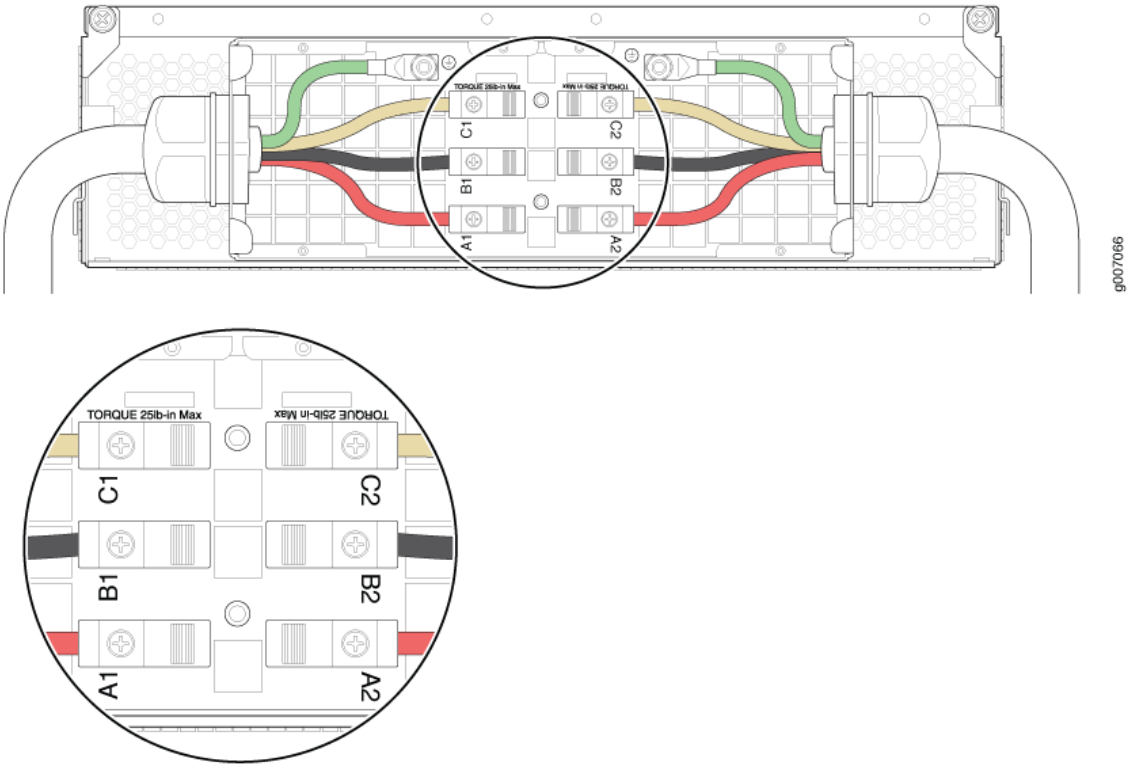
   a. Remove the wire labeled **L3** from the input terminal labeled **C1**.

   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 202: 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 203 on page 492, Figure 204 on page 493 (MX2010), and Figure 205 on page 494 (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 203: Removing a Three-Phase Delta AC Power Distribution Module (MX2020 Router)

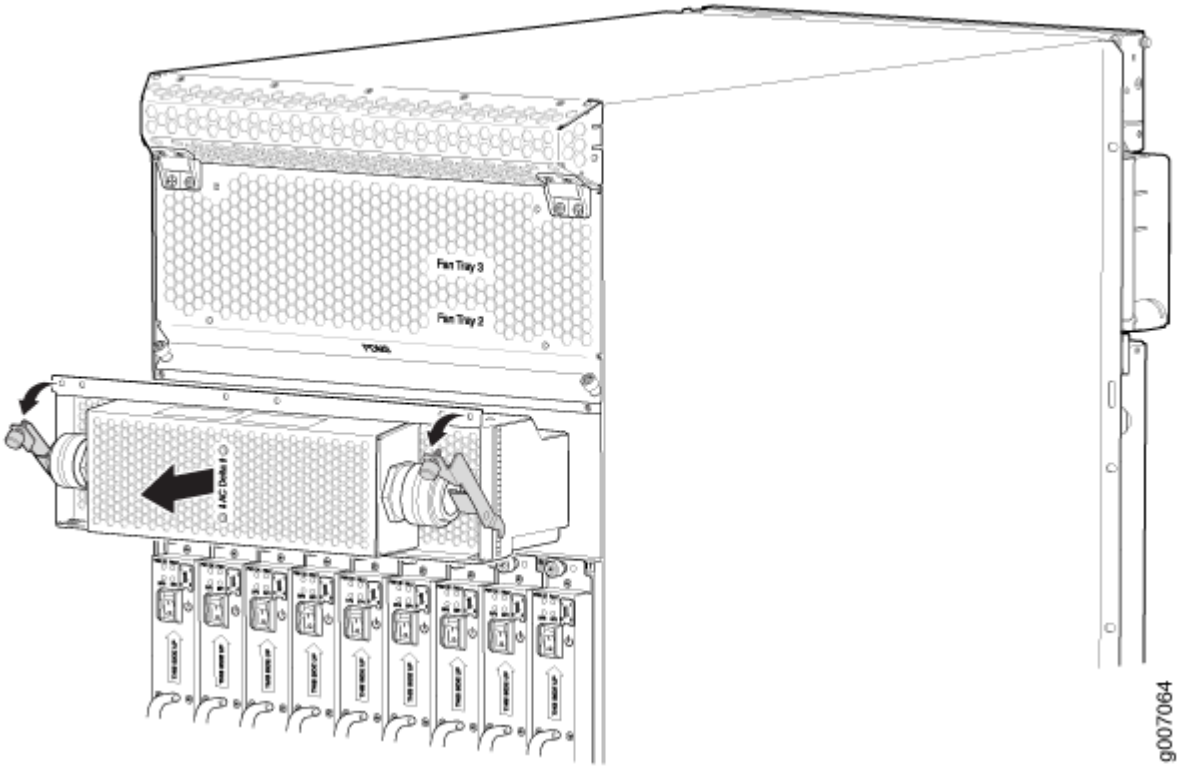


Figure 204: Removing a Three-Phase Delta AC Power Distribution Module (MX2010 Router)

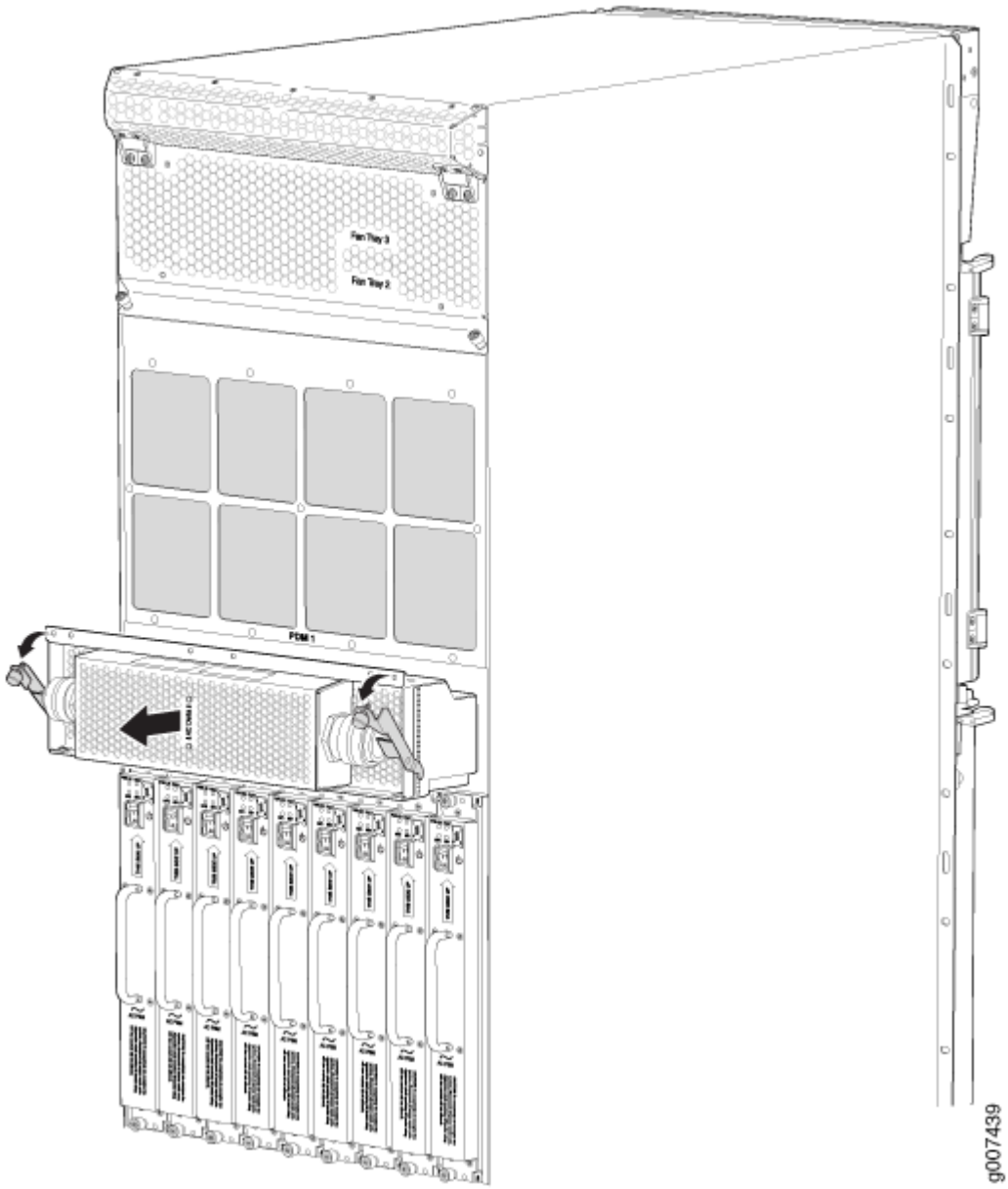
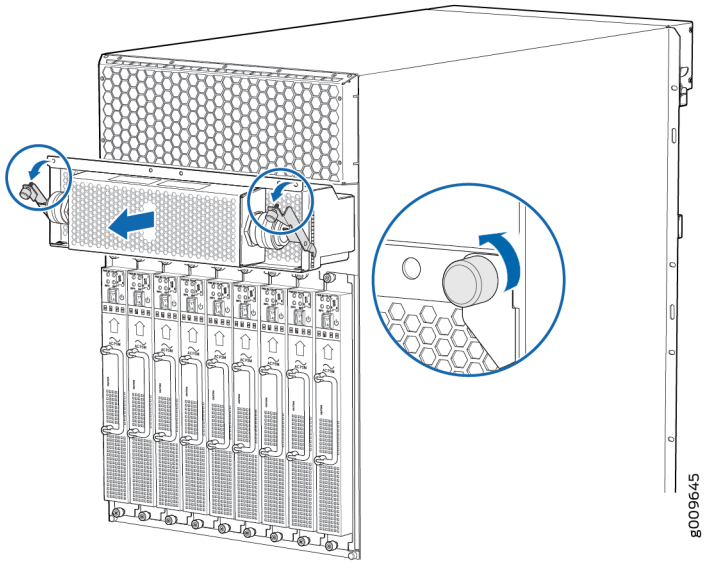


Figure 205: Removing a Three-Phase Delta AC Power Distribution Module (MX2008 Router)



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

MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications

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* 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 206 on page 496Figure 207 on page 497, and Figure 208 on page 498).
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 206: Installing a Three-Phase Delta AC Power Distribution Module (MX2020)

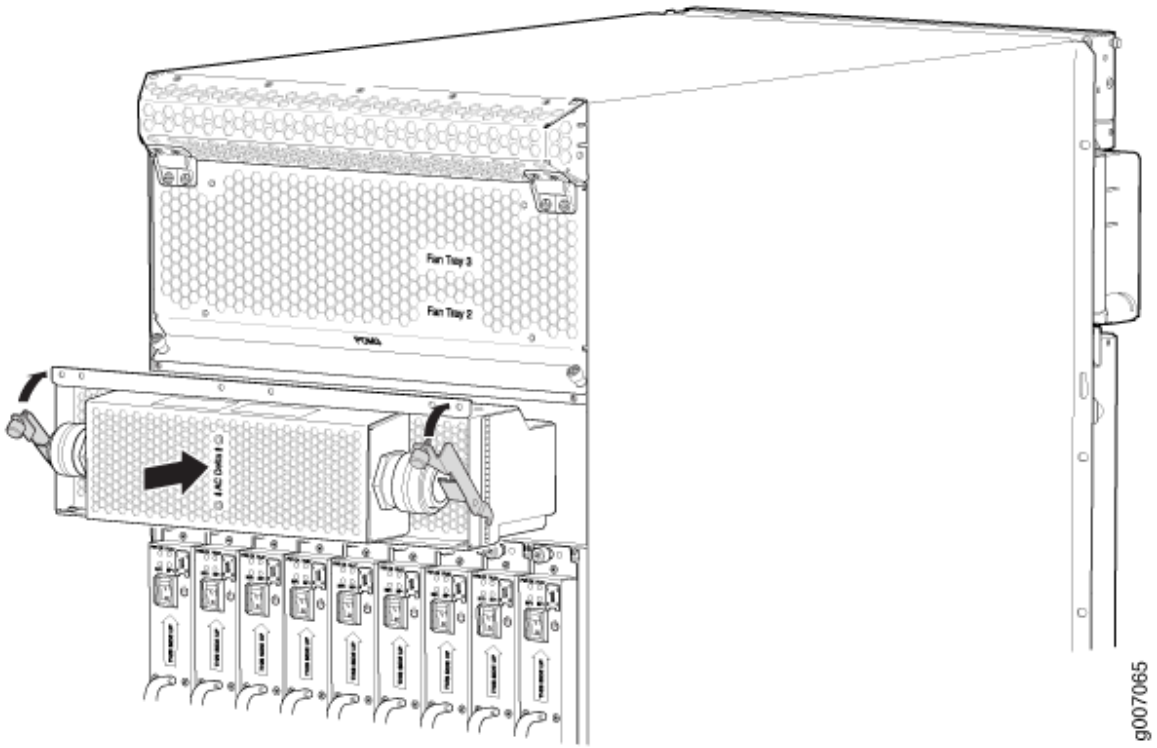


Figure 207: Installing a Three-Phase Delta AC Power Distribution Module (MX2010)

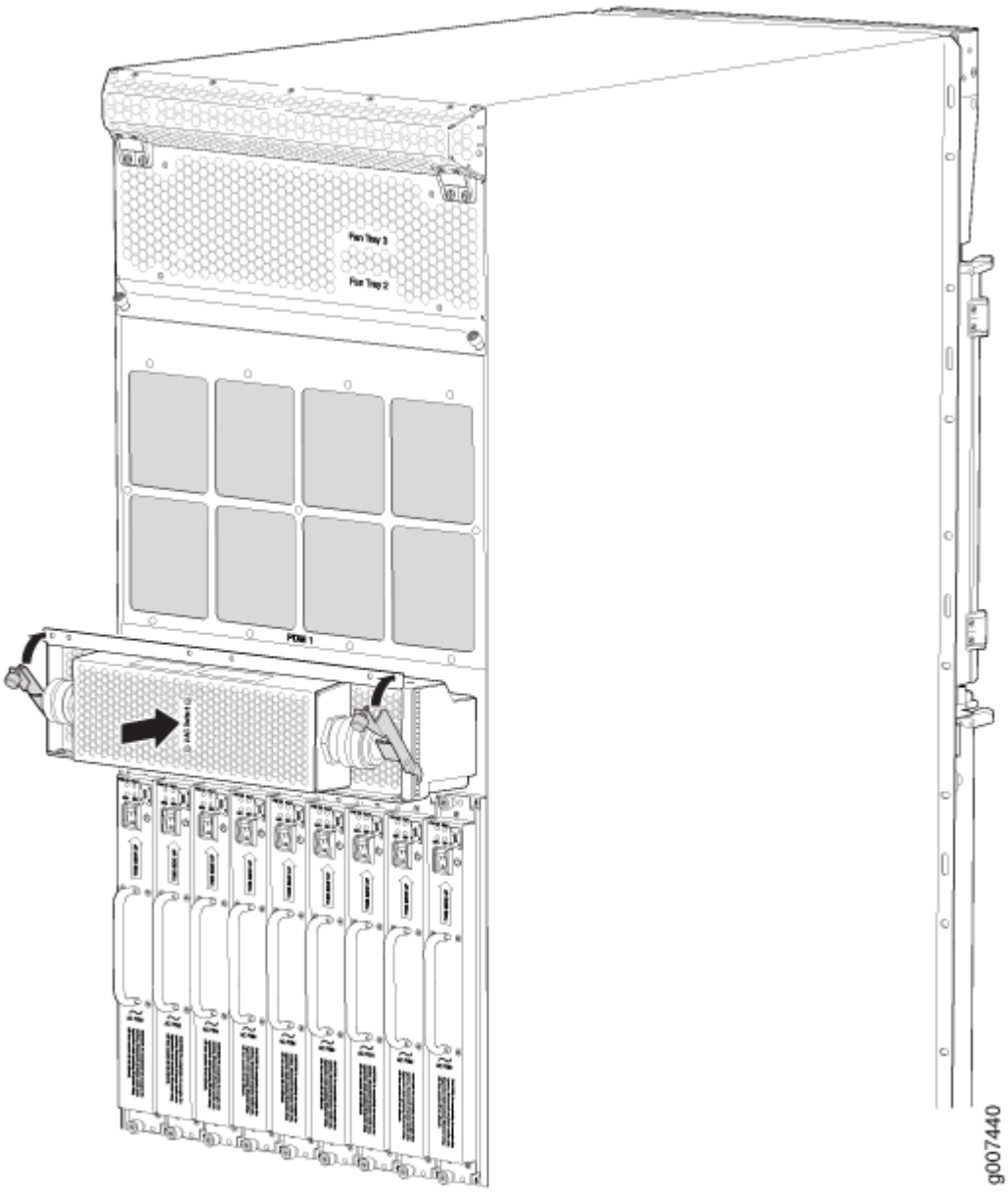
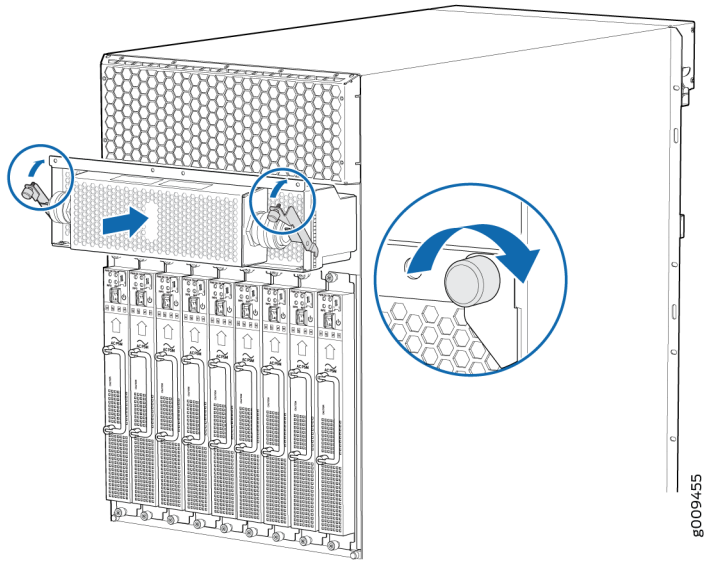


Figure 208: Installing a Three-Phase Delta AC Power Distribution Module (MX2008)



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 209 on page 499). 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 118 on page 500 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

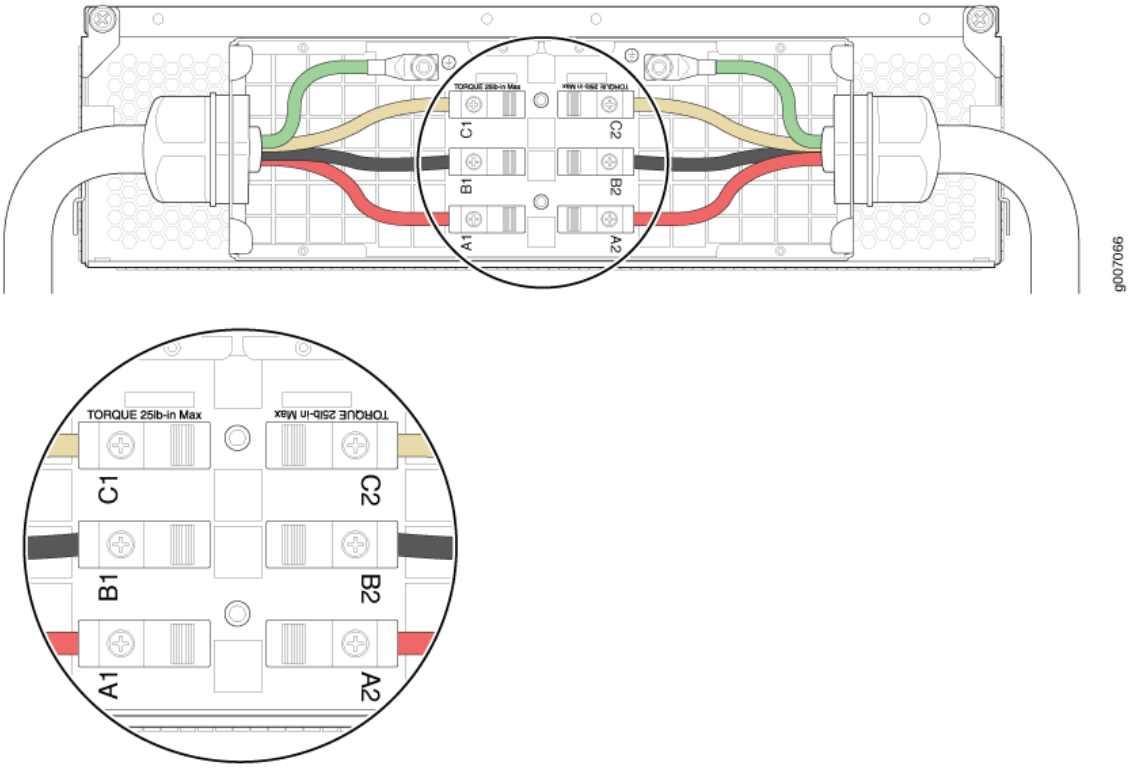
    a. Insert the grounding wire into the grounding point labeled **GND**.

    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 209: 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 118: 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*
- *MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs*
- *Connecting AC Power to an MX2000 Router with Three-Phase Delta AC Power Distribution Modules*
- *Powering On a Three-Phase AC-Powered MX2000 Router*
- *Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router*
- *Troubleshooting the MX2000 Router Power System*
- *MX2000 AC Power Cord Specifications*
- *MX2000 AC Power System Electrical Specifications*
- *MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications*

Replacing an MX2020 Three-Phase Wye AC Power Distribution Module

IN THIS SECTION

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.

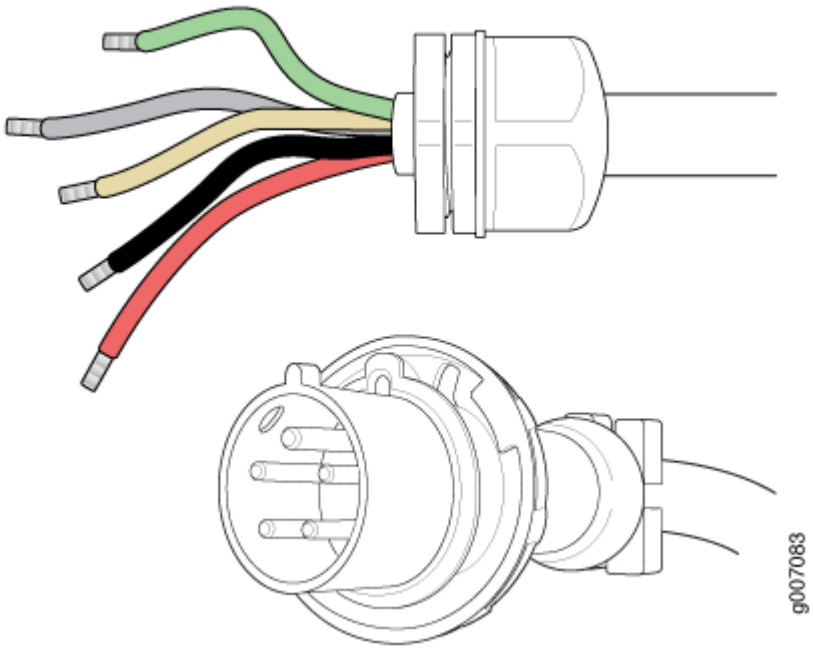
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each PDM slot must contain either a PDM or a blank panel. If you remove a PDM, you must install a replacement PDM or a blank panel shortly after the removal.

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 210 on page 503) from the power source.

Figure 210: 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 211 on page 504), 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**.

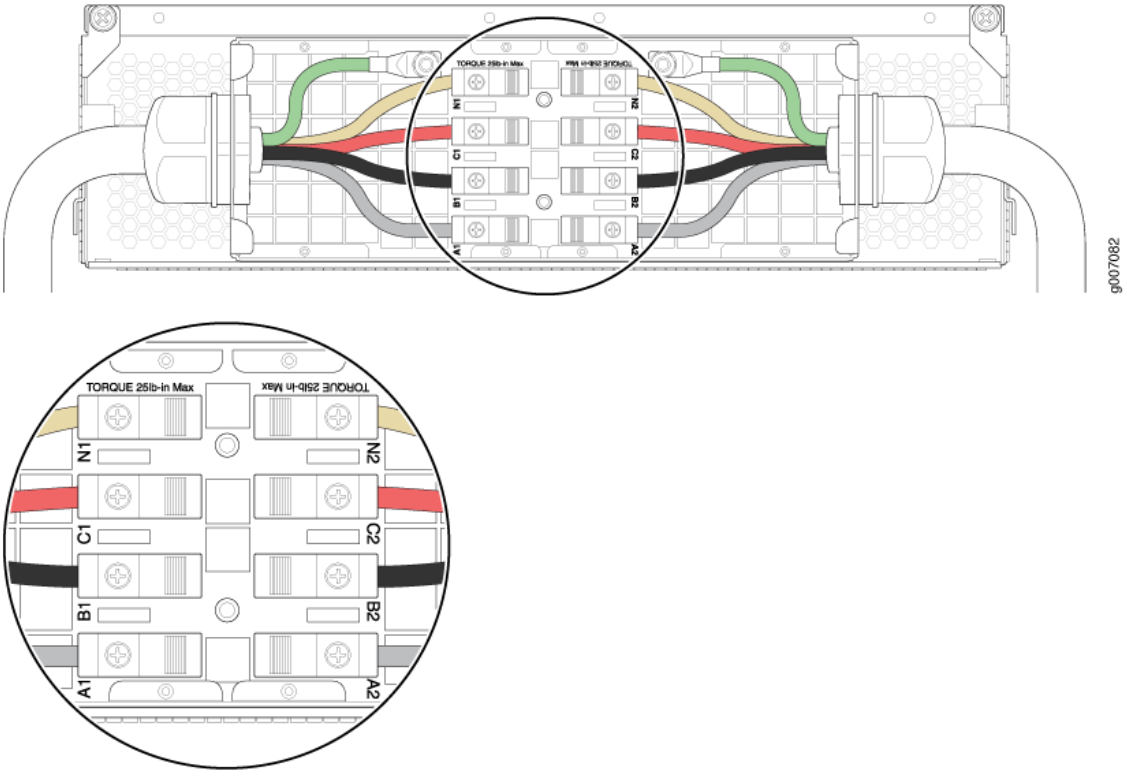
   b. Remove the wire labeled **L3** from the input terminal labeled **C1**.

   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 211: 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 212 on page 506, Figure 213 on page 507, and Figure 214 on page 508).

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 212: Removing an MX2020 Three-Phase Wye AC PDM

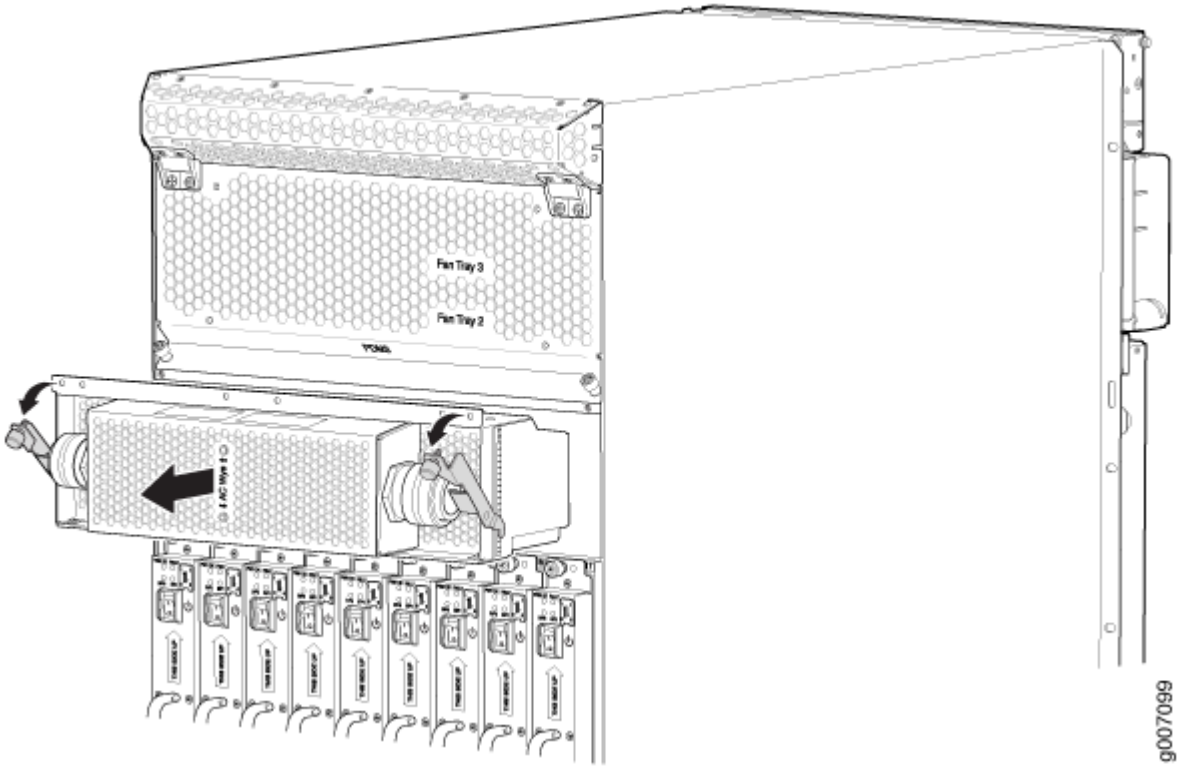


Figure 213: Removing an MX2010 Three-Phase Wye AC Power Distribution Module

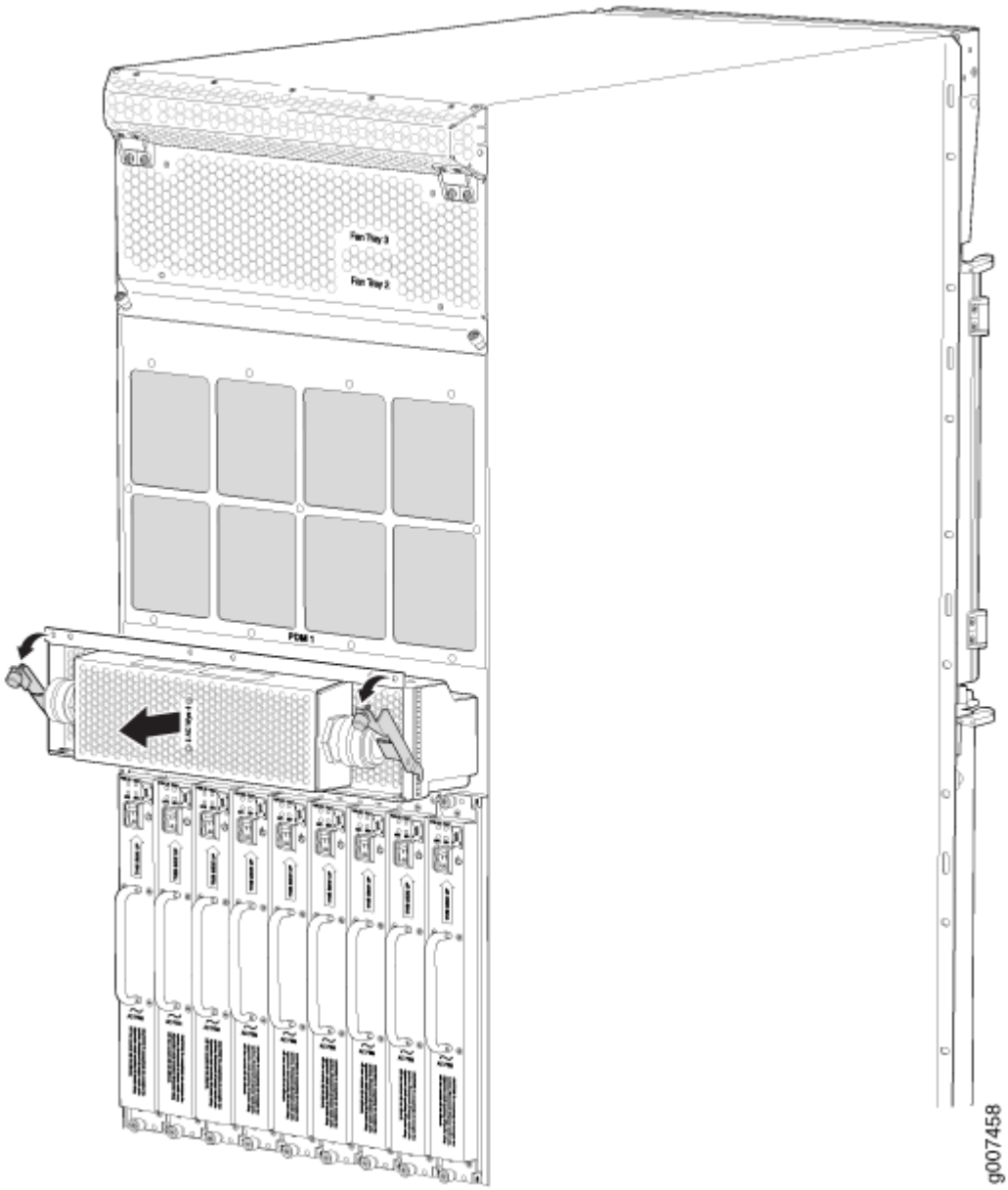
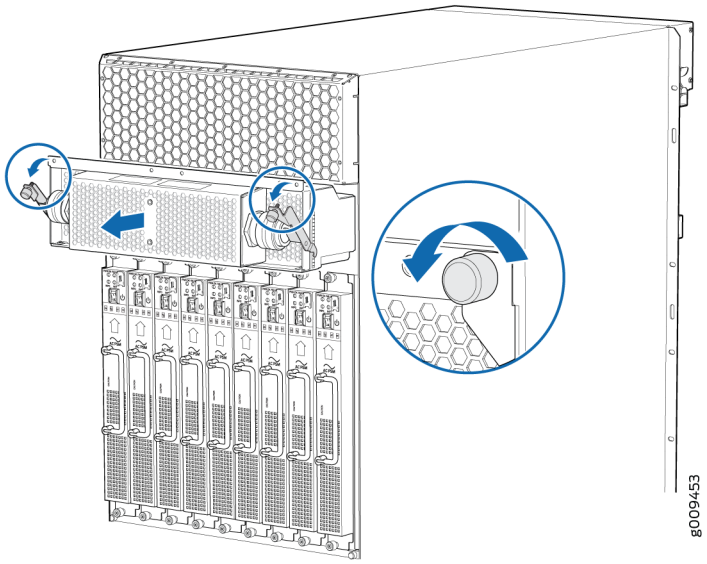


Figure 214: Removing an MX2008 Three-Phase Wye AC Power Distribution Module



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* 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 215 on page 510, Figure 216 on page 511, or Figure 217 on page 512.

Figure 215: Installing a Three-Phase Wye AC PDM (MX2020)

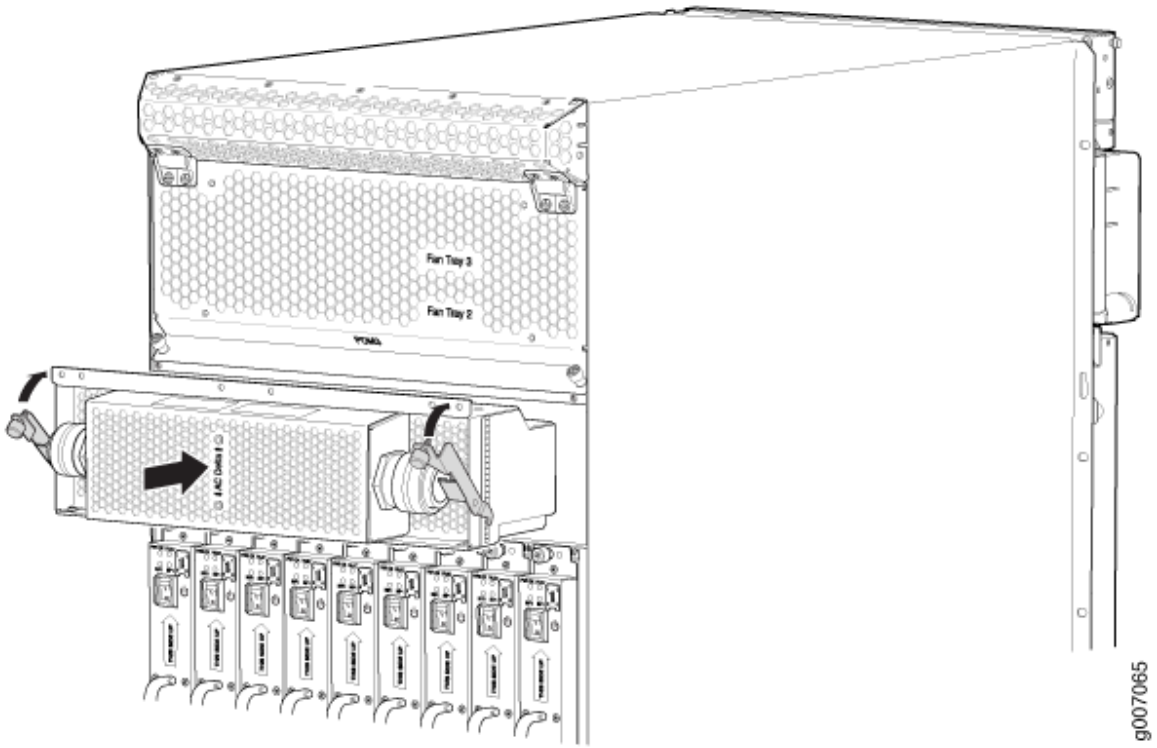


Figure 216: Installing a Three-Phase Wye AC PDM (MX2010)

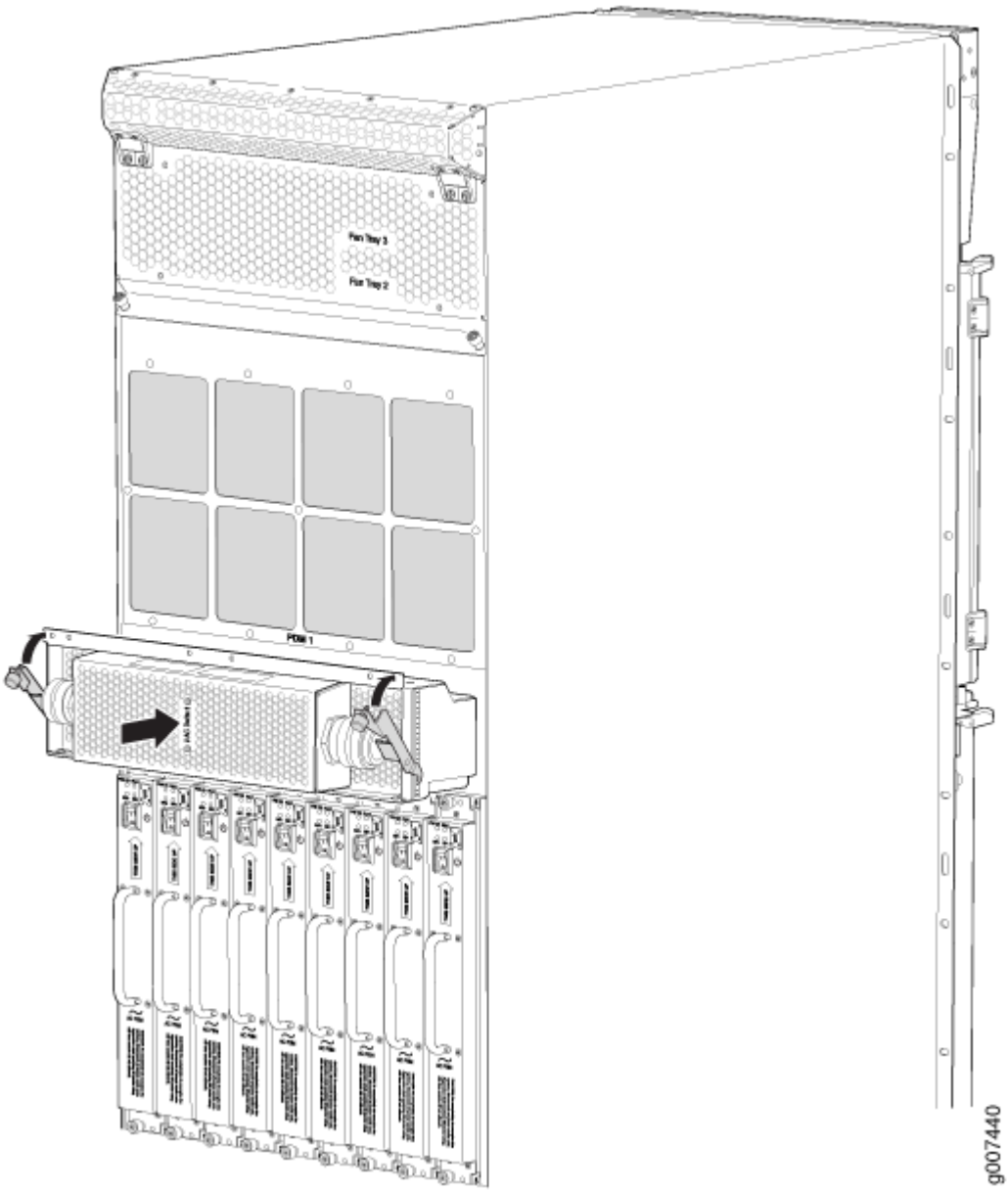
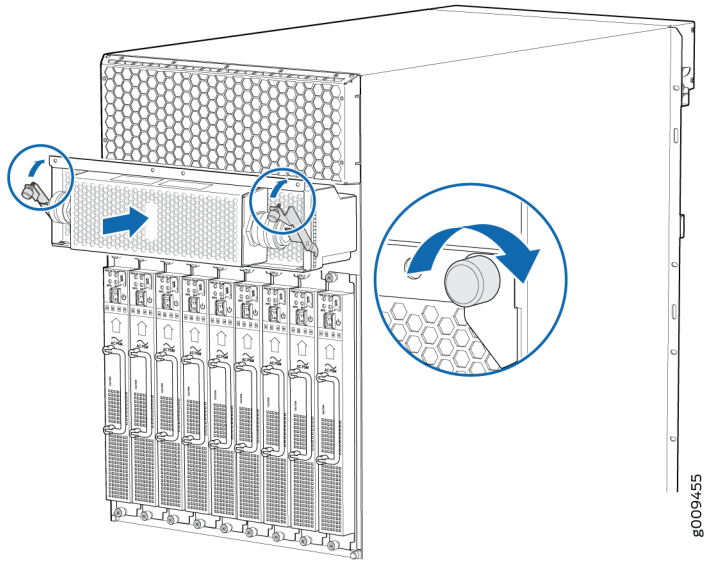


Figure 217: Installing an Three-Phase Wye AC PDM (MX2008)



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 218 on page 513). 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 119 on page 514 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**.

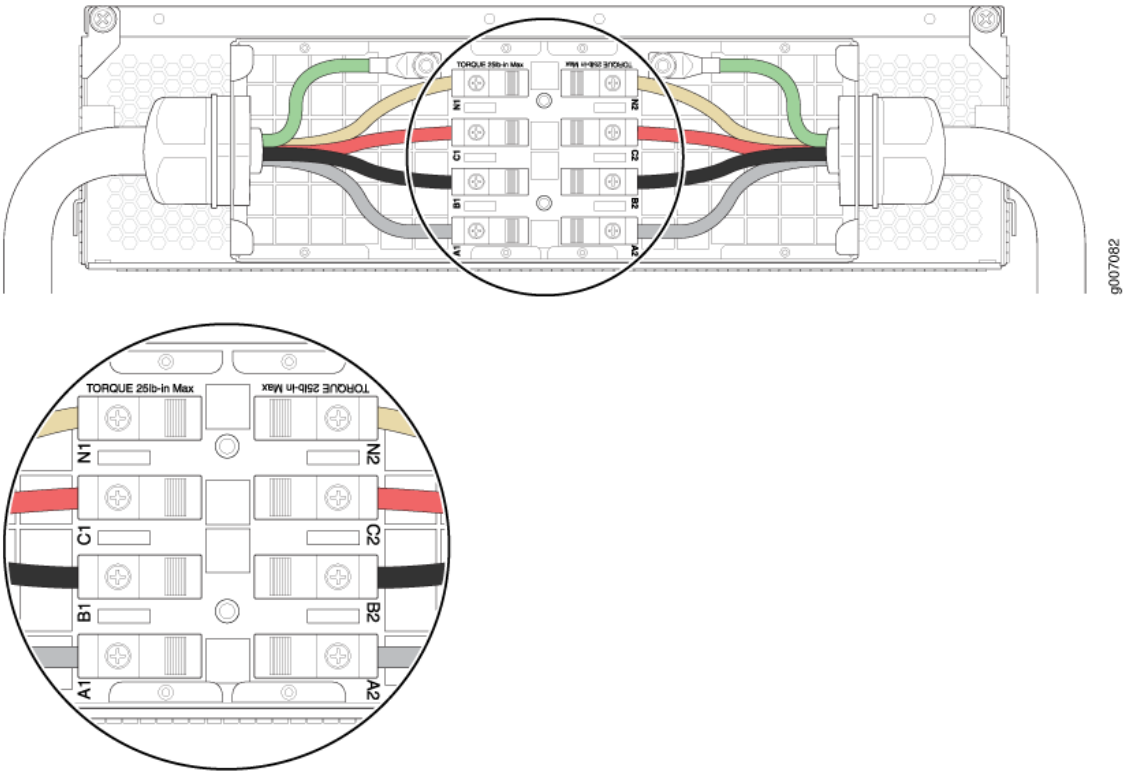
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    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 218: 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 119: 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*
- *MX2000 Three-Phase Wye AC Power Distribution Module Description*
- *MX2000 Three-Phase Delta and Wye AC Power Distribution Module LEDs*
- *Troubleshooting the MX2000 Router Power System*

Removing an MX2000 Single-Phase AC Power Distribution Module

Before you remove a single-phase 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.

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.

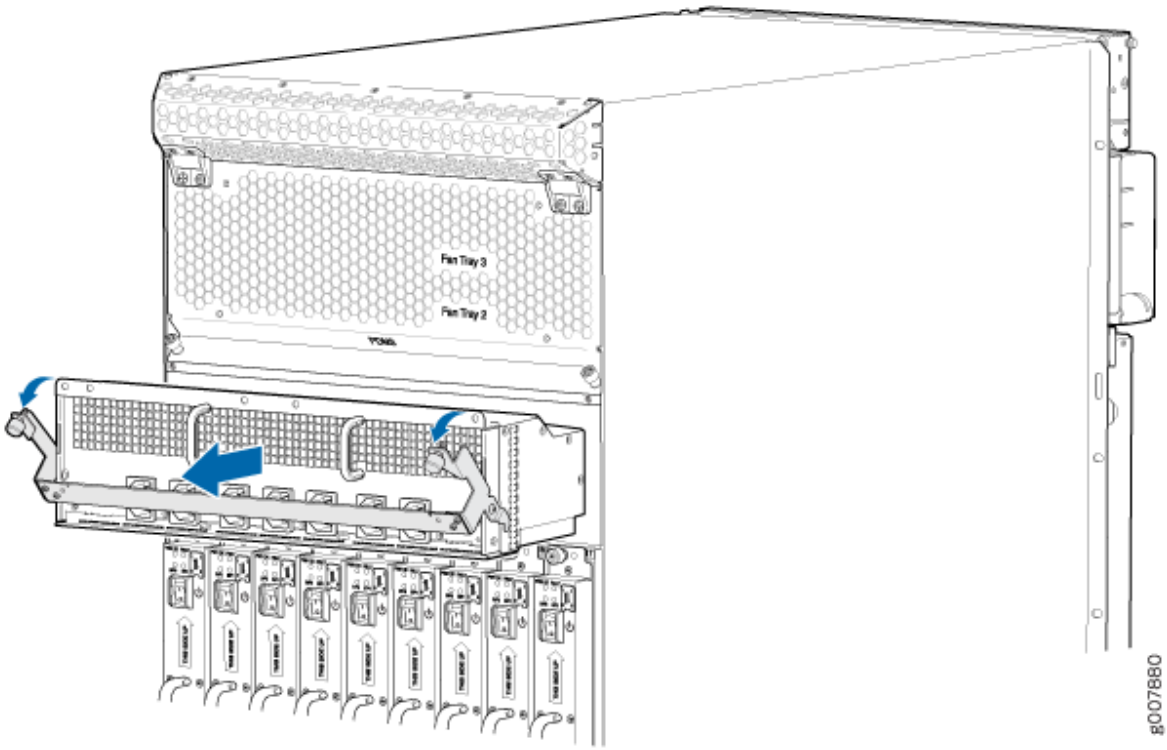
Each single-phase AC PDM weighs approximately 9 lb (3.6 kg). To remove a single-phase AC PDM:

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 switch to the off (**O**) position for the power supply modules that are powered from only the AC PDMs being removed.

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

3. Remove the two thumb screws at each end of the power cord retainer by turning them counter-clockwise.
4. Remove the power cord retainer.
5. Starting at one end of the PDM, unplug all the power cords.
6. Loosen the two thumbscrews on the PDM ejector levers and pull down the ejector bar.
7. Pull the two ejector levers away from the PDM until they stop and remove the PDM from the router chassis. Refer to Figure 219 on page 517.

Figure 219: Removing an AC PDM from the MX2000 Router Chassis



8. Place the PDM on an antistatic flat surface.
9. Cover the empty slot with a blank panel or install a new PDM into the slot. Refer to *Installing an MX2000 Single-Phase AC Power Distribution Module*.

RELATED DOCUMENTATION

- *MX2000 Seven-Feed Single-Phase AC Power Distribution Module Description*
- *MX2000 Nine-Feed Single-Phase AC Power Distribution Module Description*
- *Connecting Power to an MX2000 Single-Phase AC Power Distribution Module*
- *Installing an MX2000 Single-Phase AC Power Distribution Module*
- *MX2000 Single-Phase AC Power Distribution Module Electrical Specifications*

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.

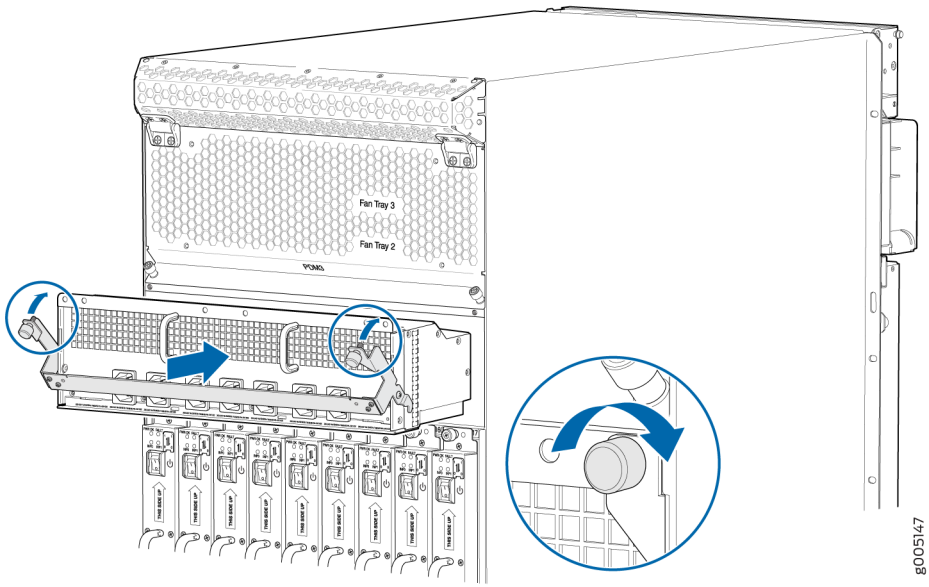
CAUTION: The single-phase AC PDM must be installed and secured in the chassis before connecting the input power cables. If the PDM must be removed, all input power cables must be removed from the PDM before the PDM can be removed from the chassis.

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:

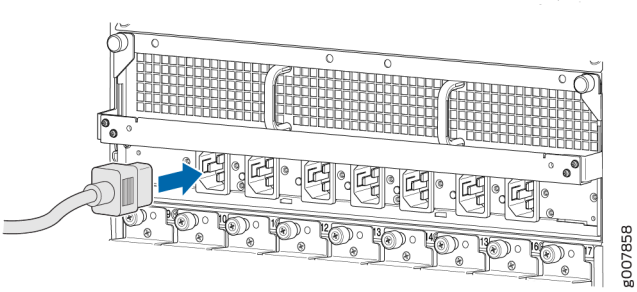
1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. (Optional) If you are switching from a DC PDM to an AC PDM, see *Converting an MX2000 Router Between AC and DC Power* 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 220 on page 519

Figure 220: Inserting the PDM into the Chassis



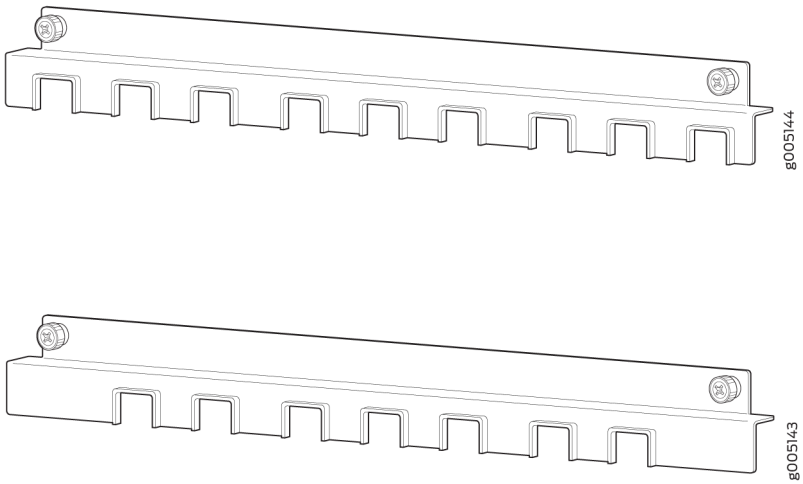
9. Gently push the ejector bar to be sure that the PDM is securely in place.
10. Tighten the two thumbscrews on the ejectors to secure the PDM in the chassis. Apply between 7 lb-in (0.8 Nm) and 9 lb-in. (1.01 Nm) of torque to each screw. Do not overtighten the screws.
11. Starting at one end of the PDM, plug the power cords into the power sockets on the PDM. Refer to Figure 221 on page 519. 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 221: Plugging into the MX2000 Single-Phase AC Power Distribution Module



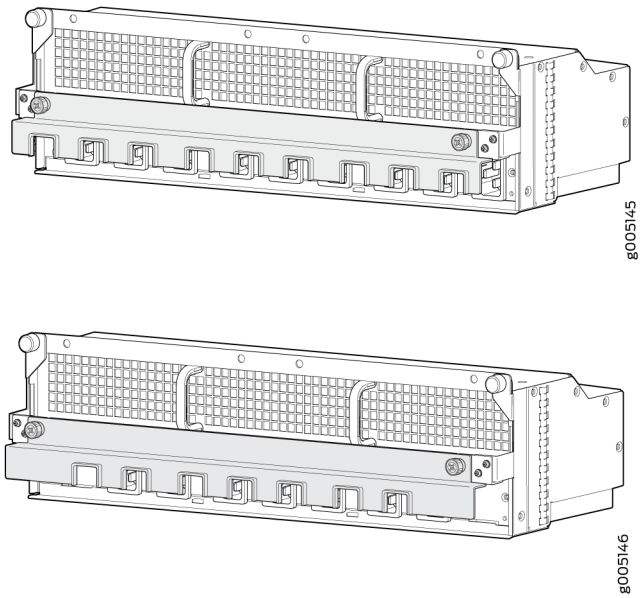
12. Attach the power cord retainer to the PDM to ensure that the AC power cords do not touch or block access to router components, and that they do not drape where people could trip on them. Figure 222 on page 520 shows the seven-feed and nine-feed power cord retainer.

Figure 222: MX2000 Single-Phase AC Power Cord Retainer



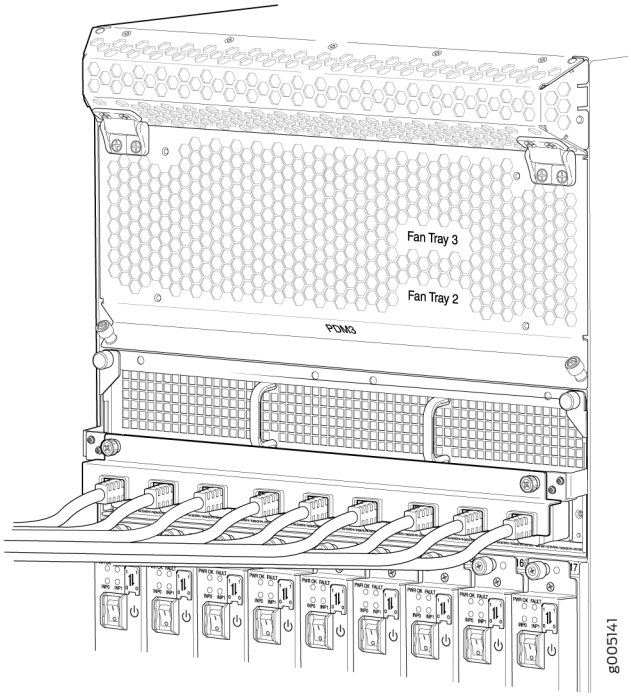
- Loosen the two screws at each end of the power cord retainer.
- Position the power cord retainer over the PDM power cords with the power cord retainer prongs facing downward. Refer to Figure 223 on page 520.

Figure 223: 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 224 on page 521

Figure 224: 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

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

MX2000 Single-Phase AC Power Distribution Module Electrical Specifications

Troubleshooting the MX2000 Router Power System

Removing an MX2000 Single-Phase AC Power Distribution Module | 515

Replacing an MX2000 DC Power Distribution Module (-48 V)

IN THIS SECTION

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 225 on page 524 (MX2020), Figure 226 on page 525 (MX2010), and Figure 227 on page 526 (MX2008)

Figure 225: Removing a DC PDM from an MX2020 Router

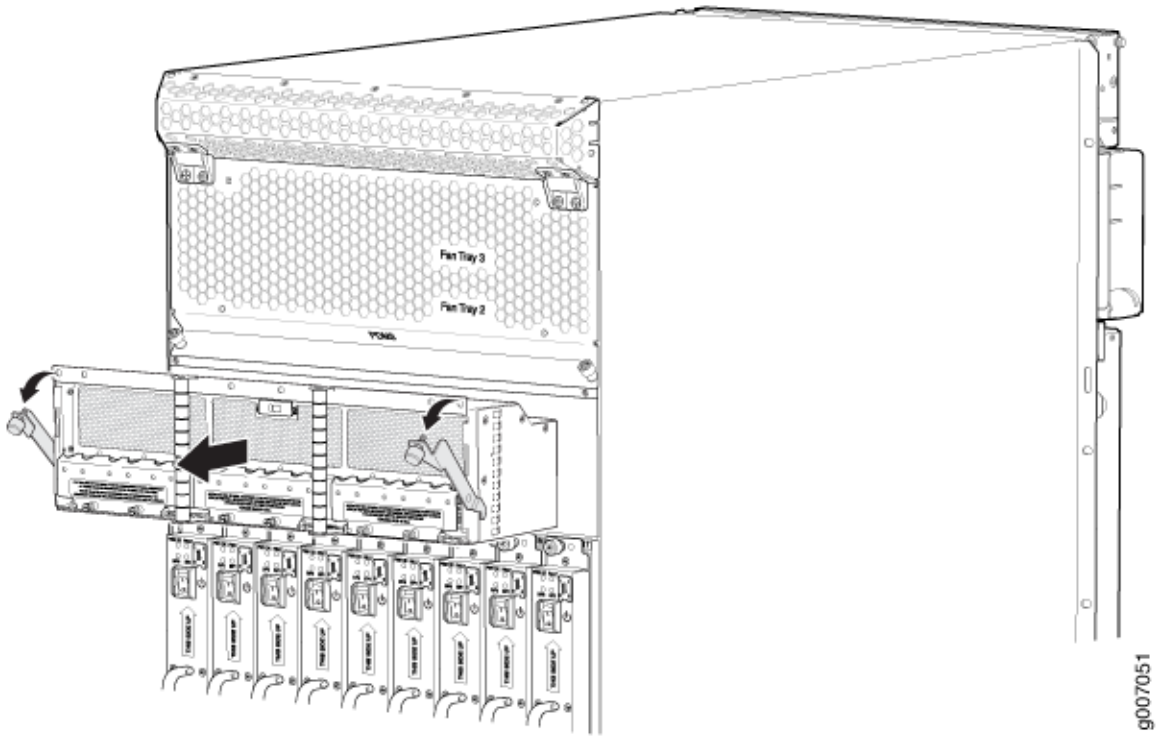


Figure 226: Removing a DC PDM from an MX2010 Router

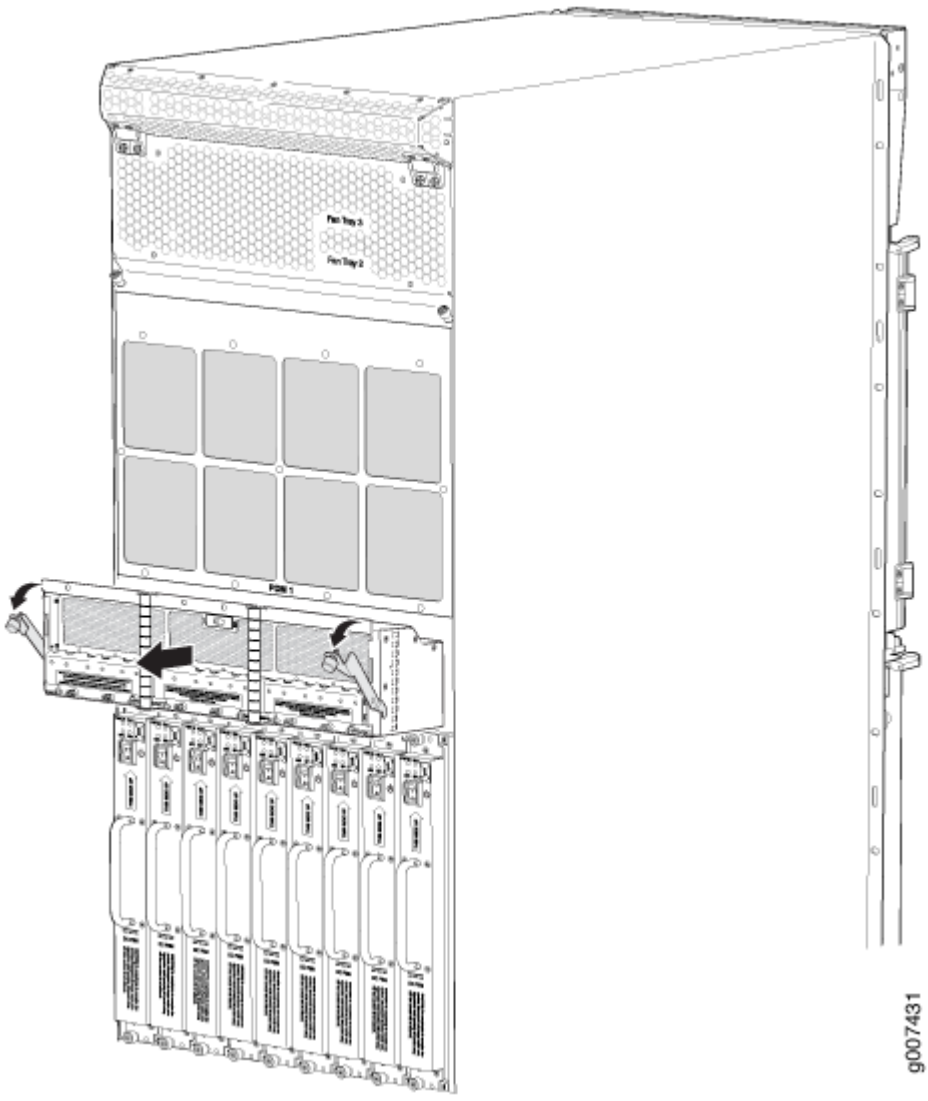
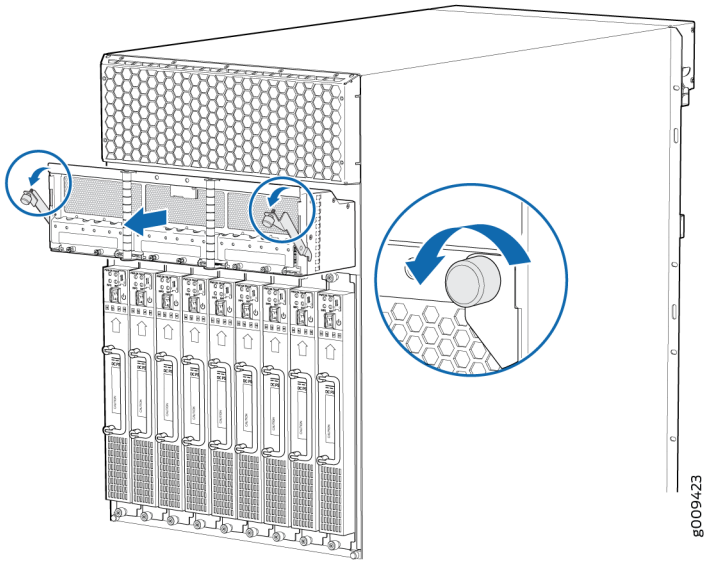


Figure 227: Removing a DC PDM from an MX2008 Router



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* 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 228 on page 527(MX2020), Figure 229 on page 528(MX2010), or Figure 230 on page 529 (MX2008).

Figure 228: Installing an MX2020 Router DC Power Distribution Module

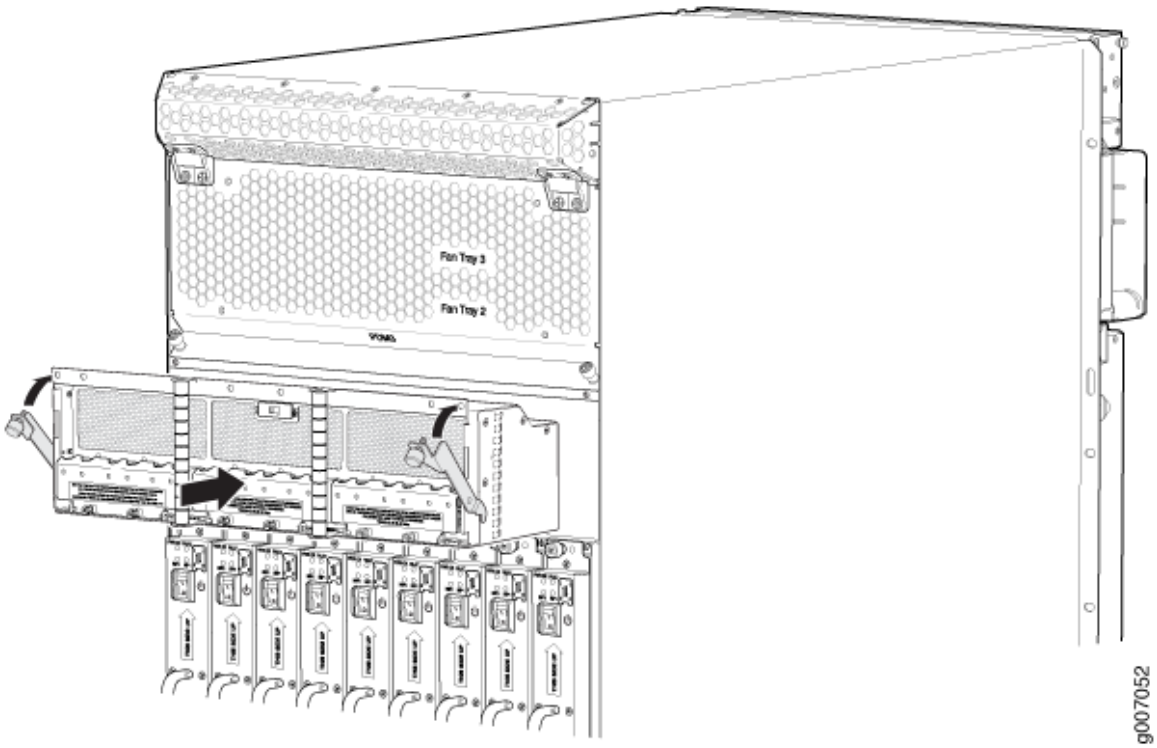


Figure 229: Installing an MX2010 Router DC Power Distribution Module

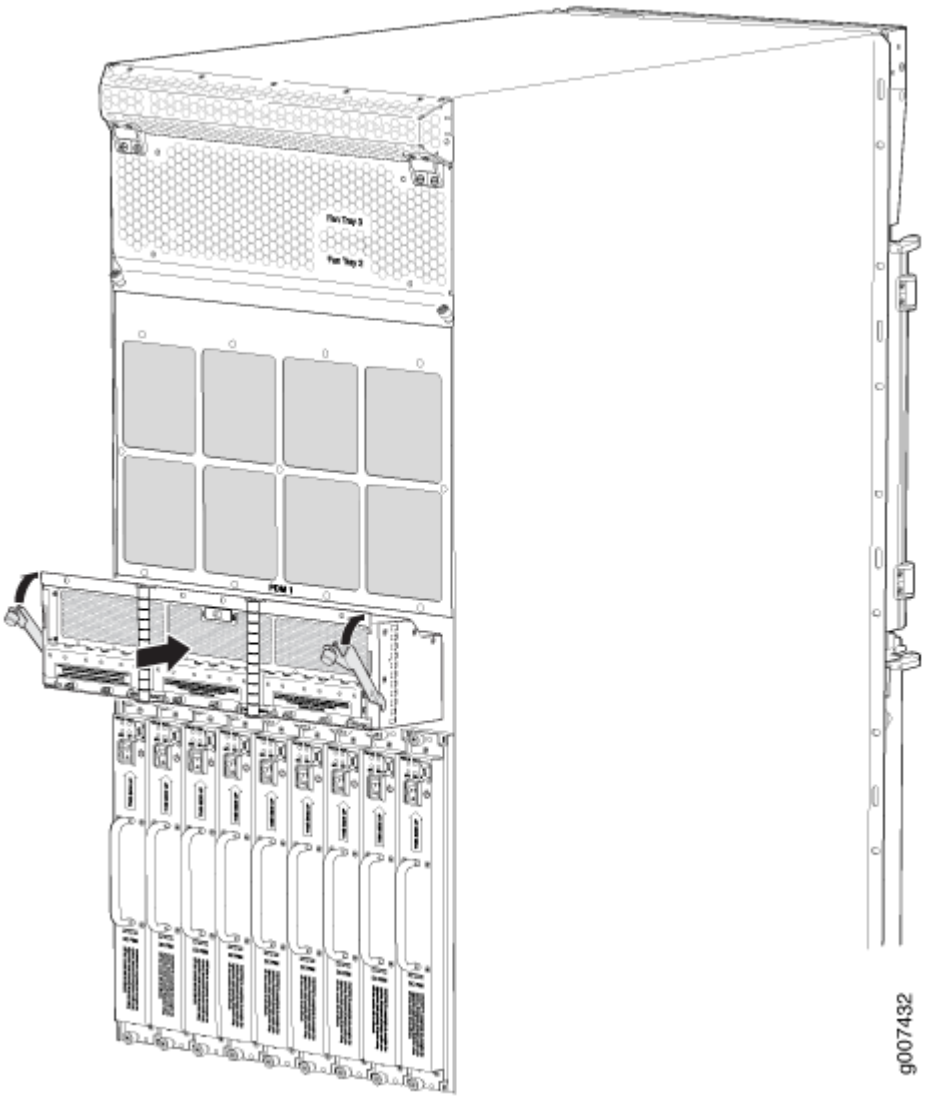
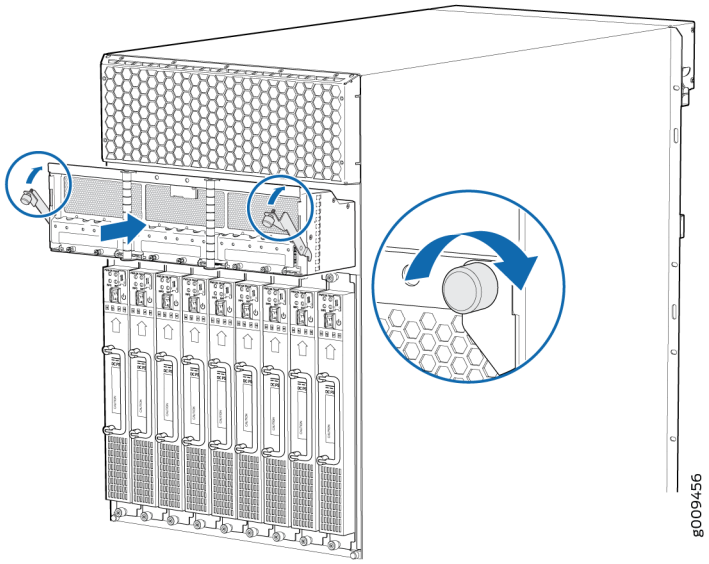


Figure 230: Installing an MX2008 Router Power Distribution Module



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

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

Troubleshooting the MX2000 Router Power System

Connecting an MX2000 DC Router Power Distribution Module (-48 V) Cable

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)

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.

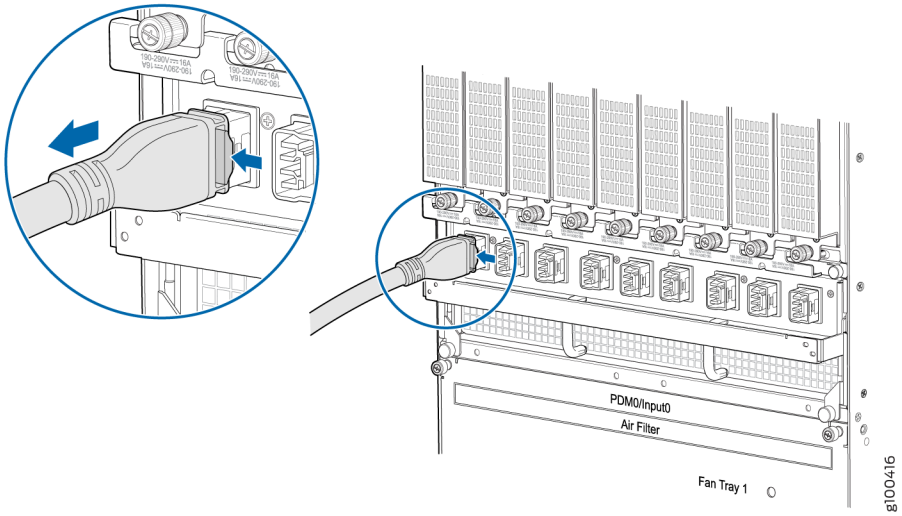
WARNING: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** 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 231 on page 531.

Figure 231: Unplugging the 240 V China Power Cord an MX2000 Router

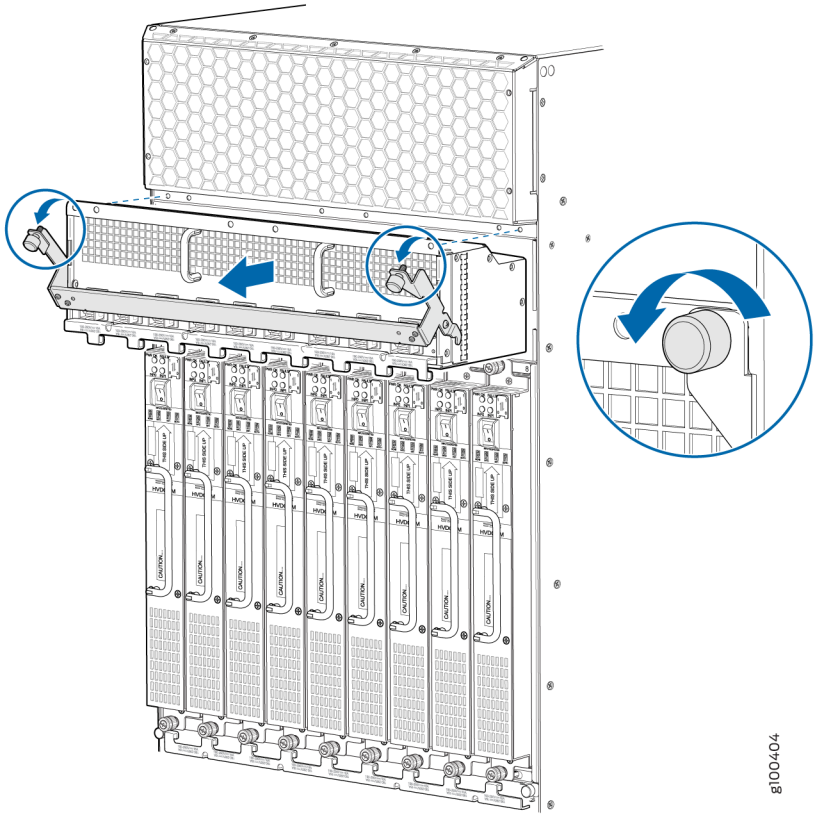


7. Loosen the two captive screws on the locking levers, and pull away from the chassis. See Figure 232 on page 532.

> **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 232: Removing a DC PDM (240 V China) from an MX2000 Router



8. The PDM is extended slightly away from the chassis. See Figure 232 on page 532.
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)

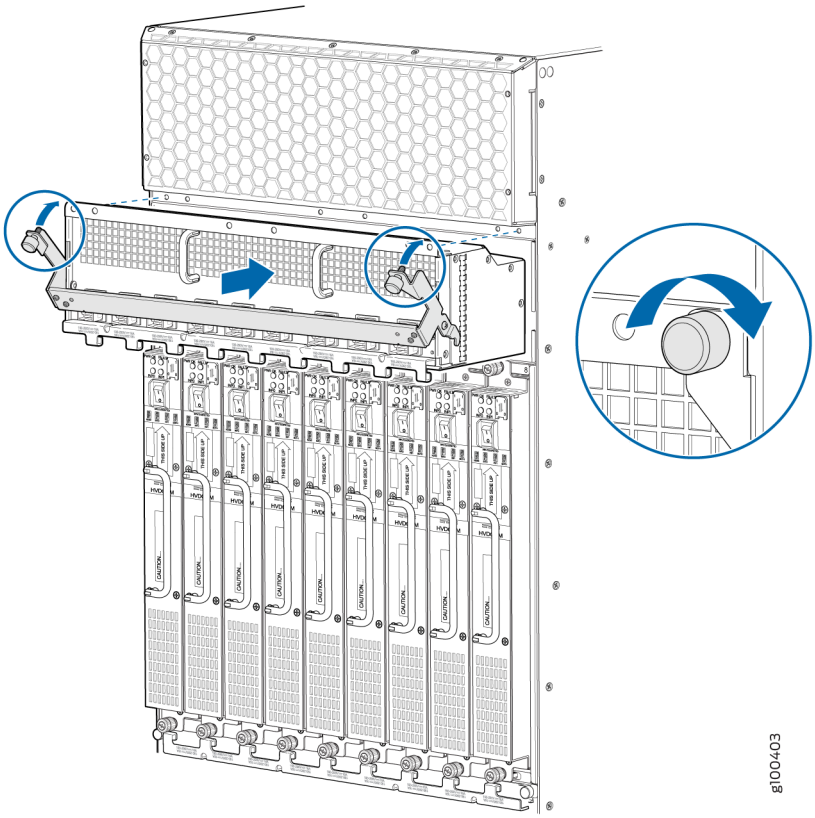
> **WARNING**: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services

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:

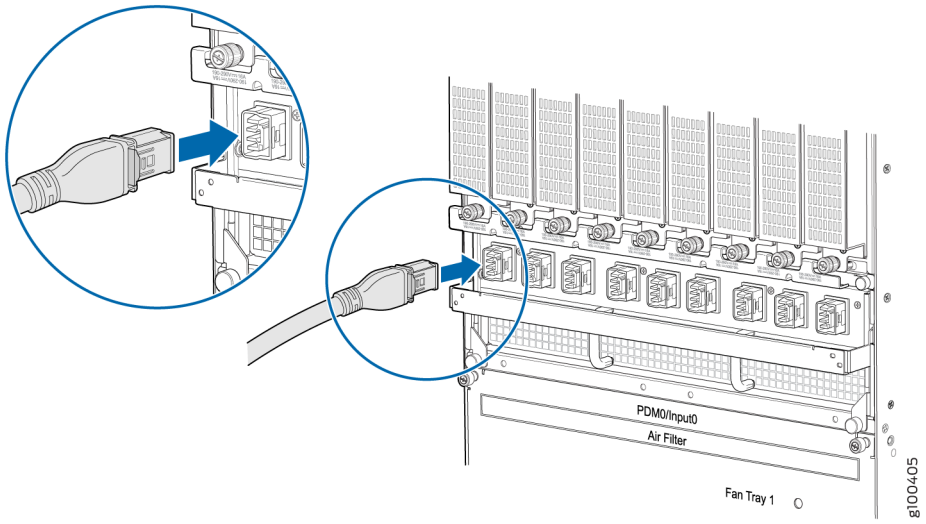
1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
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* 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 233 on page 534).

Figure 233: 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 234 on page 535.

Figure 234: 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

MX2000 Router DC (240 V China) Power Subsystem Electrical Specifications | **295**

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

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.

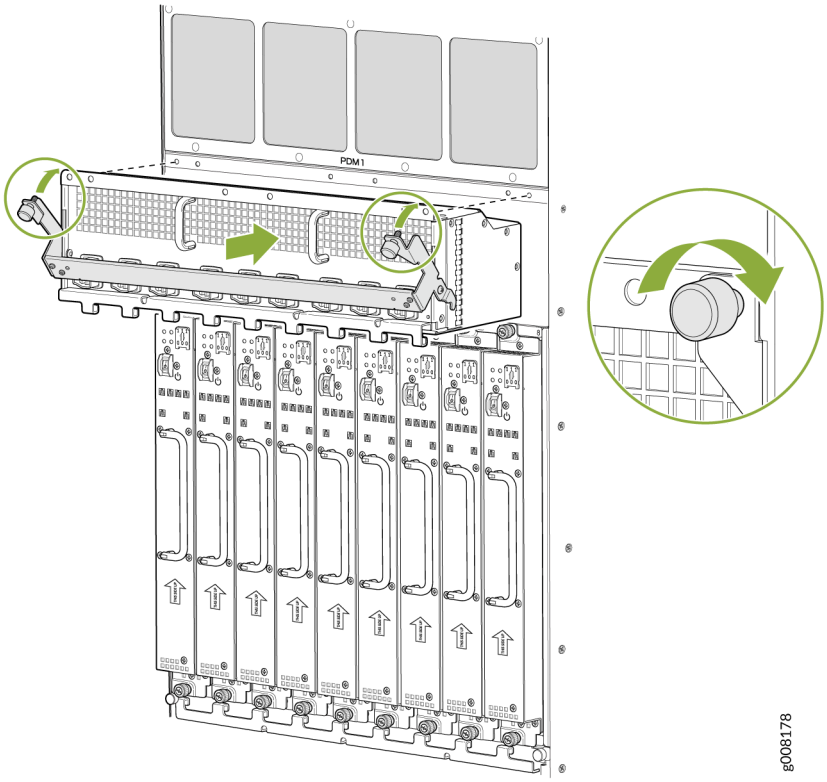
WARNING: Before performing AC power procedures, disconnect all power sources. To ensure that all power is **OFF**, locate the circuit breaker on the panel board that services the AC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF** 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:

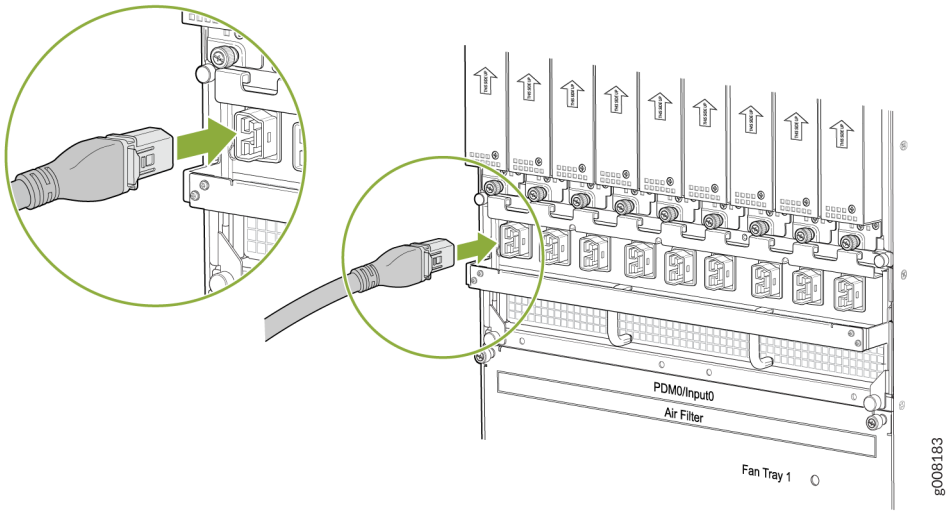
1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
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* 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 235 on page 537).

Figure 235: 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 236 on page 538.

Figure 236: 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.

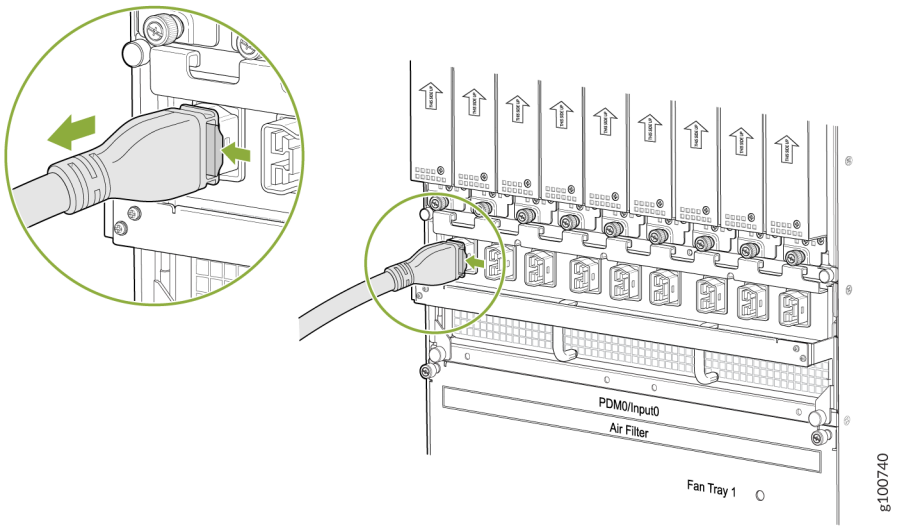
WARNING: Before working on the device or near power supplies, unplug all the power cords from an AC-powered device.

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 237 on page 540.

Figure 237: 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 238: Removing a Universal (HVAC/HVDC) PDM from an MX2020 Router

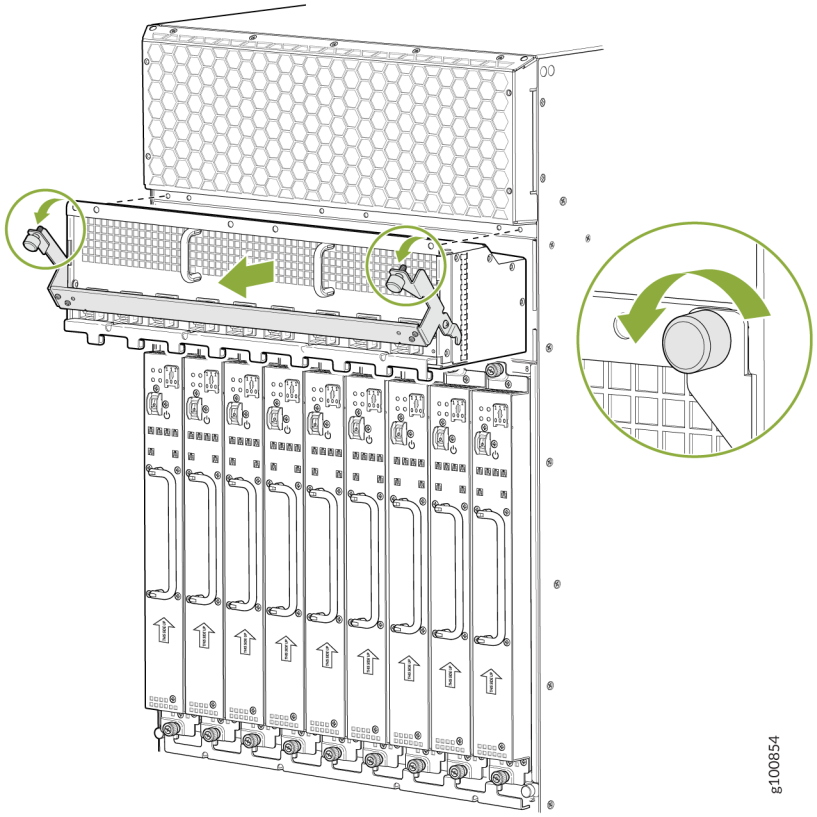


Figure 239: Removing a Universal (HVAC/HVDC) PDM from an MX2010 Router

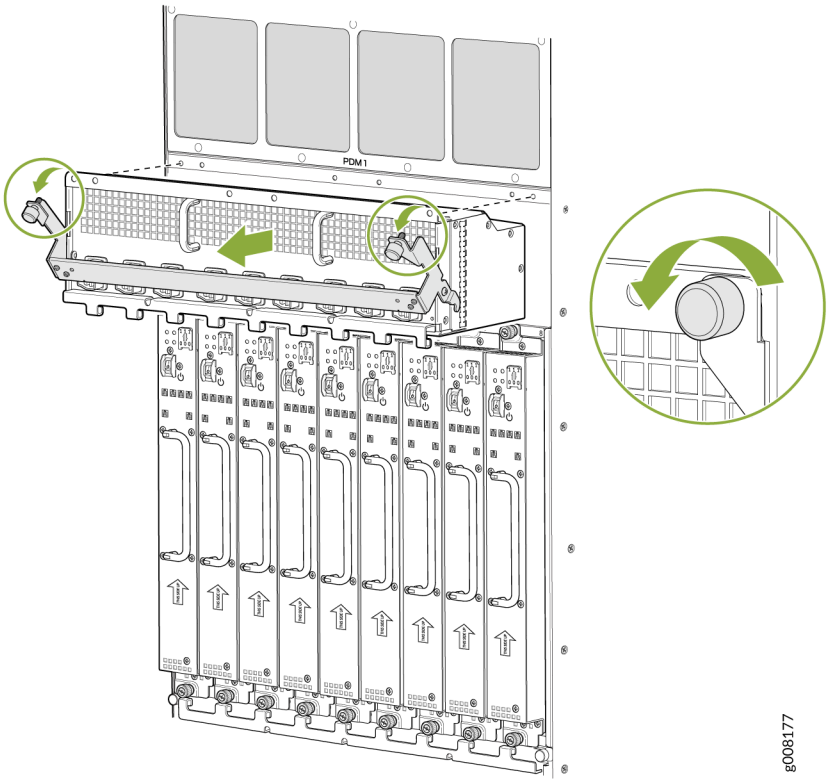
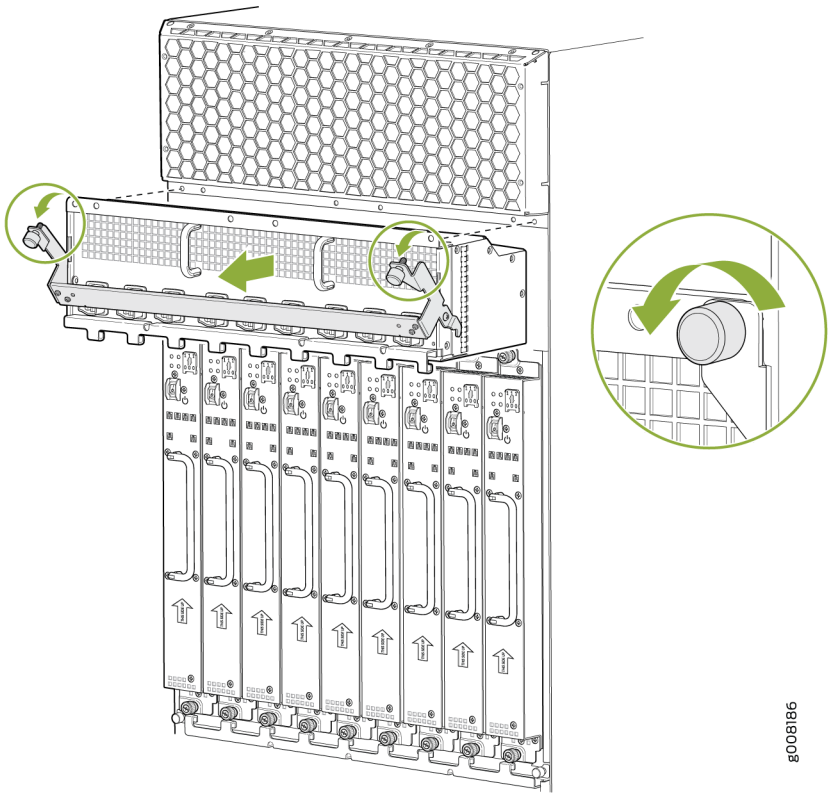


Figure 240: Removing a Universal (HVAC/HVDC) PDM from an MX2008 Router



8. The PDM is extended slightly away from the chassis. See Figure 238 on page 541, Figure 239 on page 542, and Figure 240 on page 543.
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 MX2020 DC Power Supply Module (-48 V)

IN THIS SECTION

Removing an MX2000 Router 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 241 on page 545 and Figure 242 on page 546):

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 241: Removing an MX2020 Router DC Power Supply Module

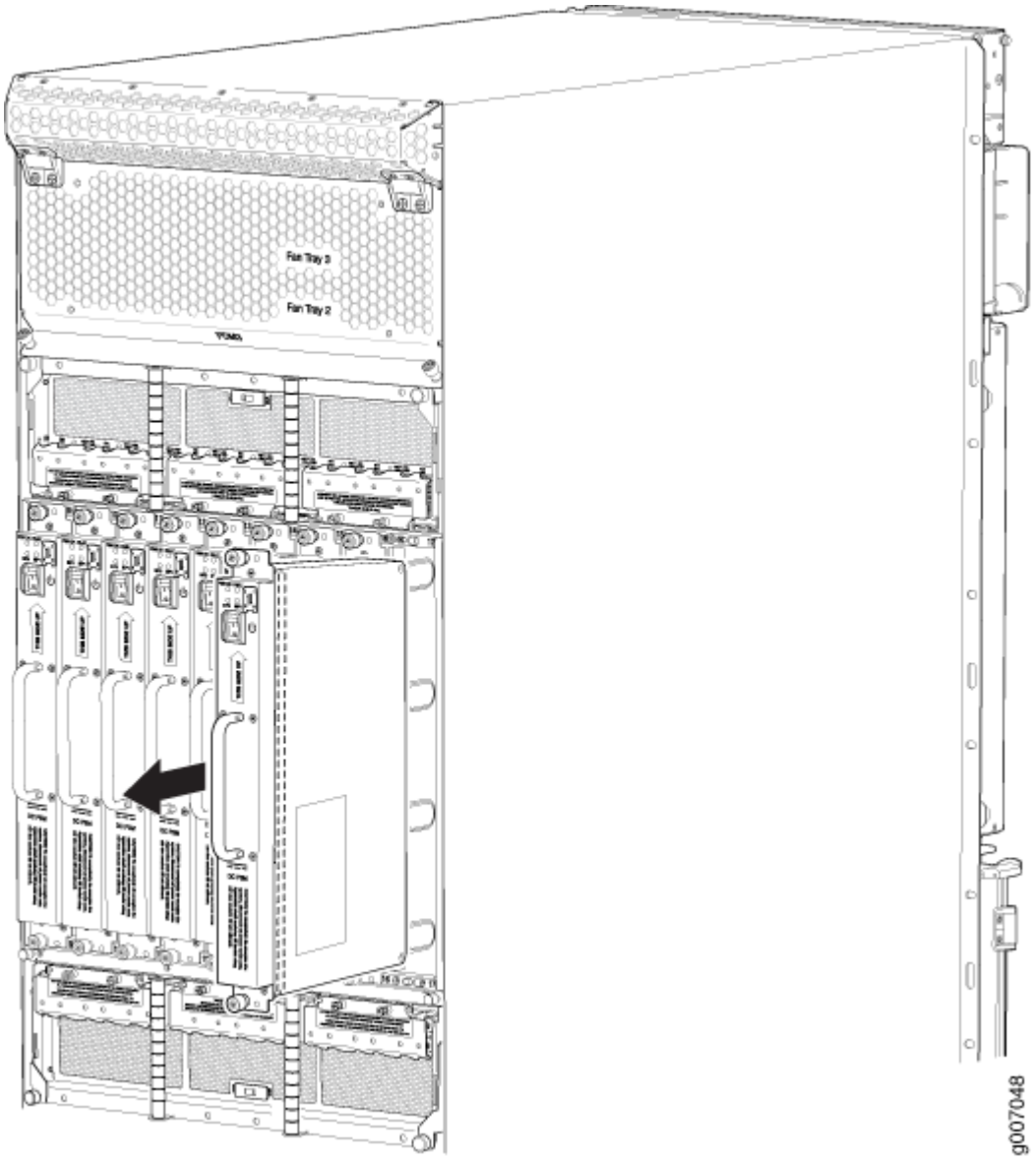
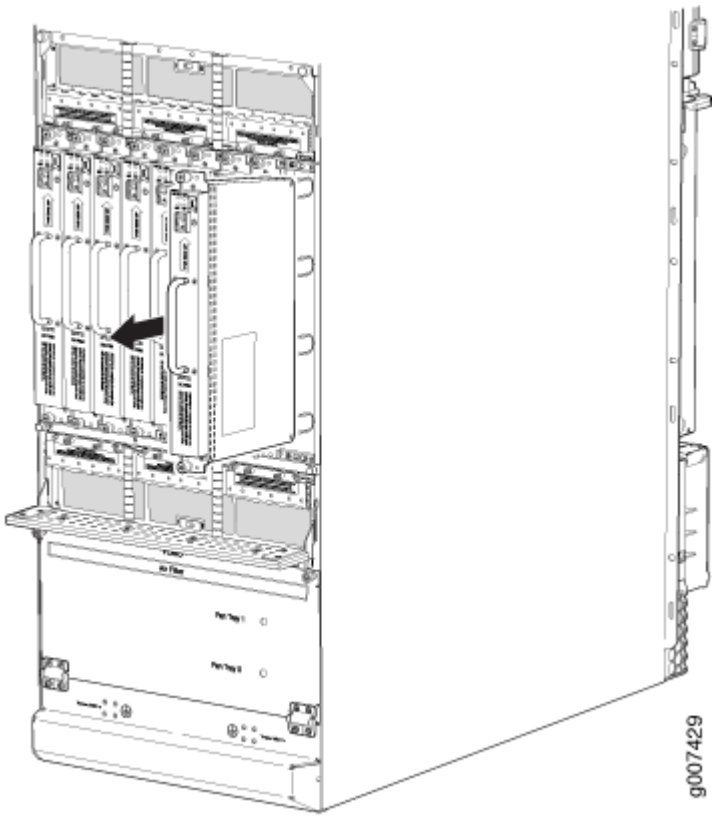


Figure 242: Removing an MX2010 Router DC Power Supply Module



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description | **181**

MX2010 DC Power Supply Module (-48 V) Description

Installing an MX2020 DC Power Supply Module (-48 V) | **546**

Installing an MX2010 DC Power Supply Module (-48 V)

Installing an MX2020 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 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.

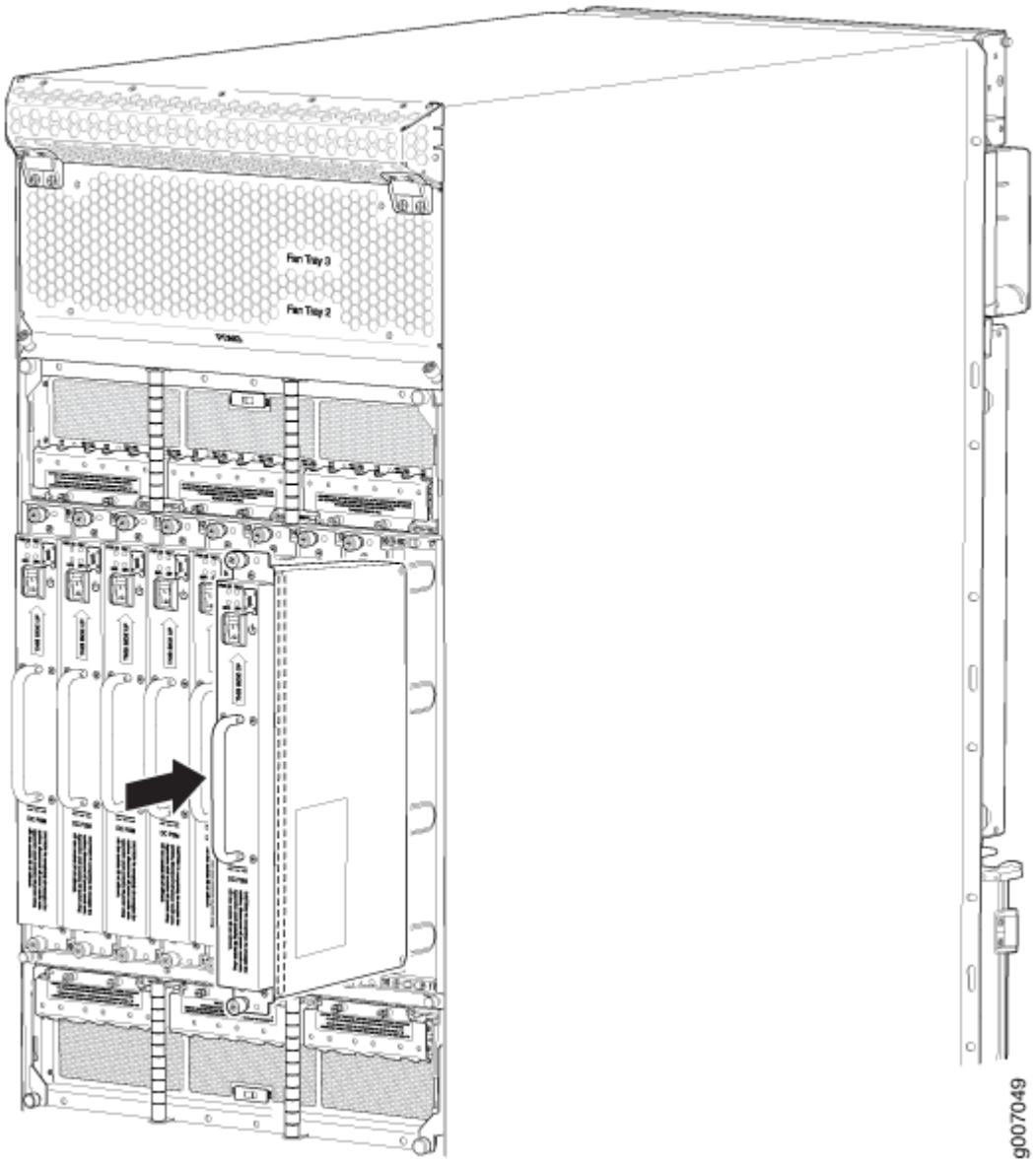
To install a DC PSM (see Figure 243 on page 548):

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 243: Installing a DC Power Supply Module



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description | **181**

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router

Troubleshooting the MX2000 Router Power System

Maintaining the Power Supply Modules on the MX2000 Line of Routers

MX2020 DC Power Supply Module (-48 V) Description | **181**

MX2020 DC Power Electrical Safety Guidelines

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | **292**

Replacing an MX2000 DC Power Supply Module (240 V China)

IN THIS SECTION

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 244 on page 551):

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.

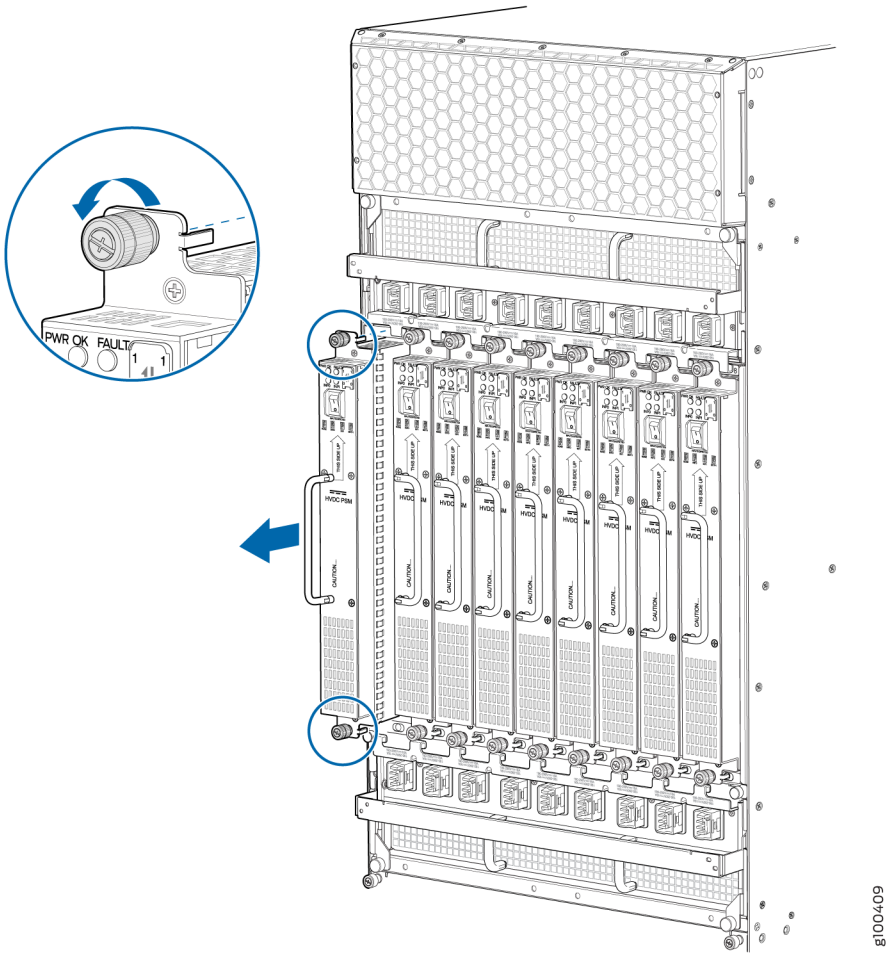
3. Loosen the two captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull 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 244: Removing an MX2000 Router DC Power Supply Module (240 V China)



SEE ALSO

- MX2020 DC Power Supply Module (-48 V) Description | **181**
- *MX2010 DC Power Supply Module (-48 V) Description*
- Installing an MX2020 DC Power Supply Module (-48 V) | **546**
- *Installing an MX2010 DC Power Supply Module (-48 V)*

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.

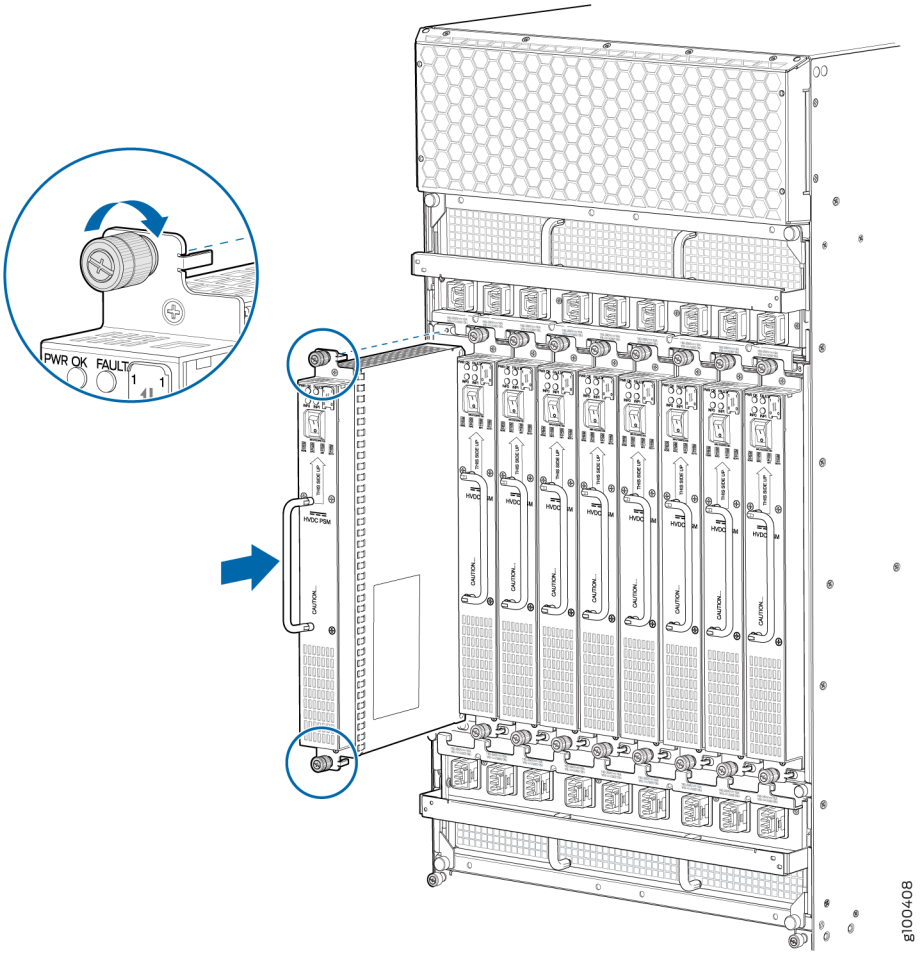
To install a DC PSM (see Figure 245 on page 553):

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 245: Installing a DC Power Supply Module (240 V China)



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description | **181**

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router

Troubleshooting the MX2000 Router Power System

Maintaining the Power Supply Modules on the MX2000 Line of Routers

MX2020 DC Power Distribution (240 V China) Description | **290**

MX2020 DC Power Electrical Safety Guidelines

MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications | 292

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

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 246 on page 556, Figure 247 on page 557, and Figure 248 on page 558):

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 246: Removing an MX2020 Router Universal (HVAC/HVDC) Power Supply Module

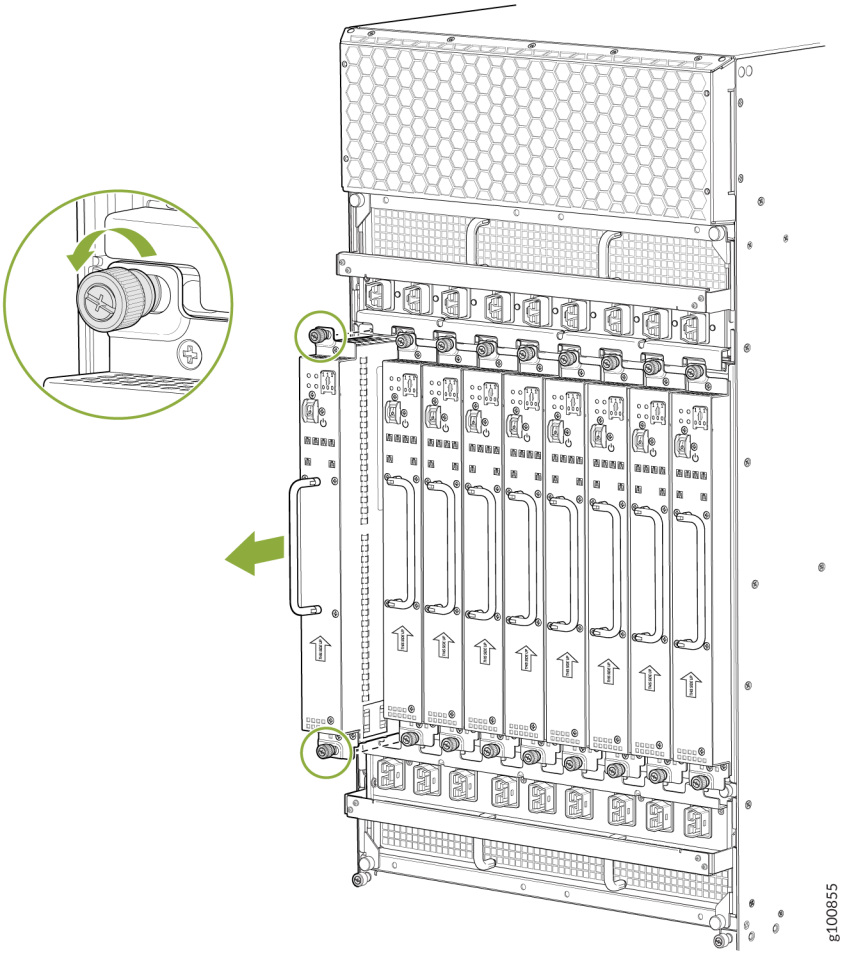


Figure 247: Removing an MX2010 Router Universal (HVAC/HVDC) Power Supply Module

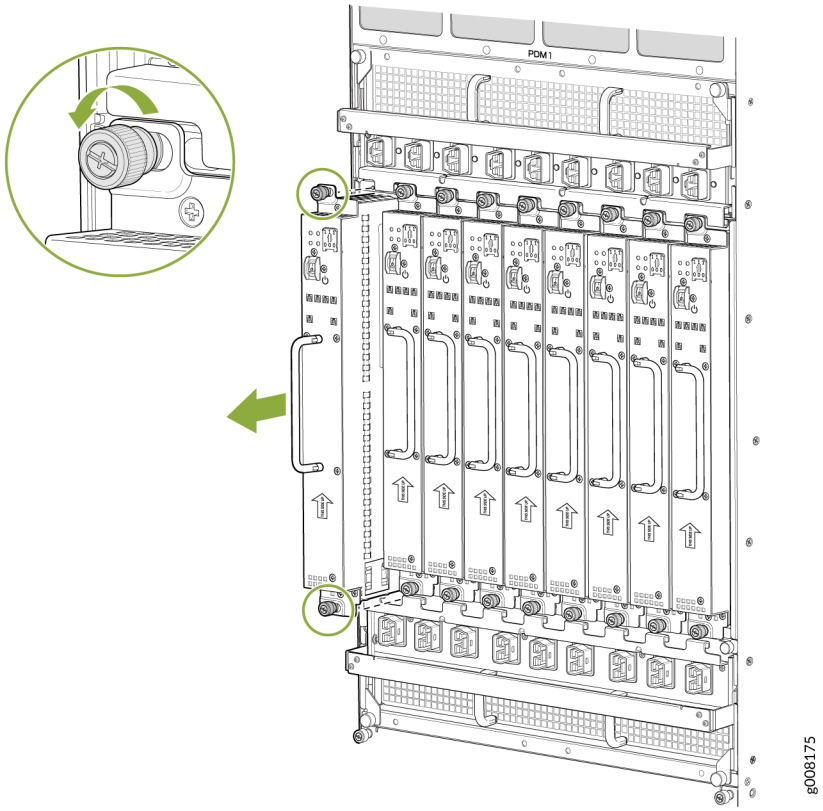
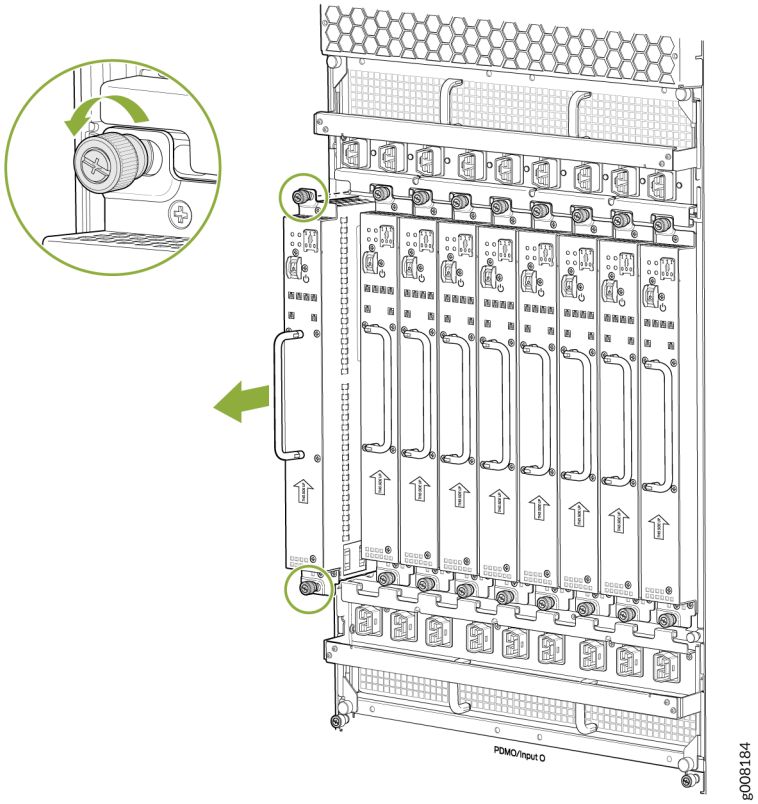


Figure 248: Removing an MX2008 Router Universal (HVAC/HVDC) Power Supply Module



SEE ALSO

MX2020 DC Power Supply Module (-48 V) Description | **181**

MX2010 DC Power Supply Module (-48 V) Description

Installing an MX2020 DC Power Supply Module (-48 V) | **546**

Installing an MX2010 DC Power Supply Module (-48 V)

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 249 on page 560, Figure 250 on page 561, and Figure 251 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 249: Installing an MX2020 Router Universal (HVAC/HVDC) Power Supply Module

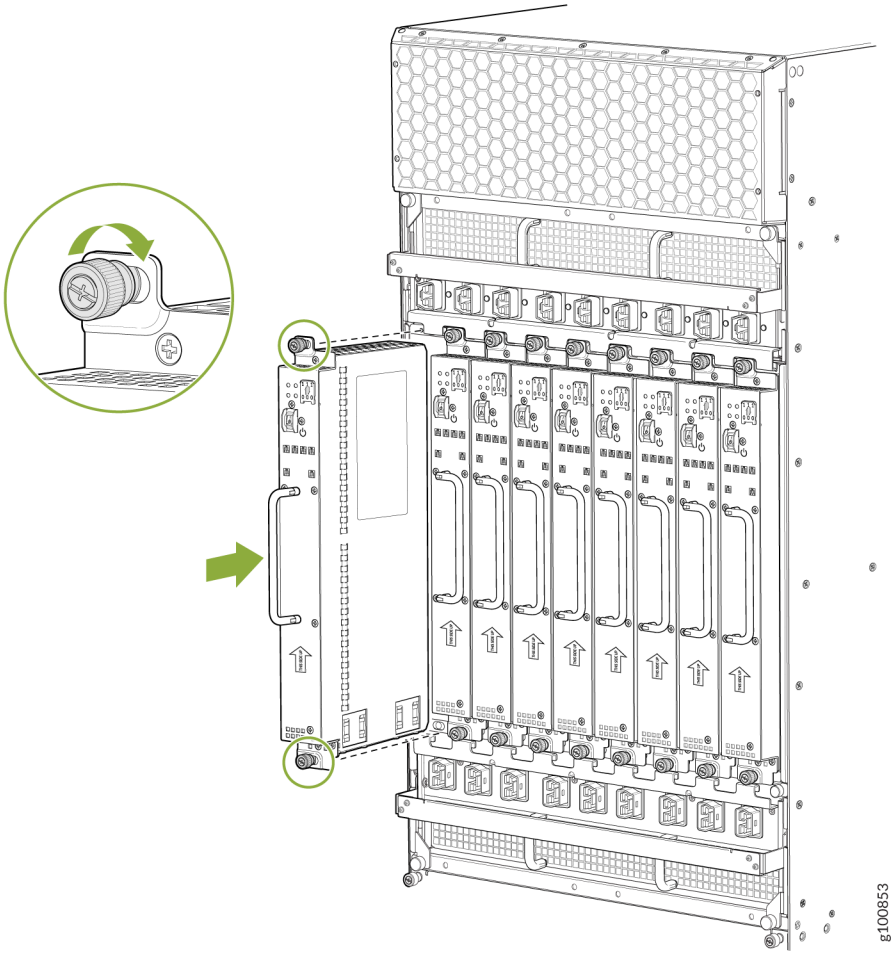


Figure 250: Installing an MX2010 Router Universal (HVAC/HVDC) Power Supply Module

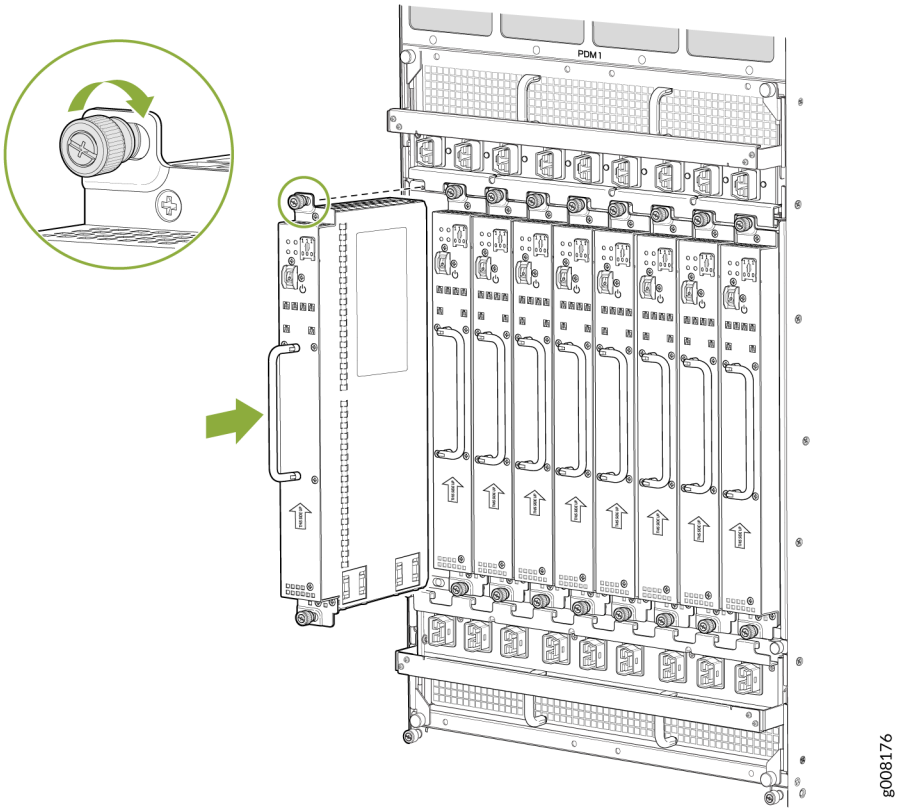
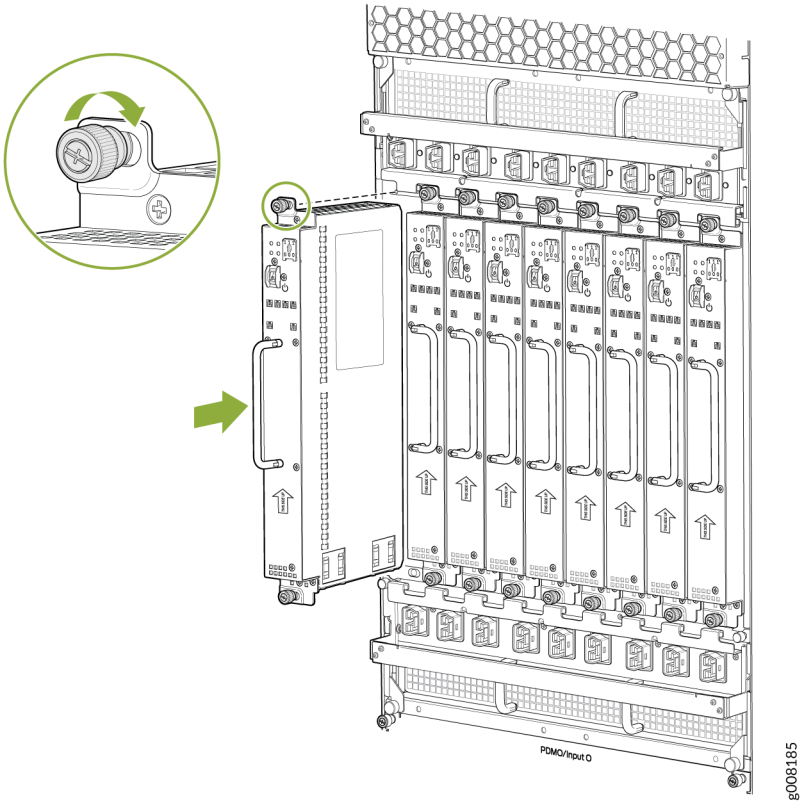


Figure 251: Installing an MX2008 Router Universal (HVAC/HVDC) Power Supply Module



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

Replacing an MX2000 AC Power Supply Module

IN THIS SECTION

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 252 on page 564 and Figure 253 on page 565, and Figure 254 on page 566):

> **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 252: Removing an MX2020 Router AC Power Supply Module

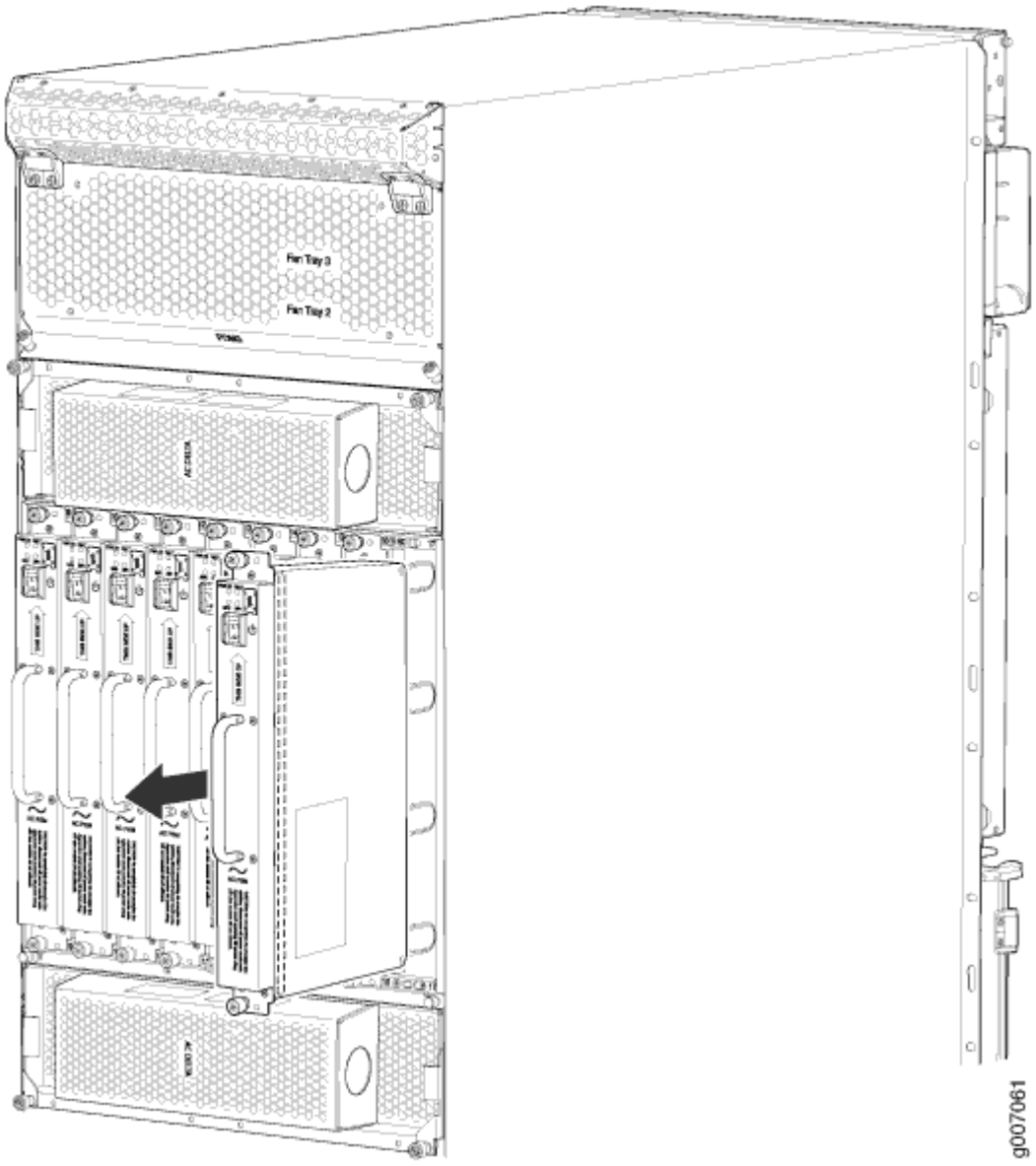


Figure 253: Removing an MX2010 Router AC Power Supply Module

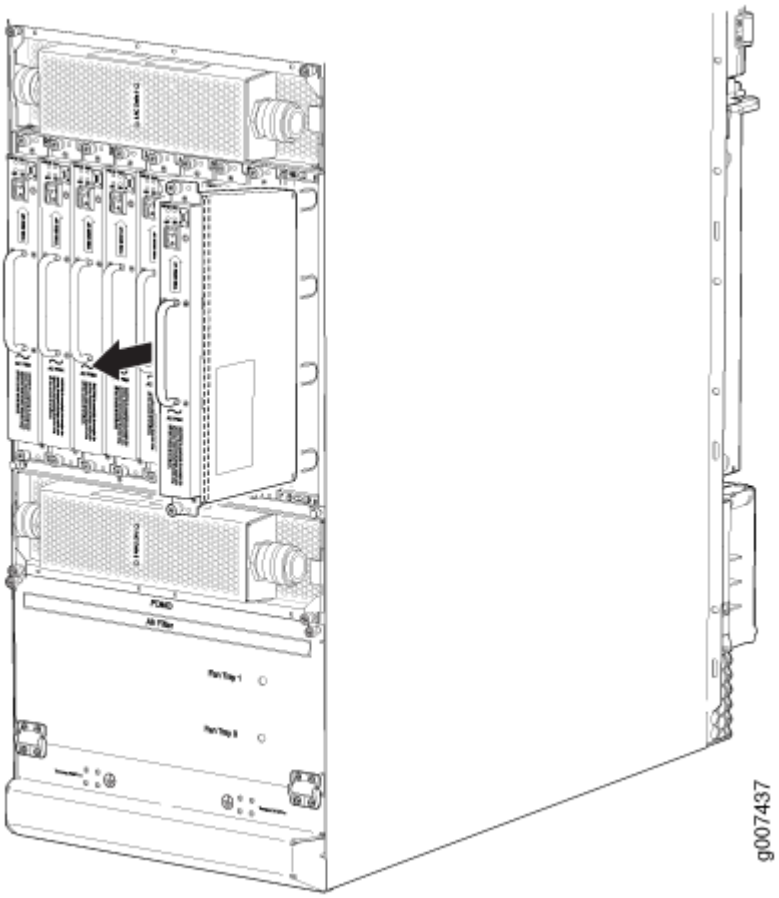
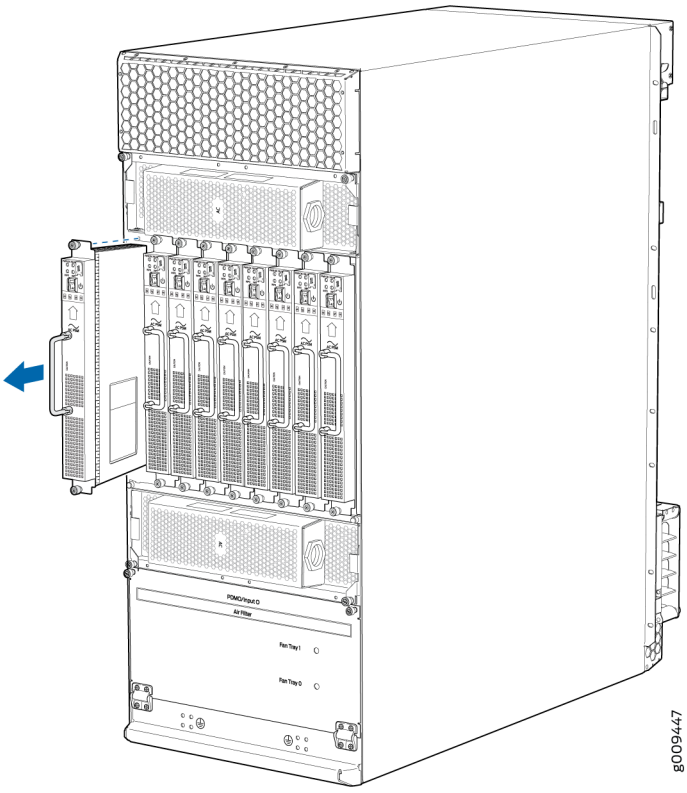


Figure 254: Removing an MX2008 AC Power Supply Module



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 255 on page 568,Figure 256 on page 569, or Figure 257 on page 570:

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 255: Installing an MX2020 Router AC Power Supply Module

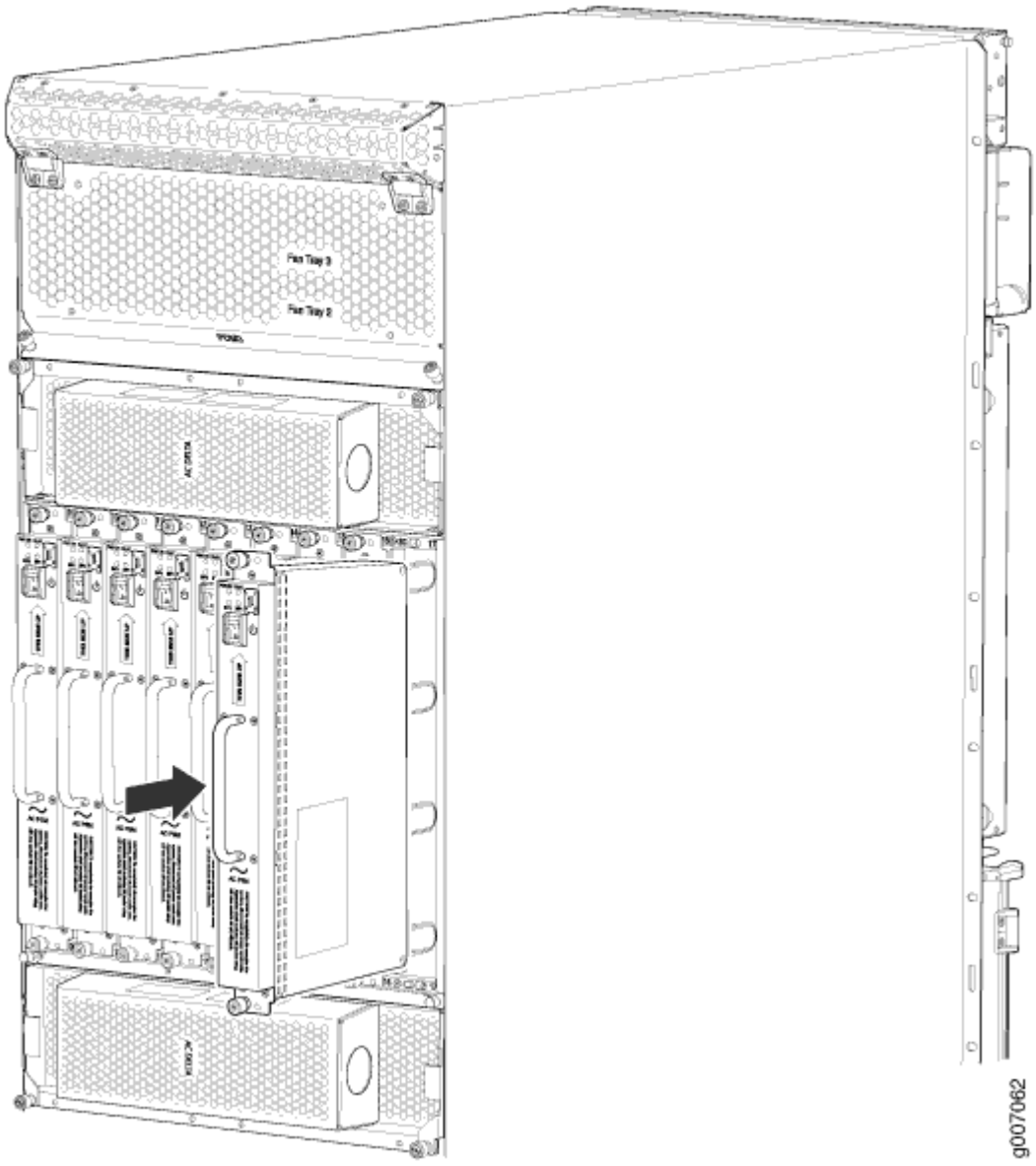


Figure 256: Installing an MX2010 Router AC Power Supply Module

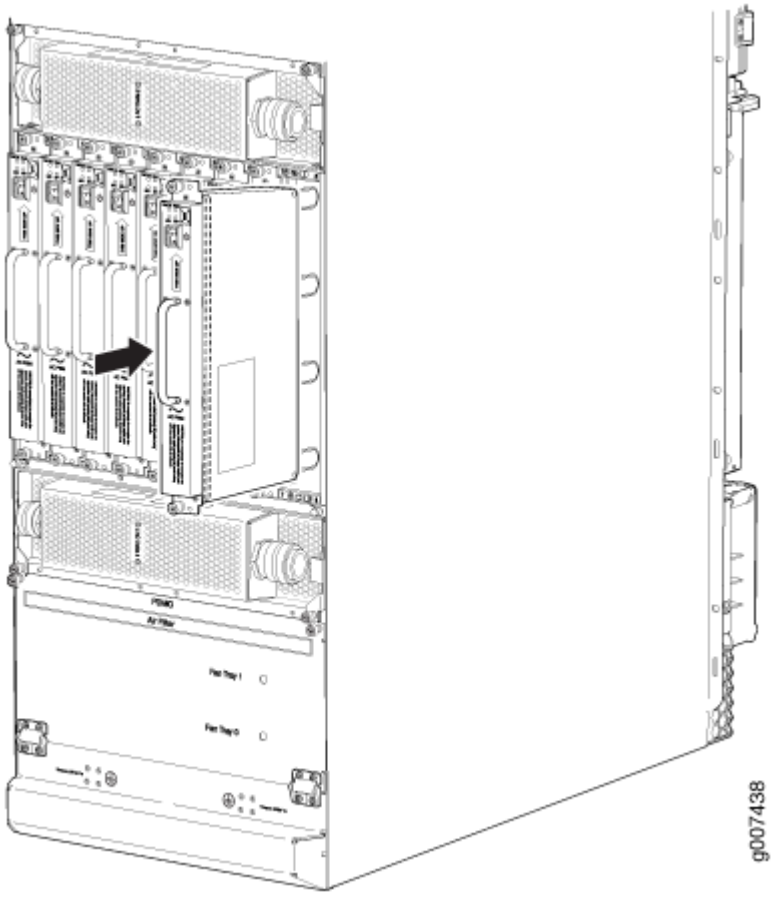
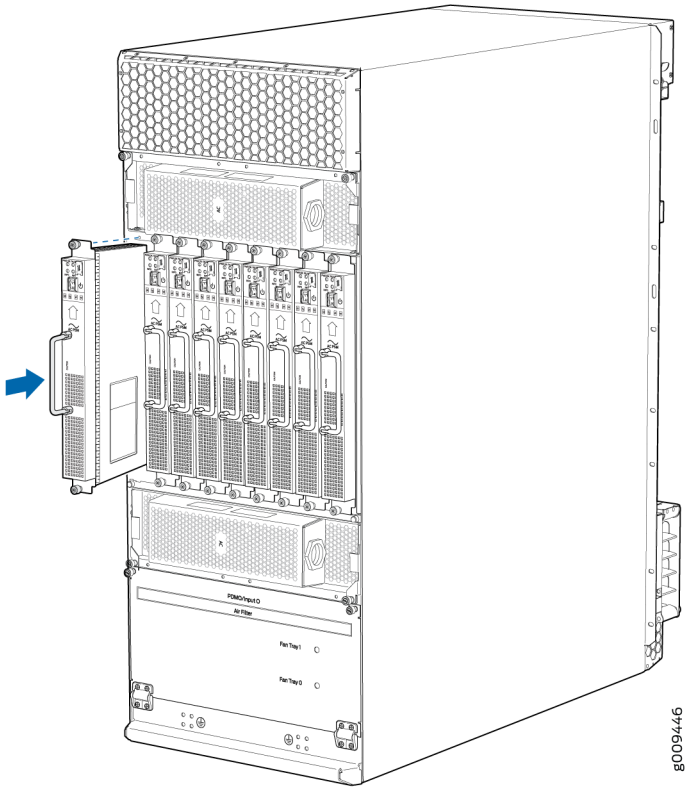


Figure 257: Installing an MX2008 Router AC Power Supply Module



RELATED DOCUMENTATION

- *MX2000 AC Power System Electrical Specifications*
- *Maintaining the Power Supply Modules on the MX2000 Line of Routers*
- *Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router*

Maintaining the Power Supply Modules on the MX2000 Line of Routers

IN THIS SECTION

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

MX2010 Troubleshooting Resources

Troubleshooting the MX2000 Router Power System

Overview of Preparing the Site for the MX2010 Router

MX2020 Power Subsystem Description | **156**

MX2020 Troubleshooting Resources | **847**

Overview of Preparing the Site for the MX2020 Router | **197**

Maintaining the MX2020 Power Usage

IN THIS SECTION

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 doesn't exceed the maximum allocated.
  - Issue the `show chassis power` command to display the information about the AC or DC power system.

The output displays the AC chassis power for 2100 W capacity.

```
user@host>show chassis power
PSM 0:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 271.69 W (Lower Zone, 5.25 A at 51.75 V, 12.94% of capacity)

PSM 1:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 247.00 W (Lower Zone, 4.75 A at 52.00 V, 11.76% of capacity)

PSM 2:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 247.00 W (Lower Zone, 4.75 A at 52.00 V, 11.76% of capacity)

PSM 3:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 260.00 W (Lower Zone, 5.00 A at 52.00 V, 12.38% of capacity)

PSM 4:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 234.00 W (Lower Zone, 4.50 A at 52.00 V, 11.14% of capacity)

PSM 5:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
```

```
  DC output: 247.00 W (Lower Zone, 4.75 A at 52.00 V, 11.76% of capacity)

PSM 6:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 273.00 W (Lower Zone, 5.25 A at 52.00 V, 13.00% of capacity)

PSM 7:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 221.00 W (Lower Zone, 4.25 A at 52.00 V, 10.52% of capacity)

PSM 8:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 260.00 W (Lower Zone, 5.00 A at 52.00 V, 12.38% of capacity)

PSM 9:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 284.62 W (Upper Zone, 5.50 A at 51.75 V, 13.55% of capacity)

PSM 10:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 286.00 W (Upper Zone, 5.50 A at 52.00 V, 13.62% of capacity)

PSM 11:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 273.00 W (Upper Zone, 5.25 A at 52.00 V, 13.00% of capacity)

PSM 12:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 273.00 W (Upper Zone, 5.25 A at 52.00 V, 13.00% of capacity)
```

```
PSM 13:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 286.00 W (Upper Zone, 5.50 A at 52.00 V, 13.62% of capacity)

PSM 14:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 258.75 W (Upper Zone, 5.00 A at 51.75 V, 12.32% of capacity)

PSM 15:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 260.00 W (Upper Zone, 5.00 A at 52.00 V, 12.38% of capacity)

PSM 16:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 273.00 W (Upper Zone, 5.25 A at 52.00 V, 13.00% of capacity)

PSM 17:
  State:     Online
  AC input:  OK (INP0 feed expected, INP0 feed connected)
  Capacity:  2100 W (maximum 2100 W)
  DC output: 271.69 W (Upper Zone, 5.25 A at 51.75 V, 12.94% of capacity)

System:
  Upper Zone:
      Capacity:          18900 W (maximum 18900 W)
      Allocated power:   7360 W (11540 W remaining)
      Actual usage:      2466.06 W
  Lower Zone:
      Capacity:          18900 W (maximum 18900 W)
      Allocated power:   7360 W (11540 W remaining)
      Actual usage:      2260.69 W
  Total system capacity: 37800 W (maximum 37800 W)
  Total remaining power: 23080 W
```

The output displays the DC chassis power for 2100 W capacity.

NOTE: The capacity of the DC PSM 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:     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
```

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
```

The output displays the universal (HVAC/HVDC) chassis power for 3400 W capacity.

```
user@host> show chassis power
PSM 0:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1124.55 W (Lower Zone, 21.42 A at 52.50 V, 33.08% of capacity)

PSM 1:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1119.20 W (Lower Zone, 21.42 A at 52.25 V, 32.92% of capacity)

PSM 2:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1172.49 W (Lower Zone, 22.44 A at 52.25 V, 34.49% of capacity)

PSM 3:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1101.43 W (Lower Zone, 21.08 A at 52.25 V, 32.39% of capacity)

PSM 4:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1136.96 W (Lower Zone, 21.76 A at 52.25 V, 33.44% of capacity)

PSM 5:
  State:     Online
  AC input:  OK (Both feed expected, Both feed connected)
  Capacity:  3400 W (maximum 3400 W)
  DC output: 1065.90 W (Lower Zone, 20.40 A at 52.25 V, 31.35% of capacity)
```

```
...
```

For further description of the output from the commands, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- MX2020 Power Subsystem Description | 156
- *Prevention of Electrostatic Discharge Damage*
- *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.

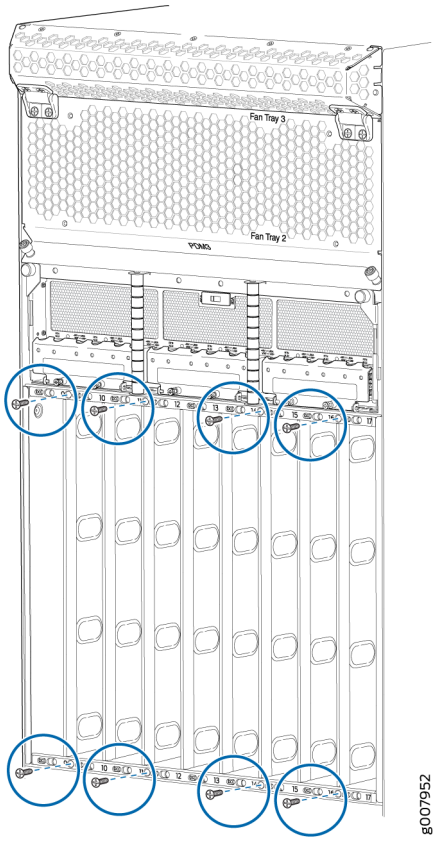
1. Power off the router. See *Powering Off the AC-Powered or Universal HVAC/HVDC-Powered MX2000 Router* or *Powering Off the DC-Powered or DC-Powered (240 V China) MX2000 Router*.
2. Switch off the dedicated customer-site circuit breakers to the PDMs being removed. Make sure that the voltage across the 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" on page 515
- *Removing an MX2000 Router DC Power Distribution Module (-48 V)*
- *Replacing an MX2000 DC Power Distribution Module (240 V China)*
- *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* or "Removing an MX2000 Router DC Power Supply Module (-48 V)" on page 544, *Replacing an MX2000 DC Power Supply Module (240 V China)*, *Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module* .
6. Remove the adjustment bar locking screws shown in Figure 258 on page 585 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 258: Removing the MX2000 Router Adjustment Bar Locking Screws

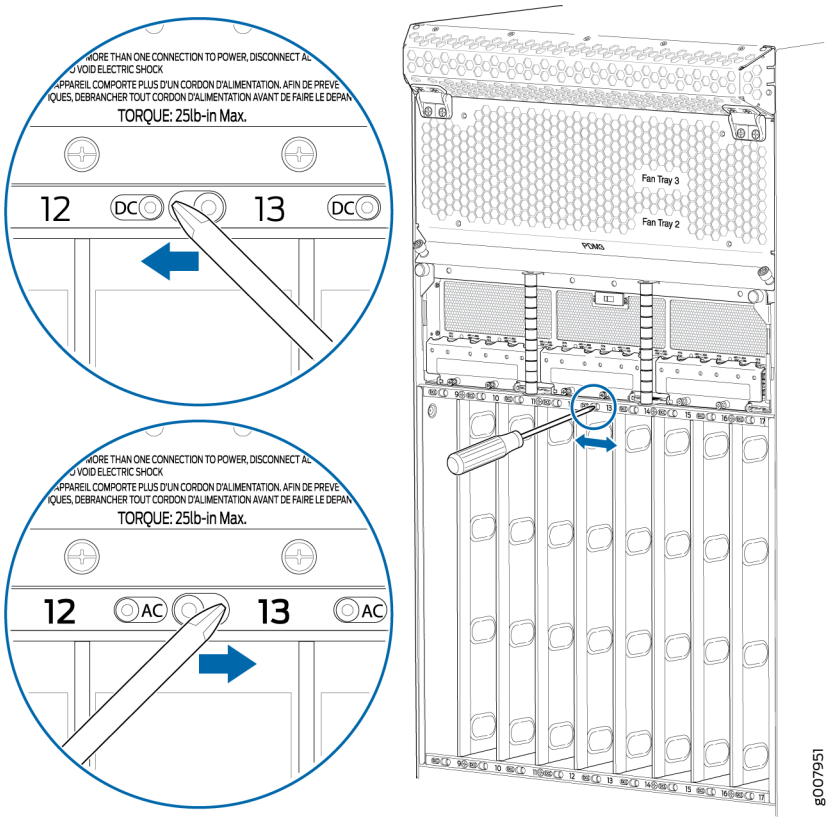


NOTE: If you are switching from AC PDMs or 48-V DC PDMs to high-voltage universal (HVAC/HVDC) PDMs, they work with either AC or DC bar setting and no mechanical change is needed. You can skip steps 6 to 8.

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 259 on page 586.

Figure 259: 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)*, *Installing MX2000 Router AC Power Supply Modules*, *Replacing an MX2000 High-Voltage Second-Generation Universal (HVAC/HVDC) Power Supply Module* , or *Replacing an MX2000 DC Power Supply Module (240 V China)*.
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*
- *Installing an MX2000 Router DC Power Distribution Module (-48 V)*
- *Replacing an MX2000 DC Power Distribution Module (240 V China)*
- *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

Troubleshooting the MX2000 Router Power System

MX2000 Router Grounding Specifications

CHAPTER 25

Installing, Removing, and Maintaining Cooling System Components

IN THIS CHAPTER

Replacing an MX2020 Fan Tray

IN THIS SECTION

Removing an MX2020 Fan Tray

NOTE: The fan trays are interchangeable and are hot-insertable and hot-removable.

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 260 on page 590 and Figure 261 on page 590):

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 then open it.
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.

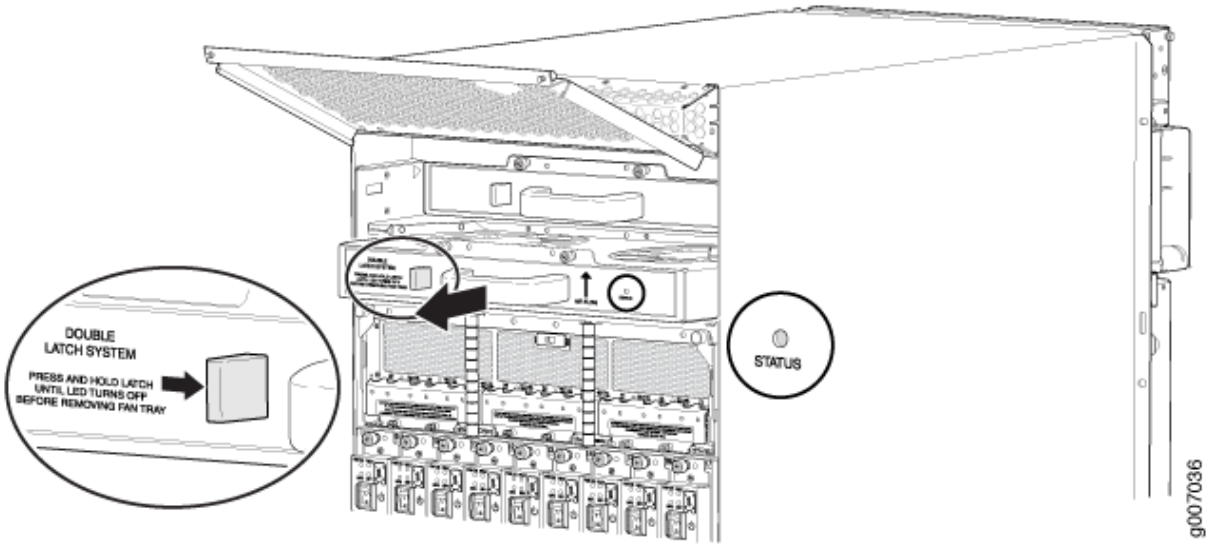
   NOTE: The fan trays are interchangeable and are hot-insertable and hot-removable.

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.

   CAUTION: The double latch system is a safety mechanism. Damage to the fan tray will occur if you do not hold the latch while removing the fan tray.

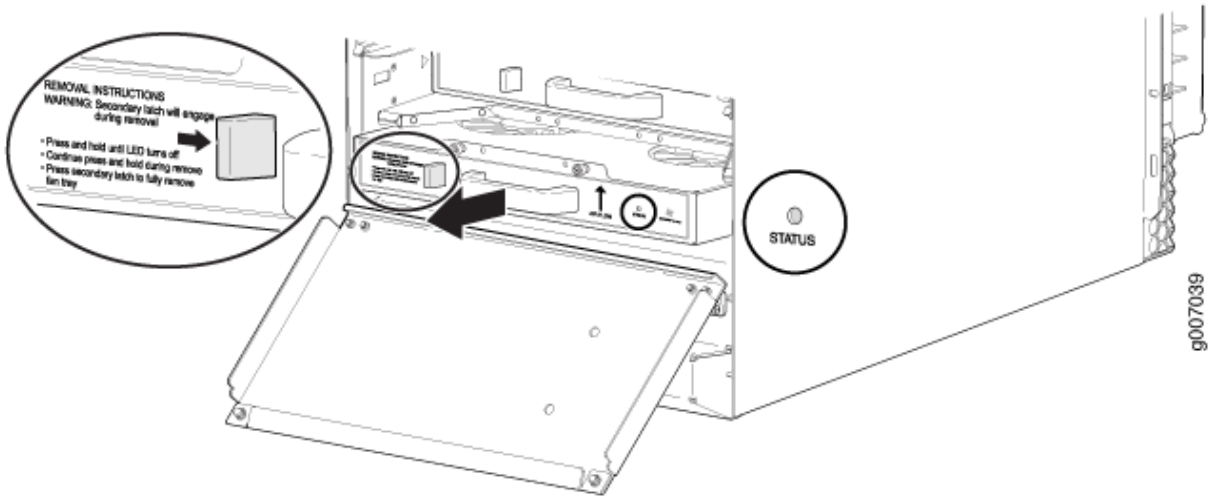
7. Place the fan tray on an antistatic mat or in an approved ESD bag.

Figure 260: Removing the Upper Fan Trays



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

Figure 261: Removing the Lower Fan Trays



SEE ALSO

Prevention of Electrostatic Discharge Damage | 924

Installing an MX2020 Fan Tray

This topic describes how to install the upper or lower fan trays in a MX2020. 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 262 on page 592 and Figure 263 on page 592):

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 each side of the fan tray access panel, and open.
4. 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.
5. While grasping the handle, place one hand under the fan tray for support, and align it into the slot.

   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 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.

7. Press and hold the latch a second time while inserting the fan tray completely into the router.
8. Tighten the two captive screws on the fan tray 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.
9. Close the fan tray access panel, and tighten the captive screws to secure it in place. 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.
10. Reinstall the DC cable manager back into position, if necessary.

Figure 262: Installing Upper Fan Trays

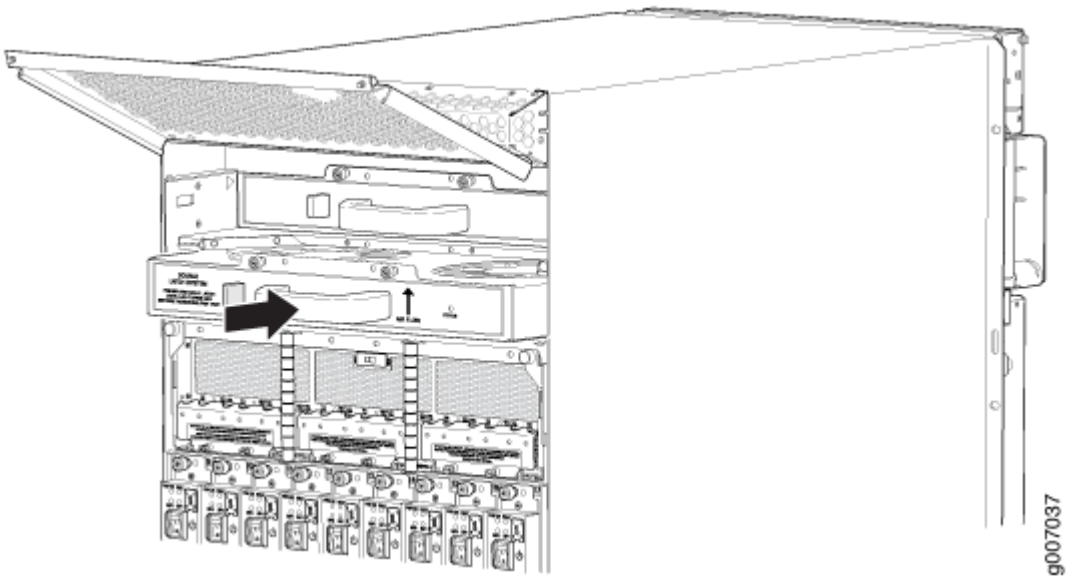
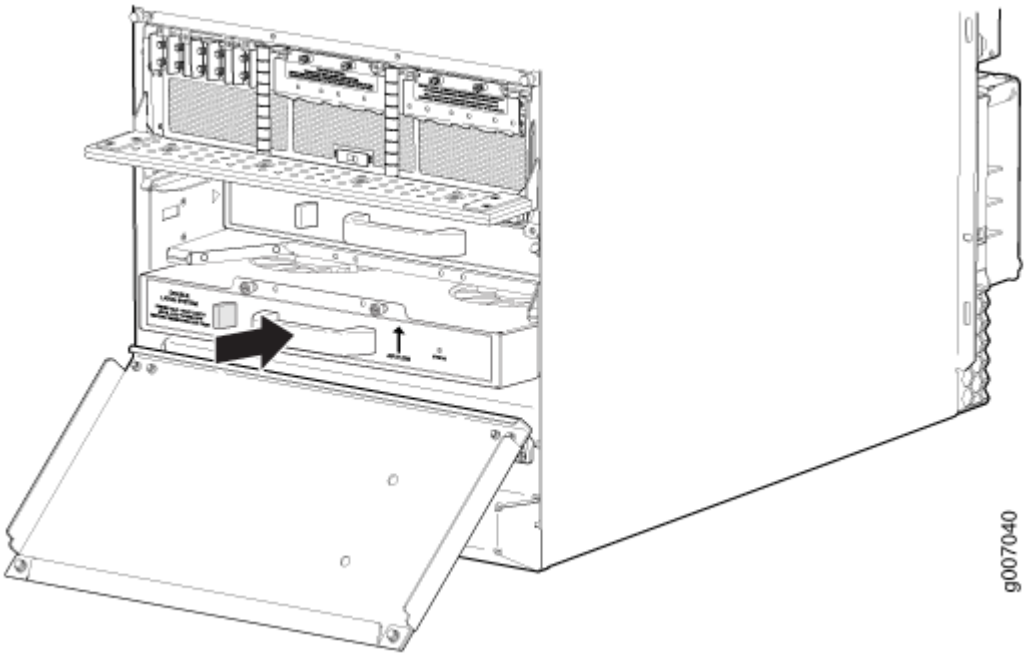


Figure 263: Installing Lower Fan Trays



SEE ALSO

Prevention of Electrostatic Discharge Damage | 924

Maintaining the MX2020 Fan Trays | 593

Removing an MX2020 Fan Tray | 589

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Maintaining the MX2020 Fan Trays | 593

Maintaining the MX2020 Fan Trays

IN THIS SECTION

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                         Absent
      PSM 1                         Absent
      PSM 2                         Absent
      PSM 3                         Absent
      PSM 4                         OK         34 degrees C / 93 degrees F
      PSM 5                         OK         31 degrees C / 87 degrees F
      PSM 6                         OK         30 degrees C / 86 degrees F
      PSM 7                         OK         30 degrees C / 86 degrees F
      PSM 8                         OK         31 degrees C / 87 degrees F
      PSM 9                         Absent
      PSM 10                        Absent
      PSM 11                        Absent
      PSM 12                        Absent
      PSM 13                        OK         32 degrees C / 89 degrees F
      PSM 14                        OK         31 degrees C / 87 degrees F
      PSM 15                        OK         30 degrees C / 86 degrees F
      PSM 16                        OK         30 degrees C / 86 degrees F
      PSM 17                        OK         30 degrees C / 86 degrees F
      PDM 0                         OK
      PDM 1                         OK
      PDM 2                         OK
      PDM 3                         OK
      CB 0 IntakeA-Zone0            OK         25 degrees C / 77 degrees F
      CB 0 IntakeB-Zone1            OK         29 degrees C / 84 degrees F
      CB 0 IntakeC-Zone0            OK         28 degrees C / 82 degrees F
      CB 0 ExhaustA-Zone0           OK         27 degrees C / 80 degrees F
      CB 0 ExhaustB-Zone1           OK         28 degrees C / 82 degrees F
      CB 0 TCBC-Zone0               OK         32 degrees C / 89 degrees F
      CB 1 IntakeA-Zone0            OK         30 degrees C / 86 degrees F
      CB 1 IntakeB-Zone1            OK         25 degrees C / 77 degrees F
      CB 1 IntakeC-Zone0            OK         39 degrees C / 102 degrees F
      CB 1 ExhaustA-Zone0           OK         33 degrees C / 91 degrees F
      CB 1 ExhaustB-Zone1           OK         28 degrees C / 82 degrees F
      CB 1 TCBC-Zone0               OK         32 degrees C / 89 degrees F
      SPMB 0 Intake                 OK         30 degrees C / 86 degrees F
      SPMB 1 Intake                 OK         24 degrees C / 75 degrees F
      Routing Engine 0              OK         35 degrees C / 95 degrees F
```

```
Routing Engine 0 CPU          OK          31 degrees C / 87 degrees F
Routing Engine 1              OK          27 degrees C / 80 degrees F
Routing Engine 1 CPU          OK          26 degrees C / 78 degrees F
SFB 0 Intake-Zone0            OK          32 degrees C / 89 degrees F
SFB 0 Exhaust-Zone1           OK          38 degrees C / 100 degrees F
SFB 0 IntakeA-Zone0           OK          28 degrees C / 82 degrees F
SFB 0 IntakeB-Zone1           OK          29 degrees C / 84 degrees F
SFB 0 Exhaust-Zone0           OK          31 degrees C / 87 degrees F
SFB 0 SFB-XF2-Zone1           OK          55 degrees C / 131 degrees F
SFB 0 SFB-XF1-Zone0           OK          48 degrees C / 118 degrees F
SFB 0 SFB-XF0-Zone0           OK          47 degrees C / 116 degrees F
SFB 1 Intake-Zone0            OK          32 degrees C / 89 degrees F
SFB 1 Exhaust-Zone1           OK          37 degrees C / 98 degrees F
SFB 1 IntakeA-Zone0           OK          28 degrees C / 82 degrees F
SFB 1 IntakeB-Zone1           OK          29 degrees C / 84 degrees F
SFB 1 Exhaust-Zone0           OK          31 degrees C / 87 degrees F
SFB 1 SFB-XF2-Zone1           OK          56 degrees C / 132 degrees F
SFB 1 SFB-XF1-Zone0           OK          47 degrees C / 116 degrees F
SFB 1 SFB-XF0-Zone0           OK          47 degrees C / 116 degrees F
SFB 2 Intake-Zone0            OK          33 degrees C / 91 degrees F
SFB 2 Exhaust-Zone1           OK          38 degrees C / 100 degrees F
SFB 2 IntakeA-Zone0           OK          29 degrees C / 84 degrees F
SFB 2 IntakeB-Zone1           OK          29 degrees C / 84 degrees F
SFB 2 Exhaust-Zone0           OK          33 degrees C / 91 degrees F
SFB 2 SFB-XF2-Zone1           OK          58 degrees C / 136 degrees F
SFB 2 SFB-XF1-Zone0           OK          49 degrees C / 120 degrees F
SFB 2 SFB-XF0-Zone0           OK          49 degrees C / 120 degrees F
SFB 3 Intake-Zone0            OK          44 degrees C / 111 degrees F
SFB 3 Exhaust-Zone1           OK          40 degrees C / 104 degrees F
SFB 3 IntakeA-Zone0           OK          36 degrees C / 96 degrees F
SFB 3 IntakeB-Zone1           OK          31 degrees C / 87 degrees F
SFB 3 Exhaust-Zone0           OK          38 degrees C / 100 degrees F
SFB 3 SFB-XF2-Zone1           OK          60 degrees C / 140 degrees F
SFB 3 SFB-XF1-Zone0           OK          52 degrees C / 125 degrees F
SFB 3 SFB-XF0-Zone0           OK          59 degrees C / 138 degrees F
SFB 4 Intake-Zone0            OK          32 degrees C / 89 degrees F
SFB 4 Exhaust-Zone1           OK          37 degrees C / 98 degrees F
SFB 4 IntakeA-Zone0           OK          28 degrees C / 82 degrees F
SFB 4 IntakeB-Zone1           OK          28 degrees C / 82 degrees F
SFB 4 Exhaust-Zone0           OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1           OK          54 degrees C / 129 degrees F
SFB 4 SFB-XF1-Zone0           OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF0-Zone0           OK          45 degrees C / 113 degrees F
```

```
SFB 5 Intake-Zone0          OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1         OK          36 degrees C / 96 degrees F
SFB 5 IntakeA-Zone0         OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1         OK          28 degrees C / 82 degrees F
SFB 5 Exhaust-Zone0         OK          32 degrees C / 89 degrees F
SFB 5 SFB-XF2-Zone1         OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0         OK          50 degrees C / 122 degrees F
SFB 5 SFB-XF0-Zone0         OK          50 degrees C / 122 degrees F
SFB 6 Intake-Zone0          OK          41 degrees C / 105 degrees F
SFB 6 Exhaust-Zone1         OK          37 degrees C / 98 degrees F
SFB 6 IntakeA-Zone0         OK          32 degrees C / 89 degrees F
SFB 6 IntakeB-Zone1         OK          29 degrees C / 84 degrees F
SFB 6 Exhaust-Zone0         OK          37 degrees C / 98 degrees F
SFB 6 SFB-XF2-Zone1         OK          55 degrees C / 131 degrees F
SFB 6 SFB-XF1-Zone0         OK          60 degrees C / 140 degrees F
SFB 6 SFB-XF0-Zone0         OK          60 degrees C / 140 degrees F
SFB 7 Intake-Zone0          OK          41 degrees C / 105 degrees F
SFB 7 Exhaust-Zone1         OK          37 degrees C / 98 degrees F
SFB 7 IntakeA-Zone0         OK          33 degrees C / 91 degrees F
SFB 7 IntakeB-Zone1         OK          29 degrees C / 84 degrees F
SFB 7 Exhaust-Zone0         OK          37 degrees C / 98 degrees F
SFB 7 SFB-XF2-Zone1         OK          55 degrees C / 131 degrees F
SFB 7 SFB-XF1-Zone0         OK          50 degrees C / 122 degrees F
SFB 7 SFB-XF0-Zone0         OK          57 degrees C / 134 degrees F
SFB 0 Intake-Zone0          OK          32 degrees C / 89 degrees F
SFB 0 Exhaust-Zone1         OK          38 degrees C / 100 degrees F
SFB 0 IntakeA-Zone0         OK          28 degrees C / 82 degrees F
SFB 0 IntakeB-Zone1         OK          29 degrees C / 84 degrees F
SFB 0 Exhaust-Zone0         OK          31 degrees C / 87 degrees F
SFB 0 SFB-XF2-Zone1         OK          55 degrees C / 131 degrees F
SFB 0 SFB-XF1-Zone0         OK          48 degrees C / 118 degrees F
SFB 0 SFB-XF0-Zone0         OK          47 degrees C / 116 degrees F
SFB 1 Intake-Zone0          OK          32 degrees C / 89 degrees F
SFB 1 Exhaust-Zone1         OK          37 degrees C / 98 degrees F
SFB 1 IntakeA-Zone0         OK          28 degrees C / 82 degrees F
SFB 1 IntakeB-Zone1         OK          29 degrees C / 84 degrees F
SFB 1 Exhaust-Zone0         OK          31 degrees C / 87 degrees F
SFB 1 SFB-XF2-Zone1         OK          56 degrees C / 132 degrees F
SFB 1 SFB-XF1-Zone0         OK          47 degrees C / 116 degrees F
SFB 1 SFB-XF0-Zone0         OK          47 degrees C / 116 degrees F
SFB 2 Intake-Zone0          OK          33 degrees C / 91 degrees F
SFB 2 Exhaust-Zone1         OK          38 degrees C / 100 degrees F
SFB 2 IntakeA-Zone0         OK          29 degrees C / 84 degrees F
```

```
SFB 2 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 2 Exhaust-Zone0          OK          33 degrees C / 91 degrees F
SFB 2 SFB-XF2-Zone1          OK          58 degrees C / 136 degrees F
SFB 2 SFB-XF1-Zone0          OK          49 degrees C / 120 degrees F
SFB 2 SFB-XF0-Zone0          OK          49 degrees C / 120 degrees F
SFB 3 Intake-Zone0           OK          44 degrees C / 111 degrees F
SFB 3 Exhaust-Zone1          OK          40 degrees C / 104 degrees F
SFB 3 IntakeA-Zone0          OK          36 degrees C / 96 degrees F
SFB 3 IntakeB-Zone1          OK          31 degrees C / 87 degrees F
SFB 3 Exhaust-Zone0          OK          38 degrees C / 100 degrees F
SFB 3 SFB-XF2-Zone1          OK          60 degrees C / 140 degrees F
SFB 3 SFB-XF1-Zone0          OK          52 degrees C / 125 degrees F
SFB 3 SFB-XF0-Zone0          OK          59 degrees C / 138 degrees F
SFB 4 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 4 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 4 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 4 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 4 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 4 SFB-XF1-Zone0          OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF0-Zone0          OK          45 degrees C / 113 degrees F
SFB 5 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1          OK          36 degrees C / 96 degrees F
SFB 5 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 5 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 5 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
SFB 5 SFB-XF0-Zone0          OK          50 degrees C / 122 degrees F
SFB 6 Intake-Zone0           OK          41 degrees C / 105 degrees F
SFB 6 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 6 IntakeA-Zone0          OK          32 degrees C / 89 degrees F
SFB 6 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 6 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 6 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 6 SFB-XF1-Zone0          OK          60 degrees C / 140 degrees F
SFB 6 SFB-XF0-Zone0          OK          60 degrees C / 140 degrees F
SFB 7 Intake-Zone0           OK          41 degrees C / 105 degrees F
SFB 7 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 7 IntakeA-Zone0          OK          33 degrees C / 91 degrees F
SFB 7 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 7 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 7 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
```

```
       SFB 7 SFB-XF1-Zone0            OK          50 degrees C / 122 degrees F
       SFB 7 SFB-XF0-Zone0            OK          57 degrees C / 134 degrees F
 Fans  Fan Tray 0 Fan 1               OK          3480 RPM
       Fan Tray 0 Fan 2               OK          3600 RPM
       Fan Tray 0 Fan 3               OK          3480 RPM
       Fan Tray 0 Fan 4               OK          3360 RPM
       Fan Tray 0 Fan 5               OK          3360 RPM
       Fan Tray 0 Fan 6               OK          3360 RPM
       Fan Tray 1 Fan 1               OK          3480 RPM
       Fan Tray 1 Fan 2               OK          3480 RPM
       Fan Tray 1 Fan 3               OK          3360 RPM
       Fan Tray 1 Fan 4               OK          3480 RPM
       Fan Tray 1 Fan 5               OK          3480 RPM
       Fan Tray 1 Fan 6               OK          3360 RPM
       Fan Tray 2 Fan 1               OK          2760 RPM
       Fan Tray 2 Fan 2               OK          2760 RPM
       Fan Tray 2 Fan 3               OK          2760 RPM
       Fan Tray 2 Fan 4               OK          2640 RPM
       Fan Tray 2 Fan 5               OK          2760 RPM
       Fan Tray 2 Fan 6               OK          2640 RPM
       Fan Tray 3 Fan 1               OK          3600 RPM
       Fan Tray 3 Fan 2               OK          3600 RPM
       Fan Tray 3 Fan 3               OK          3480 RPM
       Fan Tray 3 Fan 4               OK          3480 RPM
       Fan Tray 3 Fan 5               OK          3360 RPM
       Fan Tray 3 Fan 6               OK          3480 RPM
```

For monitoring the temperature of specific items in the MX2020 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         23 degrees C / 73 degrees F
      CB 0 IntakeB-Zone1             OK         29 degrees C / 84 degrees F
      CB 0 IntakeC-Zone0             OK         26 degrees C / 78 degrees F
      CB 0 ExhaustA-Zone0            OK         25 degrees C / 77 degrees F
      CB 0 ExhaustB-Zone1            OK         27 degrees C / 80 degrees F
      CB 0 TCBC-Zone0                OK         32 degrees C / 89 degrees F
      CB 1 IntakeA-Zone0             OK         22 degrees C / 71 degrees F
      CB 1 IntakeB-Zone1             OK         23 degrees C / 73 degrees F
      CB 1 IntakeC-Zone0             OK         26 degrees C / 78 degrees F
      CB 1 ExhaustA-Zone0            OK         25 degrees C / 77 degrees F
```

```
CB 1 ExhaustB-Zone1          OK          24 degrees C / 75 degrees F
CB 1 TCBC-Zone0              OK          28 degrees C / 82 degrees F
SPMB 0 Intake                OK          30 degrees C / 86 degrees F
SPMB 1 Intake                OK          23 degrees C / 73 degrees F
Routing Engine 0 CPU         OK          31 degrees C / 87 degrees F
Routing Engine 1 CPU         OK          25 degrees C / 77 degrees F
SFB 3 Intake-Zone0           OK          42 degrees C / 107 degrees F
SFB 3 Exhaust-Zone1          OK          41 degrees C / 105 degrees F
SFB 3 IntakeA-Zone0          OK          35 degrees C / 95 degrees F
SFB 3 IntakeB-Zone1          OK          31 degrees C / 87 degrees F
SFB 3 Exhaust-Zone0          OK          39 degrees C / 102 degrees F
SFB 3 SFB-XF2-Zone1          OK          64 degrees C / 147 degrees F
SFB 3 SFB-XF1-Zone0          OK          55 degrees C / 131 degrees F
SFB 3 SFB-XF0-Zone0          OK          62 degrees C / 143 degrees F
SFB 4 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 4 Exhaust-Zone1          OK          39 degrees C / 102 degrees F
SFB 4 IntakeA-Zone0          OK          29 degrees C / 84 degrees F
SFB 4 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 4 Exhaust-Zone0          OK          33 degrees C / 91 degrees F
SFB 4 SFB-XF2-Zone1          OK          58 degrees C / 136 degrees F
SFB 4 SFB-XF1-Zone0          OK          48 degrees C / 118 degrees F
SFB 4 SFB-XF0-Zone0          OK          46 degrees C / 114 degrees F
SFB 5 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 5 IntakeA-Zone0          OK          27 degrees C / 80 degrees F
SFB 5 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 5 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 5 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
SFB 5 SFB-XF0-Zone0          OK          51 degrees C / 123 degrees F
SFB 6 Intake-Zone0           OK          39 degrees C / 102 degrees F
SFB 6 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 6 IntakeA-Zone0          OK          30 degrees C / 86 degrees F
SFB 6 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 6 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 6 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 6 SFB-XF1-Zone0          OK          61 degrees C / 141 degrees F
SFB 6 SFB-XF0-Zone0          OK          62 degrees C / 143 degrees F
SFB 7 Intake-Zone0           OK          35 degrees C / 95 degrees F
SFB 7 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 7 IntakeA-Zone0          OK          32 degrees C / 89 degrees F
SFB 7 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0          OK          33 degrees C / 91 degrees F
```

```
    SFB 7 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
    SFB 7 SFB-XF1-Zone0          OK          49 degrees C / 120 degrees F
    SFB 7 SFB-XF0-Zone0          OK          48 degrees C / 118 degrees F
    FPC 4 Intake                 OK          28 degrees C / 82 degrees F
    FPC 4 Exhaust A              OK          28 degrees C / 82 degrees F
    FPC 4 Exhaust B              OK          29 degrees C / 84 degrees F
    FPC 4 LU 0 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 LU 0 Chip              OK          46 degrees C / 114 degrees F
    FPC 4 LU 1 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 LU 1 Chip              OK          48 degrees C / 118 degrees F
    FPC 4 LU 2 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 LU 2 Chip              OK          37 degrees C / 98 degrees F
    FPC 4 LU 3 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 LU 3 Chip              OK          42 degrees C / 107 degrees F
    FPC 4 XM 0 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 XM 0 Chip              OK          57 degrees C / 134 degrees F
    FPC 4 XM 1 TSen              OK          47 degrees C / 116 degrees F
    FPC 4 XM 1 Chip              OK          46 degrees C / 114 degrees F
    FPC 4 PLX Switch TSen        OK          47 degrees C / 116 degrees F
    FPC 4 PLX Switch Chip        OK          40 degrees C / 104 degrees F
    FPC 7 Intake                 OK          30 degrees C / 86 degrees F
    FPC 7 Exhaust A              OK          44 degrees C / 111 degrees F
    FPC 7 Exhaust B              OK          53 degrees C / 127 degrees F
    FPC 7 LU 0 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 LU 0 Chip              OK          55 degrees C / 131 degrees F
    FPC 7 LU 1 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 LU 1 Chip              OK          43 degrees C / 109 degrees F
    FPC 7 LU 2 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 LU 2 Chip              OK          50 degrees C / 122 degrees F
    FPC 7 LU 3 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 LU 3 Chip              OK          59 degrees C / 138 degrees F
    FPC 7 XM 0 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 XM 0 Chip              OK          51 degrees C / 123 degrees F
    FPC 7 XF 0 TSen              OK          42 degrees C / 107 degrees F
    FPC 7 XF 0 Chip              OK          65 degrees C / 149 degrees F
    FPC 7 PLX Switch TSen        OK          42 degrees C / 107 degrees F
    FPC 7 PLX Switch Chip        OK          44 degrees C / 111 degrees F
    FPC 11 Intake                OK          32 degrees C / 89 degrees F
    FPC 11 Exhaust A             OK          37 degrees C / 98 degrees F
    FPC 11 Exhaust B             OK          35 degrees C / 95 degrees F
    FPC 11 QX 0 TSen             OK          48 degrees C / 118 degrees F
    FPC 11 QX 0 Chip             OK          53 degrees C / 127 degrees F
    FPC 11 LU 0 TCAM TSen        OK          48 degrees C / 118 degrees F
```

```
        FPC 11 LU 0 TCAM Chip          OK          45 degrees C / 113 degrees F
        FPC 11 LU 0 TSen               OK          48 degrees C / 118 degrees F
        FPC 11 LU 0 Chip               OK          48 degrees C / 118 degrees F
        FPC 11 MQ 0 TSen               OK          48 degrees C / 118 degrees F
        FPC 11 MQ 0 Chip               OK          47 degrees C / 116 degrees F
        FPC 11 QX 1 TSen               OK          42 degrees C / 107 degrees F
        FPC 11 QX 1 Chip               OK          44 degrees C / 111 degrees F
        FPC 11 LU 1 TCAM TSen          OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 TCAM Chip          OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 TSen               OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 Chip               OK          44 degrees C / 111 degrees F
        FPC 11 MQ 1 TSen               OK          42 degrees C / 107 degrees F
        FPC 11 MQ 1 Chip               OK          45 degrees C / 113 degrees F
        FPC 16 Intake                  OK          35 degrees C / 95 degrees F
        FPC 16 Exhaust A               OK          44 degrees C / 111 degrees F
        FPC 16 Exhaust B               Absent
        FPC 16 LU TSen                 OK          50 degrees C / 122 degrees F
        FPC 16 LU Chip                 OK          55 degrees C / 131 degrees F
        FPC 16 XM TSen                 OK          50 degrees C / 122 degrees F
        FPC 16 XM Chip                 OK          63 degrees C / 145 degrees F
        FPC 16 PCIe TSen               OK          50 degrees C / 122 degrees F
        FPC 16 PCIe Chip               OK          63 degrees C / 145 degrees F
        FPC 18 Intake                  OK          31 degrees C / 87 degrees F
        FPC 18 Exhaust A               OK          39 degrees C / 102 degrees F
        FPC 18 Exhaust B               OK          40 degrees C / 104 degrees F
        FPC 18 LU 0 TSen               OK          43 degrees C / 109 degrees F
        FPC 18 LU 0 Chip               OK          41 degrees C / 105 degrees F
        FPC 18 LU 1 TSen               OK          43 degrees C / 109 degrees F
        FPC 18 LU 1 Chip               OK          48 degrees C / 118 degrees F
        FPC 18 LU 2 TSen               OK          43 degrees C / 109 degrees F
        FPC 18 LU 2 Chip               OK          41 degrees C / 105 degrees F
        FPC 18 LU 3 TSen               OK          43 degrees C / 109 degrees F
        FPC 18 LU 3 Chip               OK          42 degrees C / 107 degrees F
        FPC 18 MQ 0 TSen               OK          38 degrees C / 100 degrees F
        FPC 18 MQ 0 Chip               OK          39 degrees C / 102 degrees F
        FPC 18 MQ 1 TSen               OK          38 degrees C / 100 degrees F
        FPC 18 MQ 1 Chip               OK          43 degrees C / 109 degrees F
        FPC 18 MQ 2 TSen               OK          38 degrees C / 100 degrees F
        FPC 18 MQ 2 Chip               OK          35 degrees C / 95 degrees F
        FPC 18 MQ 3 TSen               OK          38 degrees C / 100 degrees F
        FPC 18 MQ 3 Chip               OK          39 degrees C / 102 degrees F
        ADC 4 Intake                   OK          28 degrees C / 82 degrees F
        ADC 4 Exhaust                  OK          36 degrees C / 96 degrees F
```

```
      ADC 4 ADC-XF1                OK          44 degrees C / 111 degrees F
      ADC 4 ADC-XF0                OK          50 degrees C / 122 degrees F
      ADC 7 Intake                 OK          28 degrees C / 82 degrees F
      ADC 7 Exhaust                OK          39 degrees C / 102 degrees F
      ADC 7 ADC-XF1                OK          41 degrees C / 105 degrees F
      ADC 7 ADC-XF0                OK          51 degrees C / 123 degrees F
      ADC 11 Intake                OK          34 degrees C / 93 degrees F
      ADC 11 Exhaust               OK          32 degrees C / 89 degrees F
      ADC 11 ADC-XF1               OK          45 degrees C / 113 degrees F
      ADC 11 ADC-XF0               OK          49 degrees C / 120 degrees F
      ADC 16 Intake                OK          43 degrees C / 109 degrees F
      ADC 16 Exhaust               OK          33 degrees C / 91 degrees F
      ADC 16 ADC-XF1               OK          52 degrees C / 125 degrees F
      ADC 16 ADC-XF0               OK          54 degrees C / 129 degrees F
      ADC 18 Intake                OK          39 degrees C / 102 degrees F
      ADC 18 Exhaust               OK          34 degrees C / 93 degrees F
      ADC 18 ADC-XF1               OK          49 degrees C / 120 degrees F
      ADC 18 ADC-XF0               OK          54 degrees C / 129 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
SPMB 1 Intake                56    62       75       63       83       76       95
```

```
SFB 0 Intake-Zone0          56    62       75       63       90       76       95
SFB 0 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 0 IntakeA-Zone0         56    62       75       63       90       76       95
SFB 0 IntakeB-Zone1         56    62       75       63       90       76       95
SFB 0 Exhaust-Zone0         56    62       75       63       90       76       95
SFB 0 SFB-XF2-Zone1         70    80       90       90      107      107      115
SFB 0 SFB-XF1-Zone0         70    80       90       90      107      107      115
SFB 0 SFB-XF0-Zone0         70    80       90       90      107      107      115
SFB 1 Intake-Zone0          56    62       75       63       90       76       95
SFB 1 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 1 IntakeA-Zone0         56    62       75       63       90       76       95
SFB 1 IntakeB-Zone1         56    62       75       63       90       76       95
SFB 1 Exhaust-Zone0         56    62       75       63       90       76       95
SFB 1 SFB-XF2-Zone1         70    80       90       90      107      107      115
SFB 1 SFB-XF1-Zone0         70    80       90       90      107      107      115
SFB 1 SFB-XF0-Zone0         70    80       90       90      107      107      115
SFB 2 Intake-Zone0          56    62       75       63       90       76       95
SFB 2 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 2 IntakeA-Zone0         56    62       75       63       90       76       95
SFB 2 IntakeB-Zone1         56    62       75       63       90       76       95
SFB 2 Exhaust-Zone0         56    62       75       63       90       76       95
SFB 2 SFB-XF2-Zone1         70    80       90       90      107      107      115
SFB 2 SFB-XF1-Zone0         70    80       90       90      107      107      115
SFB 2 SFB-XF0-Zone0         70    80       90       90      107      107      115
SFB 3 Intake-Zone0          56    62       75       63       90       76       95
SFB 3 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 3 IntakeA-Zone0         56    62       75       63       90       76       95
SFB 3 IntakeB-Zone1         56    62       75       63       90       76       95
SFB 3 Exhaust-Zone0         56    62       75       63       90       76       95
SFB 3 SFB-XF2-Zone1         70    80       90       90      107      107      115
SFB 3 SFB-XF1-Zone0         70    80       90       90      107      107      115
SFB 3 SFB-XF0-Zone0         70    80       90       90      107      107      115
SFB 4 Intake-Zone0          56    62       75       63       90       76       95
SFB 4 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 4 IntakeA-Zone0         56    62       75       63       90       76       95
SFB 4 IntakeB-Zone1         56    62       75       63       90       76       95
SFB 4 Exhaust-Zone0         56    62       75       63       90       76       95
SFB 4 SFB-XF2-Zone1         70    80       90       90      107      107      115
SFB 4 SFB-XF1-Zone0         70    80       90       90      107      107      115
SFB 4 SFB-XF0-Zone0         70    80       90       90      107      107      115
SFB 5 Intake-Zone0          56    62       75       63       90       76       95
SFB 5 Exhaust-Zone1         56    62       75       63       90       76       95
SFB 5 IntakeA-Zone0         56    62       75       63       90       76       95
```

SFB 5 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 5 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 5 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 5 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 5 SFB-XF0-Zone0	70	80	90	90	107	107	115
SFB 6 Intake-Zone0	56	62	75	63	90	76	95
SFB 6 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 6 IntakeA-Zone0	56	62	75	63	90	76	95
SFB 6 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 6 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 6 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 6 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 6 SFB-XF0-Zone0	70	80	90	90	107	107	115
SFB 7 Intake-Zone0	56	62	75	63	90	76	95
SFB 7 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 7 IntakeA-Zone0	56	62	75	63	90	76	95
SFB 7 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 7 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 7 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 7 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 7 SFB-XF0-Zone0	70	80	90	90	107	107	115
FPC 4	55	60	75	65	95	80	100
FPC 7	55	60	75	65	90	80	95
FPC 11	55	60	75	65	90	80	95
FPC 16	55	60	75	65	90	80	95
FPC 18	55	60	75	65	90	80	95
ADC 4 Intake	56	62	75	63	83	76	95
ADC 4 Exhaust	56	62	75	63	83	76	95
ADC 4 ADC-XF1	70	80	90	90	107	107	115
ADC 4 ADC-XF0	70	80	90	90	107	107	115
ADC 7 Intake	56	62	75	63	83	76	95
ADC 7 Exhaust	56	62	75	63	83	76	95
ADC 7 ADC-XF1	70	80	90	90	107	107	115
ADC 7 ADC-XF0	70	80	90	90	107	107	115
ADC 11 Intake	56	62	75	63	83	76	95
ADC 11 Exhaust	56	62	75	63	83	76	95
ADC 11 ADC-XF1	70	80	90	90	107	107	115
ADC 11 ADC-XF0	70	80	90	90	107	107	115
ADC 16 Intake	56	62	75	63	83	76	95
ADC 16 Exhaust	56	62	75	63	83	76	95
ADC 16 ADC-XF1	70	80	90	90	107	107	115
ADC 16 ADC-XF0	70	80	90	90	107	107	115
ADC 18 Intake	56	62	75	63	83	76	95

```
ADC 18 Exhaust                56    62       75       63       83       76       95
ADC 18 ADC-XF1                70    80       90       90      107      107      115
ADC 18 ADC-XF0                70    80       90       90      107      107      115
```

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       38%       3480 RPM
      Fan Tray 0 Fan 2          OK       37%       3360 RPM
      Fan Tray 0 Fan 3          OK       37%       3360 RPM
      Fan Tray 0 Fan 4          OK       37%       3360 RPM
      Fan Tray 0 Fan 5          OK       37%       3360 RPM
      Fan Tray 0 Fan 6          OK       37%       3360 RPM
      Fan Tray 1 Fan 1          OK       37%       3360 RPM
      Fan Tray 1 Fan 2          OK       38%       3480 RPM
      Fan Tray 1 Fan 3          OK       37%       3360 RPM
      Fan Tray 1 Fan 4          OK       37%       3360 RPM
      Fan Tray 1 Fan 5          OK       38%       3480 RPM
      Fan Tray 1 Fan 6          OK       38%       3480 RPM
      Fan Tray 2 Fan 1          OK       30%       2760 RPM
      Fan Tray 2 Fan 2          OK       29%       2640 RPM
      Fan Tray 2 Fan 3          OK       30%       2760 RPM
      Fan Tray 2 Fan 4          OK       29%       2640 RPM
      Fan Tray 2 Fan 5          OK       29%       2640 RPM
      Fan Tray 2 Fan 6          OK       29%       2640 RPM
      Fan Tray 3 Fan 1          OK       38%       3480 RPM
      Fan Tray 3 Fan 2          OK       40%       3600 RPM
      Fan Tray 3 Fan 3          OK       38%       3480 RPM
      Fan Tray 3 Fan 4          OK       38%       3480 RPM
      Fan Tray 3 Fan 5          OK       38%       3480 RPM
      Fan Tray 3 Fan 6          OK       38%       3480 RPM
```

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

MX2020 Cooling System Description | 83

Troubleshooting the MX2020 Cooling System | 851

MX2020 Component LEDs on the Craft Interface

Replacing an MX2020 Fan Tray | 588

Removing the MX2020 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:

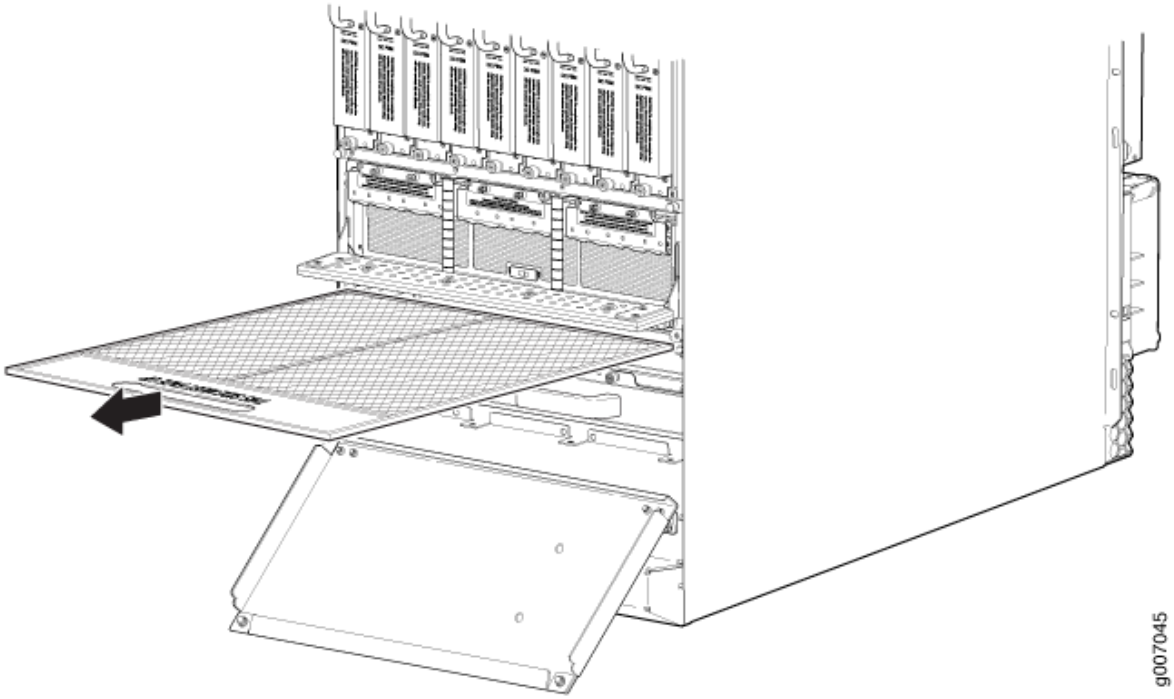
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the two captive screws located on either side of the fan tray and air filter access door.

   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 264 on page 607.

Figure 264: Removing the Lower Air Filter from the Chassis



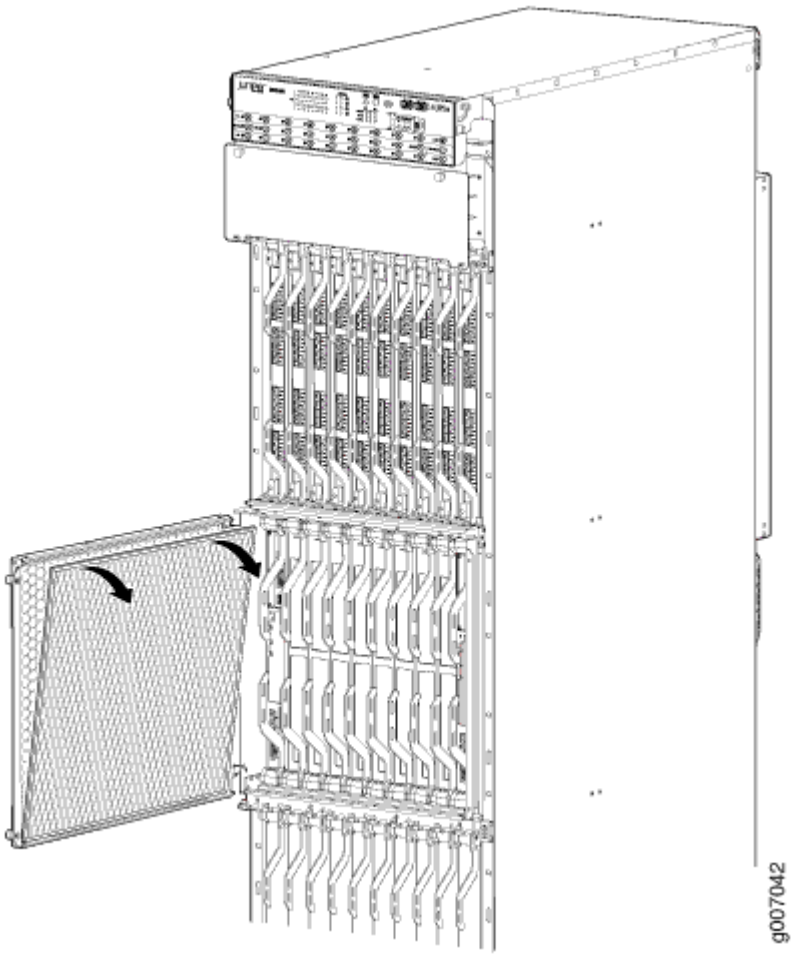
To remove the middle card cage cable manager air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the middle card cage cable manager, if necessary.
3. Loosen the two captive screws located on the front of the middle 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 265 on page 608).

Figure 265: Removing the Middle Card Cage Cable Manager Air Filter



To remove the PSM air filter:

NOTE: The MX2020 has two PSM air filters - one under each PSM section.

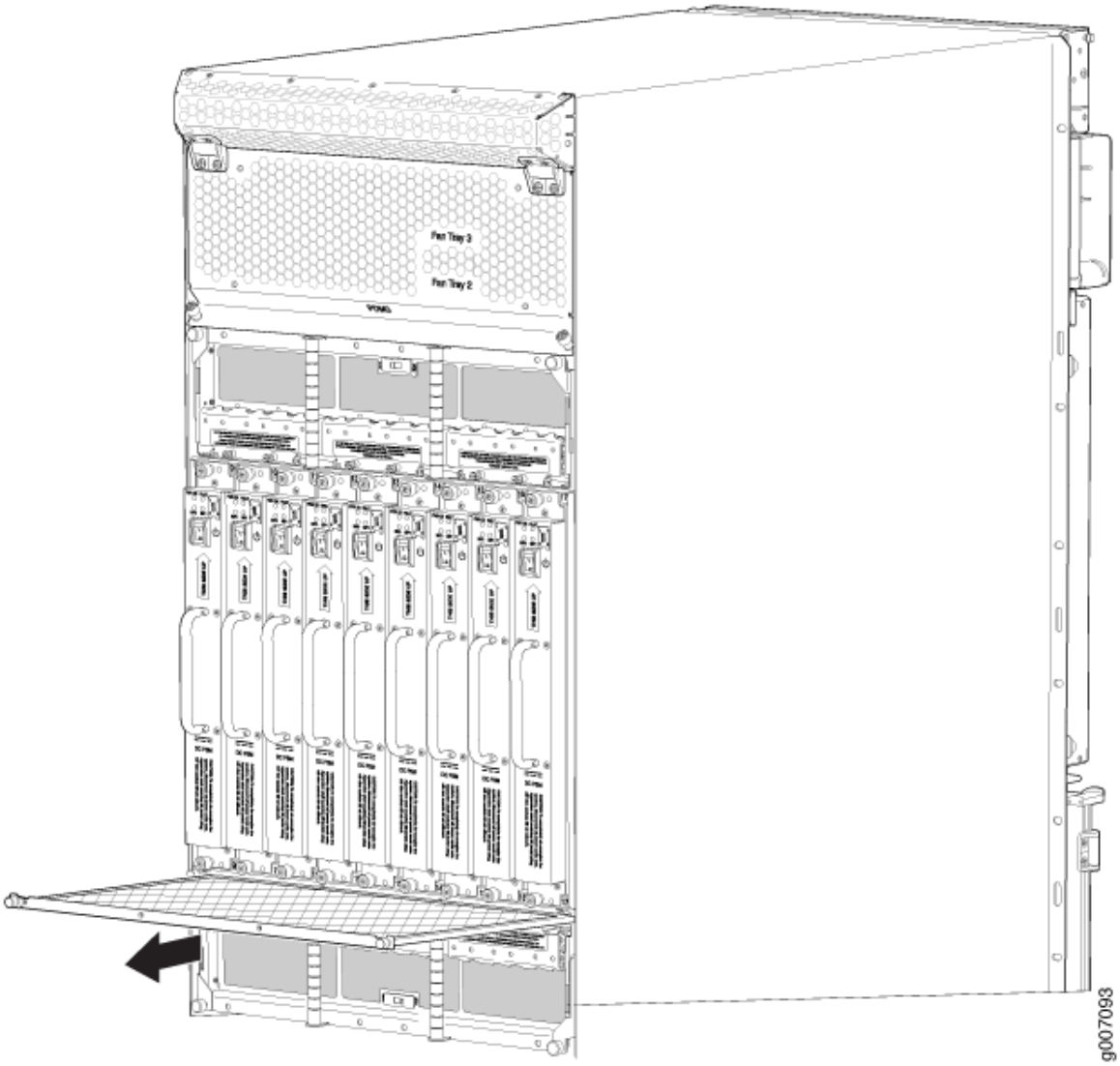
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the two captive screws located on either side of the air filter and pull slightly out of the chassis.

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 266 on page 609.

> **NOTE**: The AC and -48 VDC powered routers use the same air filter.

Figure 266: Removing the PSM Air Filter from the Chassis



To remove the PSM air filter 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. See Figure 267 on page 610 and Figure 268 on page 611.

Figure 267: Removing the Bracket from the PDM (240 V China)

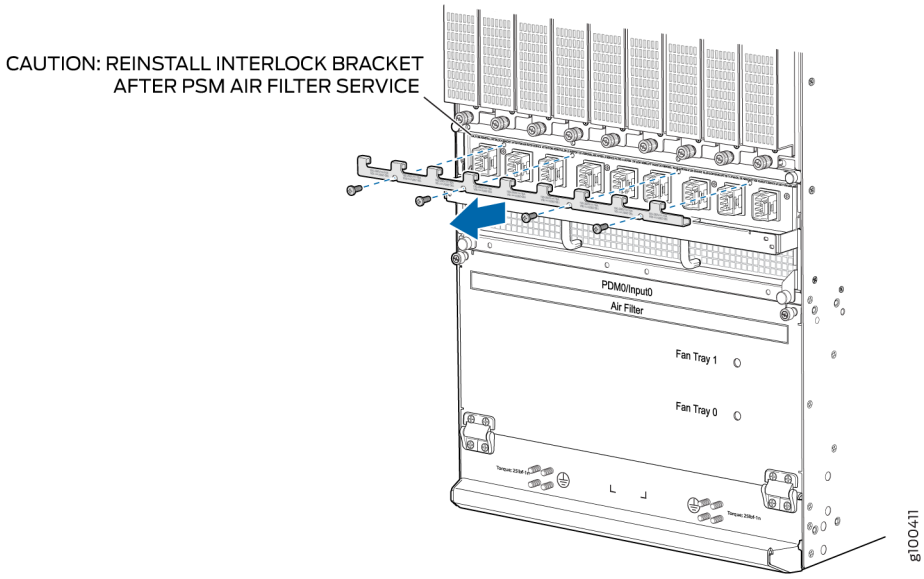
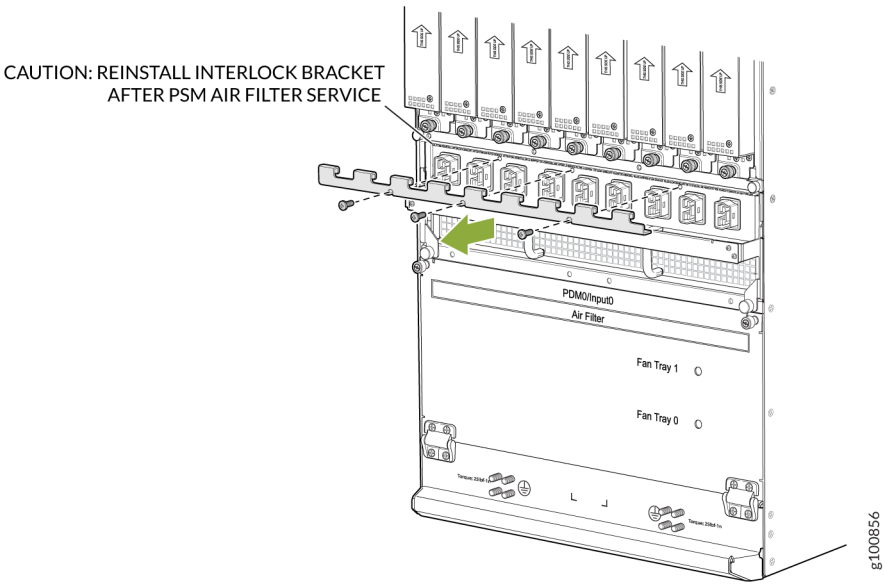


Figure 268: Removing the Bracket from the Universal (HVAC/HVDC) PDM



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 269 on page 612 and Figure 270 on page 612.

Figure 269: Removing the PSM (for the 240 V China) Air Filter from the Chassis

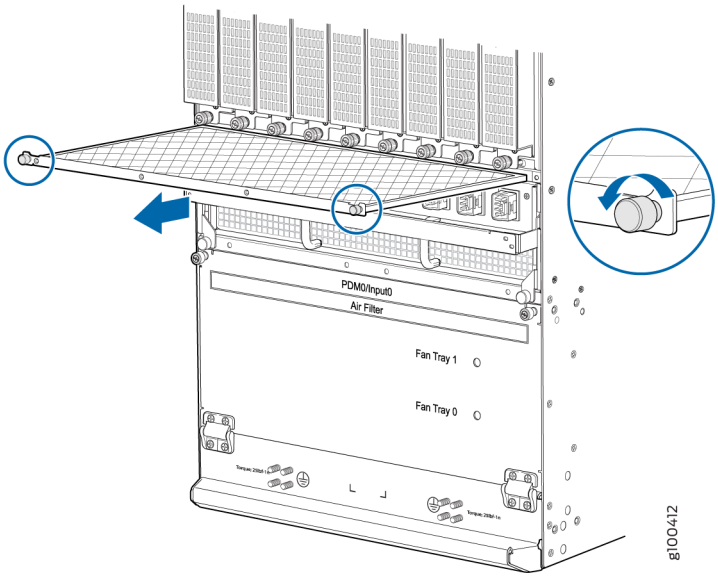
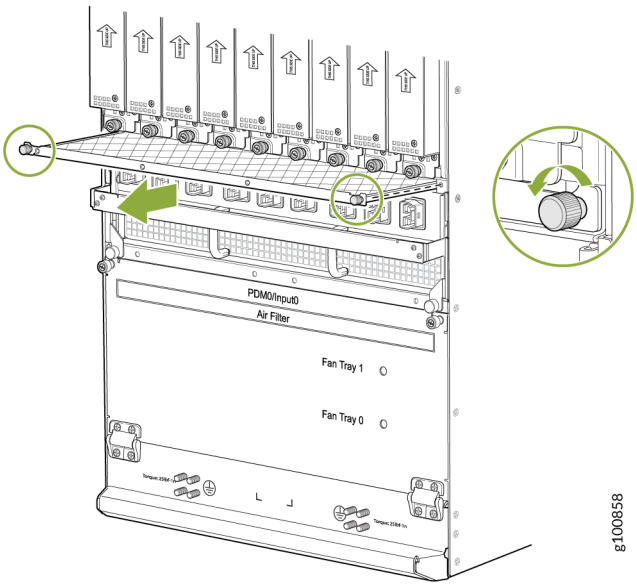


Figure 270: Removing the PSM (for the Universal HVAC/HVDC) Air Filter from the Chassis



6. Make sure to re-install the mechanical interlock bracket after you remove the filter. Secure the screws on the mechanical interlock bracket. See and Figure 271 on page 613 and Figure 272 on page 613.

Figure 271: Installing the Mechanical Interlock Bracket (with 240 V China PSM Installed)

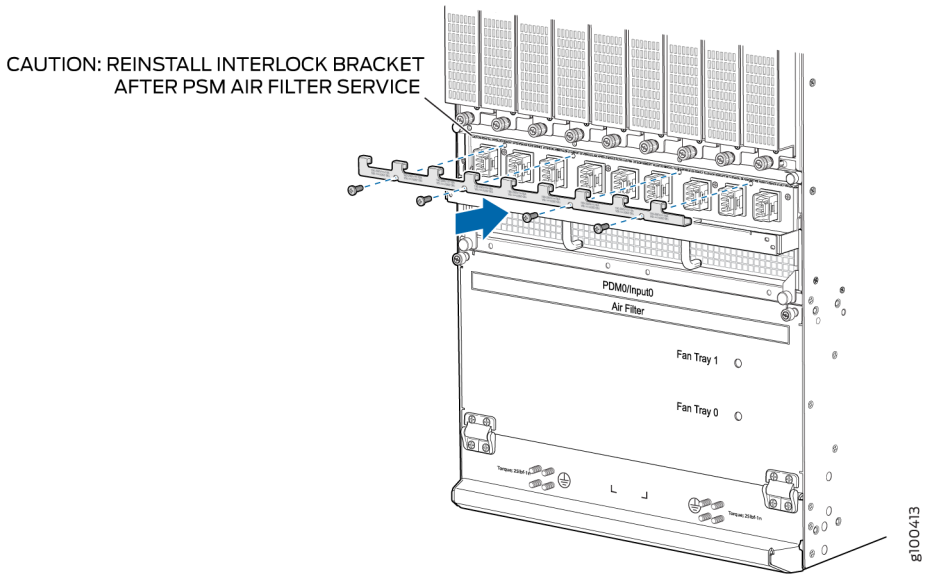
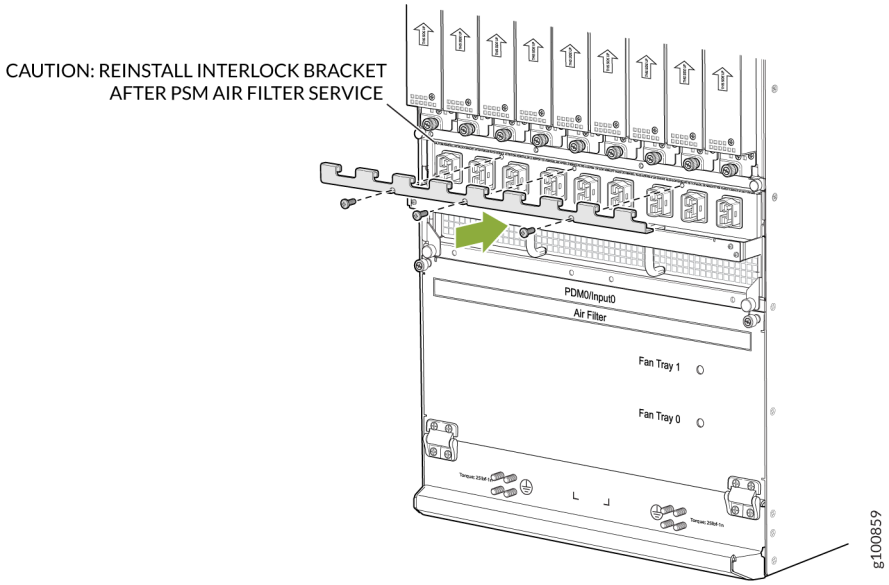


Figure 272: Installing the Mechanical Interlock Bracket (with Universal HVAC/HVDC PSM Installed)



RELATED DOCUMENTATION

Maintaining the MX2020 Air Filter | **621**

Installing an MX2020 Air Filter

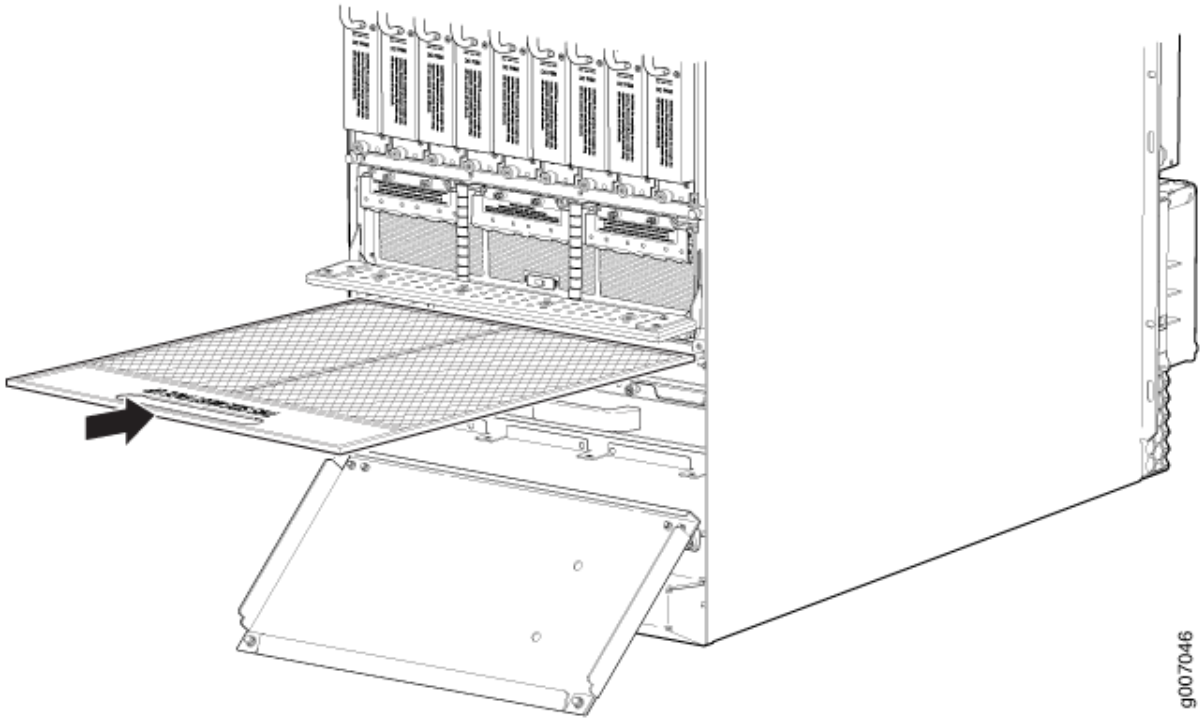
The MX2020 router has four air filters: a lower air filter, middle card cage cable manager air filter, and two Power Supply Module (PSM) air filters. These filters are included in the MX2020 Filter Kit (MX2020-FLTR-KIT-S).

Use these procedures to install the air filters.

To install the lower air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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 273 on page 615).
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 273: Installing the Air Filter



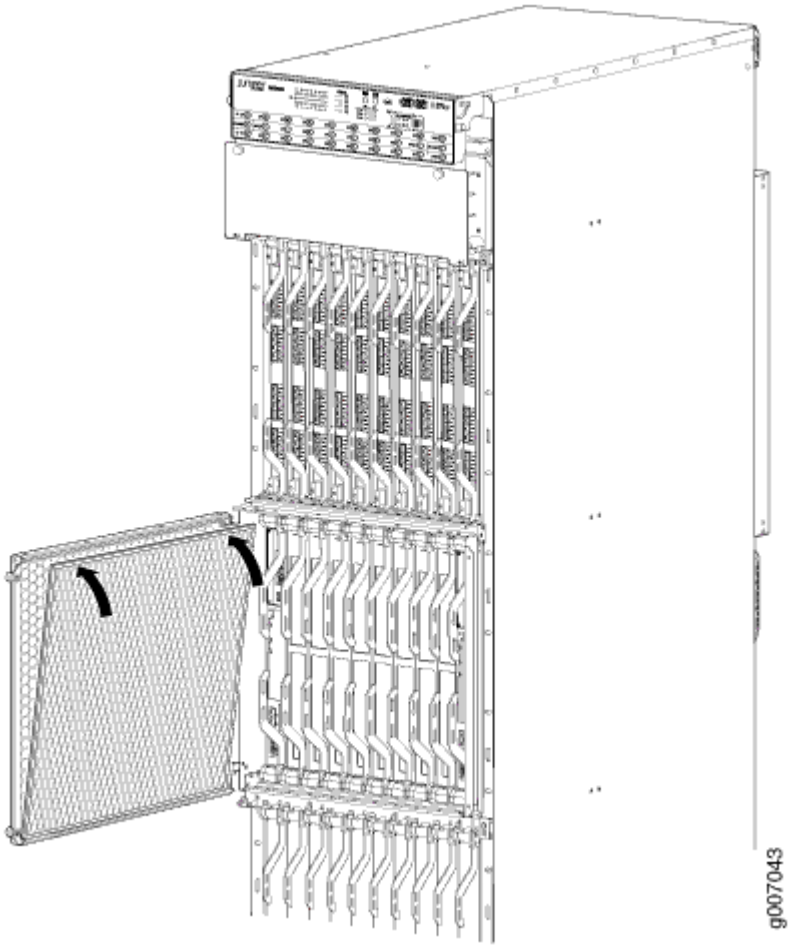
To install the middle card cage cable manager air filter:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the middle card cage cable manager, if necessary.
3. Loosen the two captive screws located on the front of the middle 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 274 on page 616).

Figure 274: Installing the Middle 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 middle card cage cable manager, if necessary.

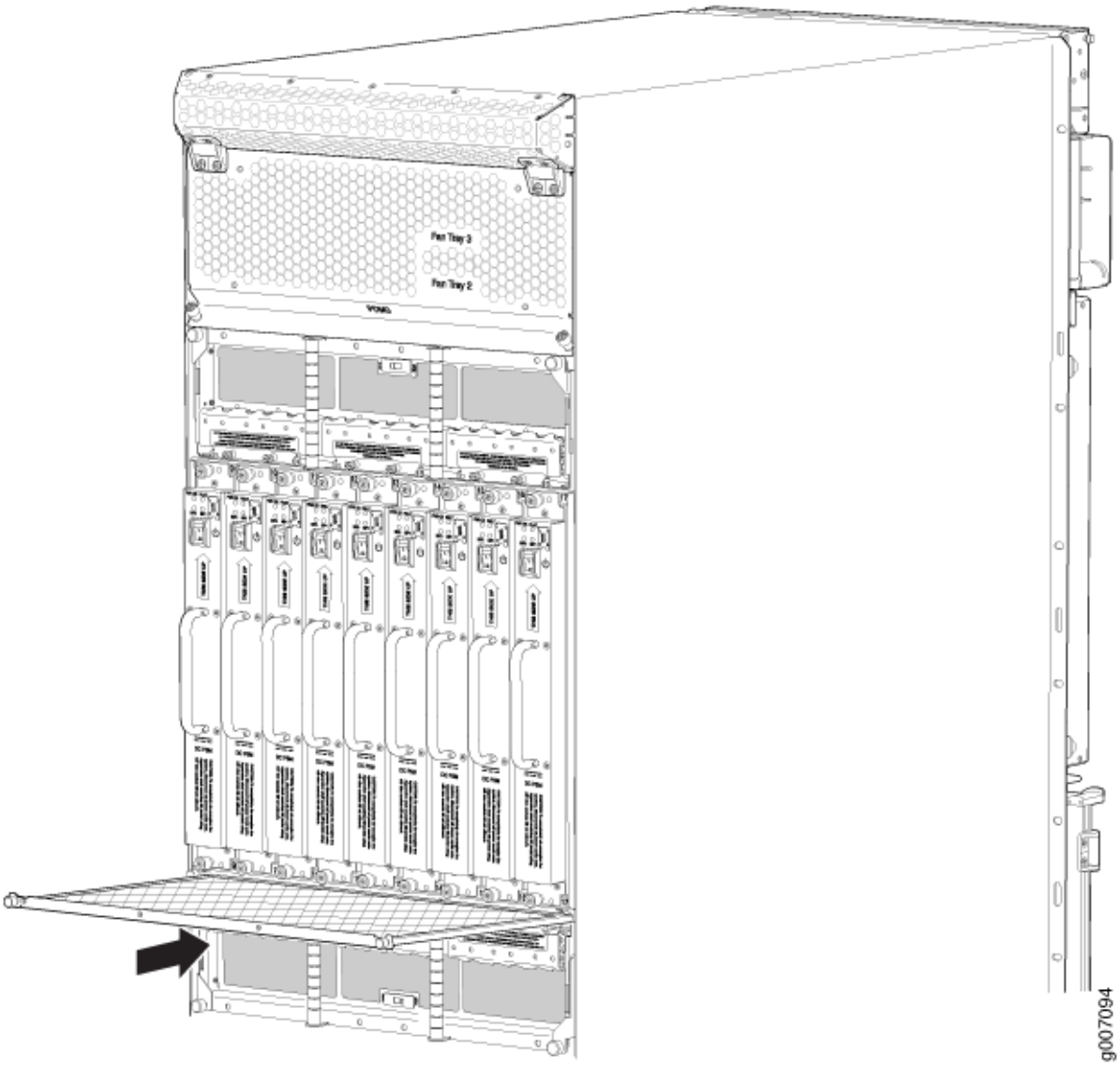
To install the PSM air filter:

NOTE: The MX2020 has two PSM air filters - one under each PSM section.

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 275 on page 617).

4. Tighten the two captive screws to secure.

Figure 275: Installing the PSM Air Filter



To install the PSM air filter 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 276 on page 618 and Figure 277 on page 618).

Figure 276: Removing the Bracket from the PDM

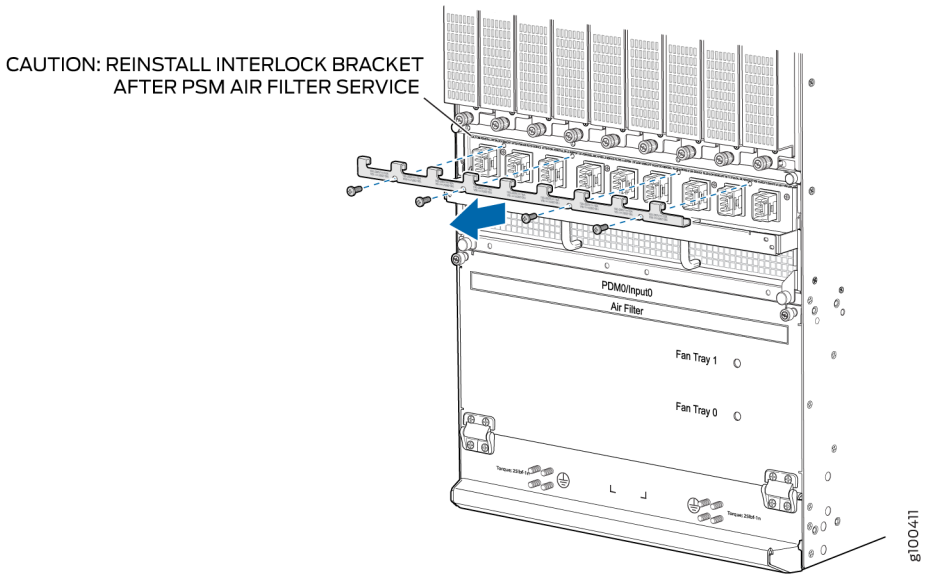
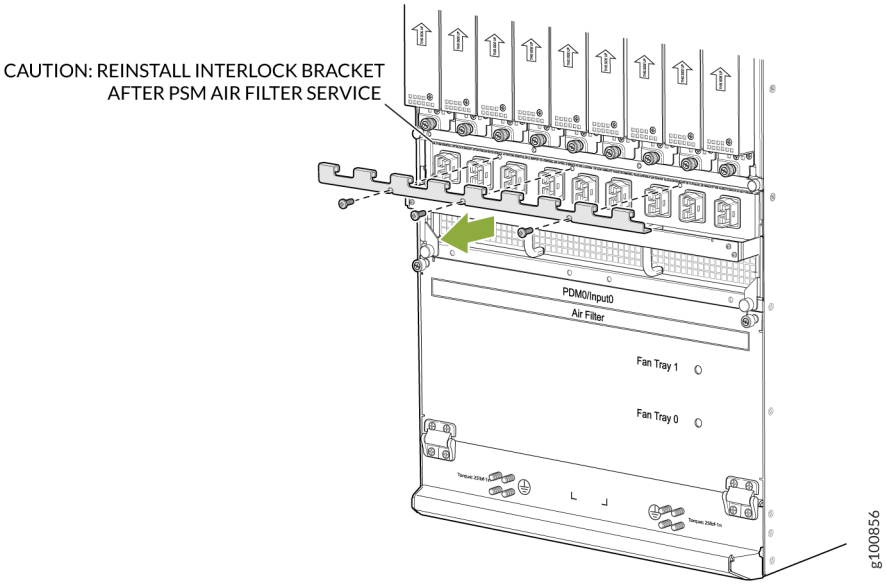


Figure 277: Removing the Bracket from the Universal (HVAC/HVDC) PDM



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 278 on page 619 and Figure 279 on page 620).

5. Tighten the two captive screws to secure.

Figure 278: Installing the PSM Filter

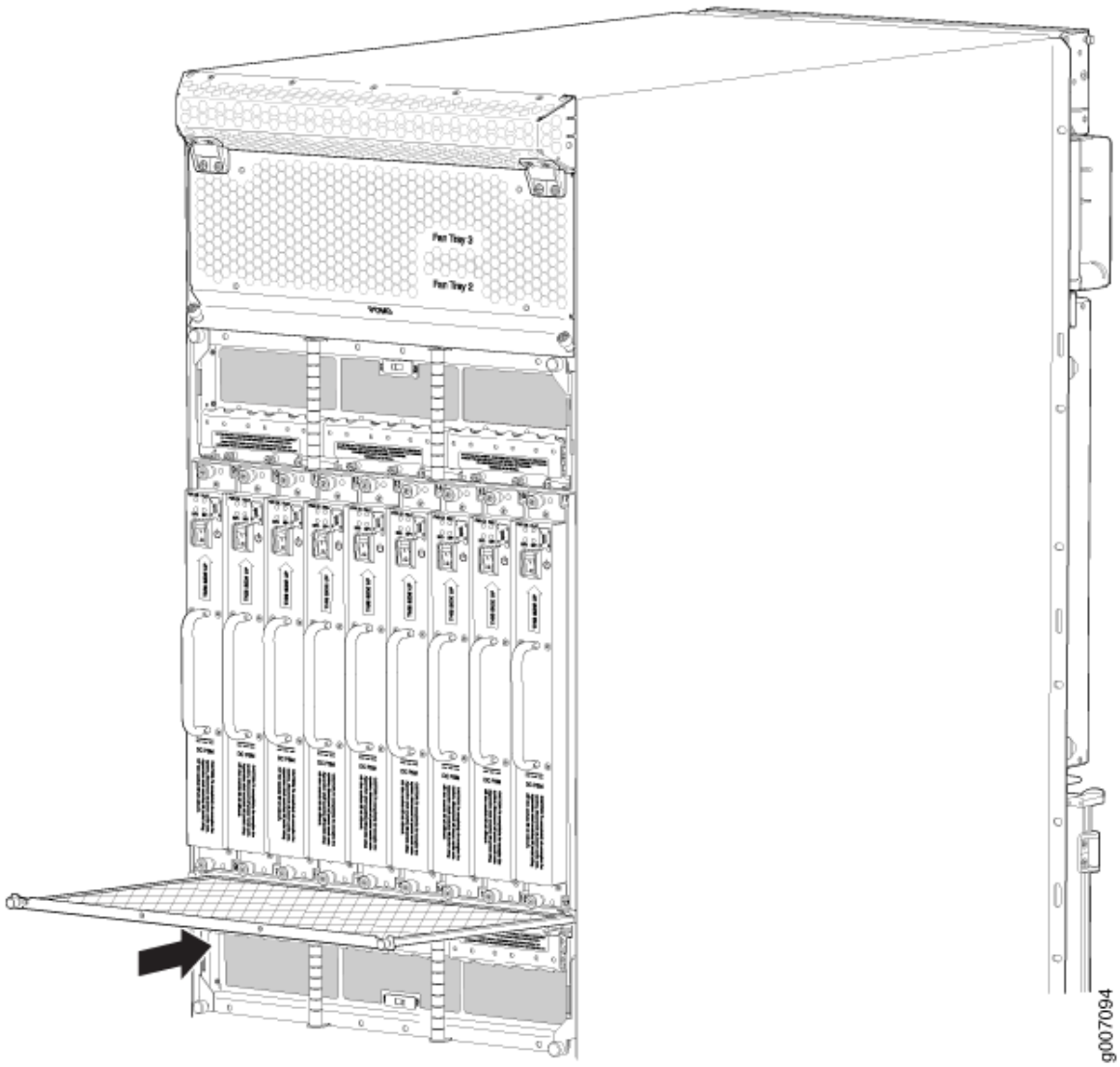
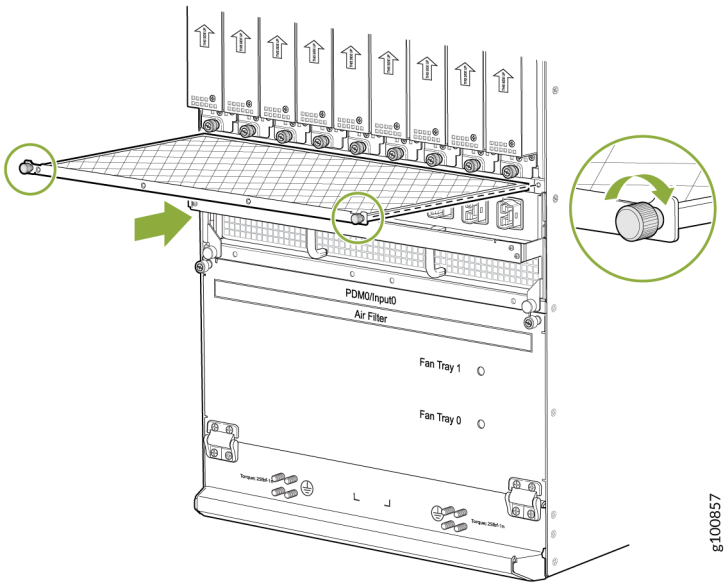


Figure 279: Installing the PSM Filter for the Universal (HVAC/HVDC) PSM



6. Install the mechanical interlock bracket and tighten the screws. See Figure 280 on page 620 and Figure 281 on page 621.

Figure 280: Installing the Bracket

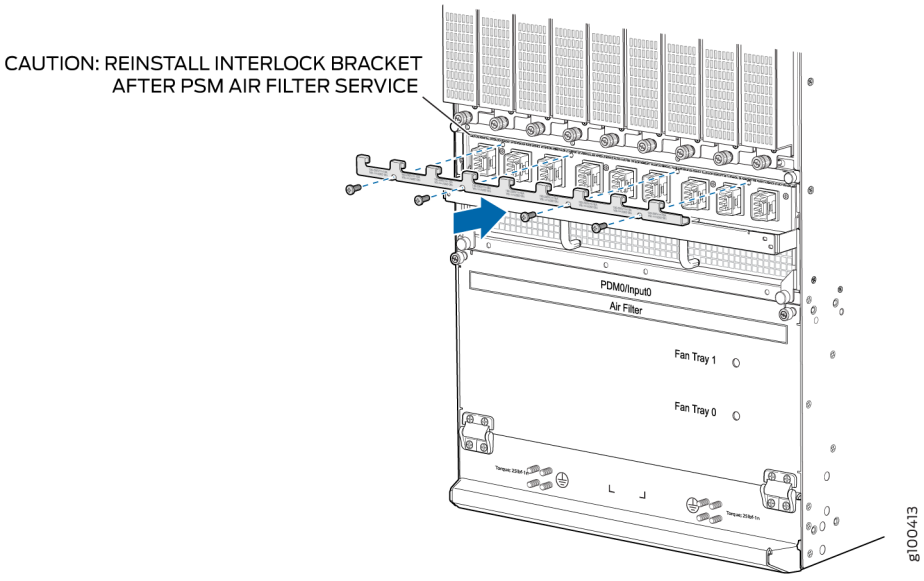
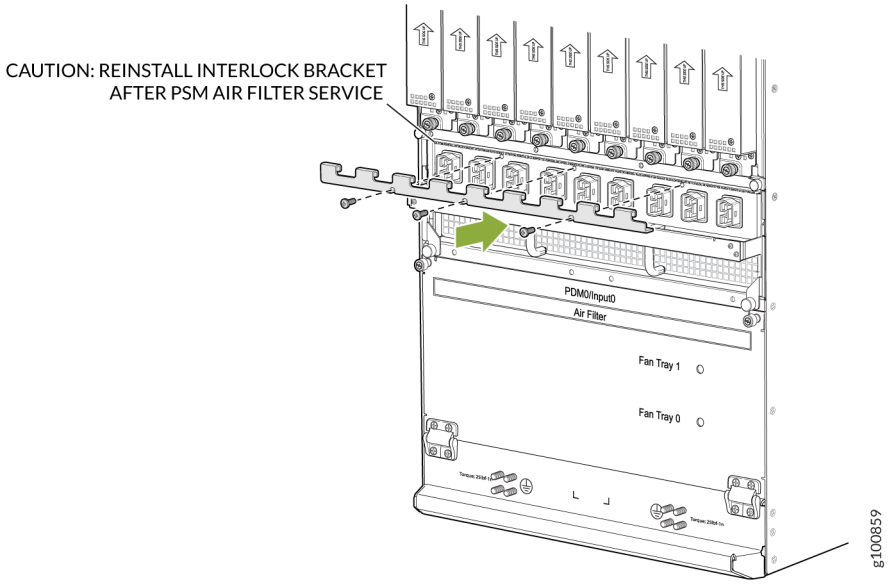


Figure 281: Installing the Mechanical Interlock Bracket (with Universal HVAC/HVDC PSM Installed)



RELATED DOCUMENTATION

Maintaining the MX2020 Air Filter | 621

Removing the MX2020 Air Filter | 606

Maintaining the MX2020 Air Filter

IN THIS SECTION

Purpose

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

Action

- Regularly inspect the air filter. A dirty air filter restricts airflow in the unit, producing a negative effect on the ventilation of the chassis. The filter degrades over time. You must replace the filter 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 MX2020 Hardware Components | 330

MX2020 Cooling System Description | 83

Removing the MX2020 Air Filter | 606

Maintaining the MX2020 Air Vents

IN THIS SECTION

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 MX2020 Router | 212

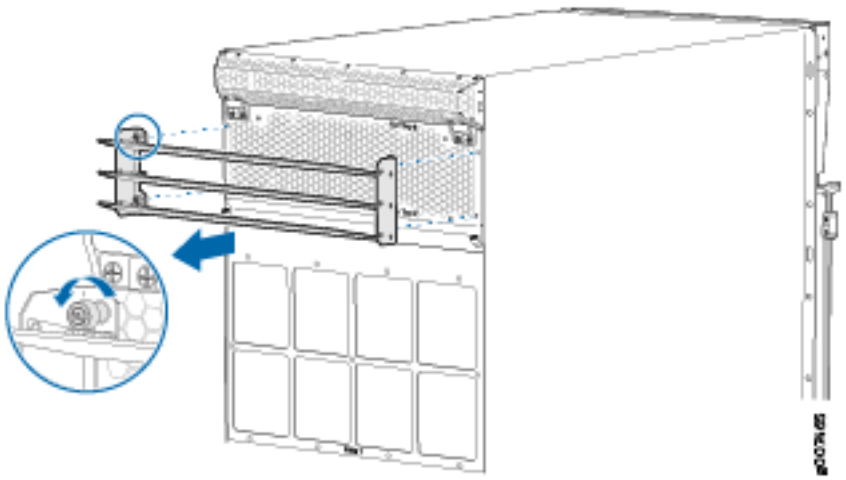
MX2020 Cooling System Description | 83

Removing the MX2020 Air Baffle

To remove the air baffle—MX2000-UPR-BAFFLE:

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 282 on page 623.

Figure 282: Removing the Air Baffle



RELATED DOCUMENTATION

Maintaining the MX2020 Air Baffle | 627

Installing the MX2020 Air Baffle | 624

Installing the MX2020 Air Baffle

To install the air baffle—MX2000-UPR-BAFFLE:

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 283 on page 624).
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 284 on page 625).

Figure 283: Installing the Air Baffle

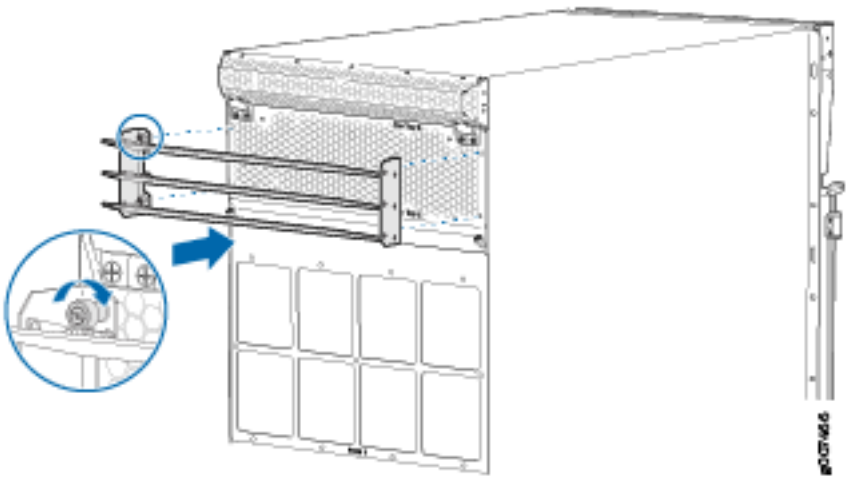
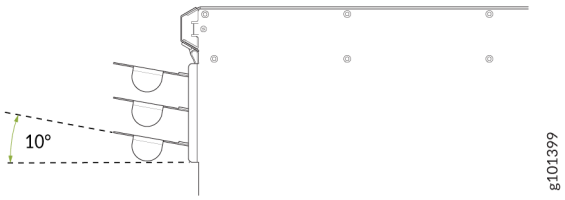


Figure 284: Air Baffle Louvers Adjusted at 10 Degrees Angle



RELATED DOCUMENTATION

- Maintaining the MX2020 Air Baffle | **627**
- Removing the MX2020 Air Baffle | **623**

Maintaining the MX2020 Cooling System Components

IN THIS SECTION

Maintaining the MX2020 Air Vents

IN THIS SECTION

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 MX2020 Router | 212

MX2020 Cooling System Description | 83

Maintaining the MX2020 Air Filter

IN THIS SECTION

Purpose

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

Action

- Regularly inspect the air filter. A dirty air filter restricts airflow in the unit, producing a negative effect on the ventilation of the chassis. The filter degrades over time. You must replace the filter 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 MX2020 Hardware Components | 330

MX2020 Cooling System Description | 83

Removing the MX2020 Air Filter | 606

Maintaining the MX2020 Air Baffle

IN THIS SECTION

Purpose

For optimum cooling, visually inspect the condition of the air baffle. See (Figure 285 on page 628 and Figure 286 on page 628).

NOTE: The air baffle is optional.

Action

- Inspect the air baffle with adjustable louvers regularly to determine if they are set to a 10-degree upward tilt/angle to direct the exhaust air away from the router.

Figure 285: Air Baffle - Fixed Louvers

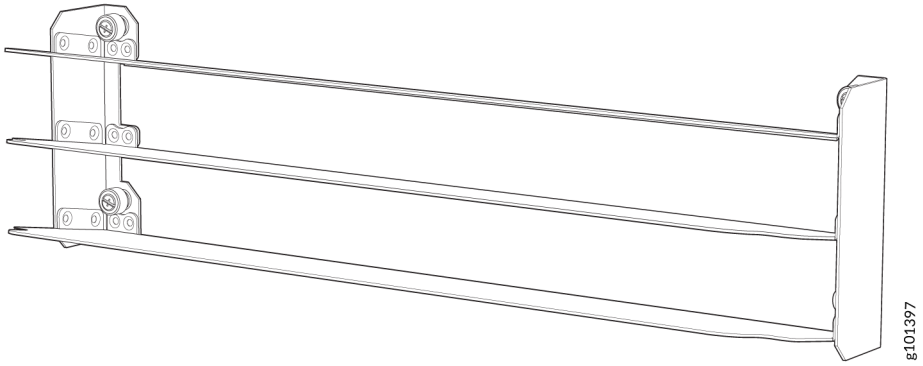
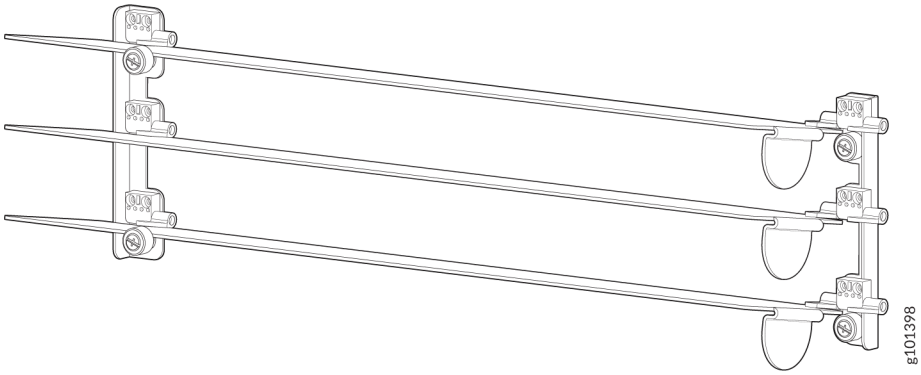


Figure 286: Air Baffle - Adjustable Louvers



SEE ALSO

Tools and Parts Required to Maintain the MX2020 Hardware Components | 330

MX2020 Cooling System Description | 83

Maintaining the MX2020 Fan Trays

IN THIS SECTION

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                         Absent
      PSM 1                         Absent
      PSM 2                         Absent
      PSM 3                         Absent
      PSM 4                         OK         34 degrees C / 93 degrees F
      PSM 5                         OK         31 degrees C / 87 degrees F
      PSM 6                         OK         30 degrees C / 86 degrees F
      PSM 7                         OK         30 degrees C / 86 degrees F
      PSM 8                         OK         31 degrees C / 87 degrees F
      PSM 9                         Absent
      PSM 10                        Absent
      PSM 11                        Absent
      PSM 12                        Absent
      PSM 13                        OK         32 degrees C / 89 degrees F
      PSM 14                        OK         31 degrees C / 87 degrees F
      PSM 15                        OK         30 degrees C / 86 degrees F
      PSM 16                        OK         30 degrees C / 86 degrees F
      PSM 17                        OK         30 degrees C / 86 degrees F
      PDM 0                         OK
      PDM 1                         OK
      PDM 2                         OK
      PDM 3                         OK
```

```
CB 0 IntakeA-Zone0              OK          25 degrees C / 77 degrees F
CB 0 IntakeB-Zone1              OK          29 degrees C / 84 degrees F
CB 0 IntakeC-Zone0              OK          28 degrees C / 82 degrees F
CB 0 ExhaustA-Zone0             OK          27 degrees C / 80 degrees F
CB 0 ExhaustB-Zone1             OK          28 degrees C / 82 degrees F
CB 0 TCBC-Zone0                 OK          32 degrees C / 89 degrees F
CB 1 IntakeA-Zone0              OK          30 degrees C / 86 degrees F
CB 1 IntakeB-Zone1              OK          25 degrees C / 77 degrees F
CB 1 IntakeC-Zone0              OK          39 degrees C / 102 degrees F
CB 1 ExhaustA-Zone0             OK          33 degrees C / 91 degrees F
CB 1 ExhaustB-Zone1             OK          28 degrees C / 82 degrees F
CB 1 TCBC-Zone0                 OK          32 degrees C / 89 degrees F
SPMB 0 Intake                   OK          30 degrees C / 86 degrees F
SPMB 1 Intake                   OK          24 degrees C / 75 degrees F
Routing Engine 0                OK          35 degrees C / 95 degrees F
Routing Engine 0 CPU            OK          31 degrees C / 87 degrees F
Routing Engine 1                OK          27 degrees C / 80 degrees F
Routing Engine 1 CPU            OK          26 degrees C / 78 degrees F
SFB 0 Intake-Zone0              OK          32 degrees C / 89 degrees F
SFB 0 Exhaust-Zone1             OK          38 degrees C / 100 degrees F
SFB 0 IntakeA-Zone0             OK          28 degrees C / 82 degrees F
SFB 0 IntakeB-Zone1             OK          29 degrees C / 84 degrees F
SFB 0 Exhaust-Zone0             OK          31 degrees C / 87 degrees F
SFB 0 SFB-XF2-Zone1             OK          55 degrees C / 131 degrees F
SFB 0 SFB-XF1-Zone0             OK          48 degrees C / 118 degrees F
SFB 0 SFB-XF0-Zone0             OK          47 degrees C / 116 degrees F
SFB 1 Intake-Zone0              OK          32 degrees C / 89 degrees F
SFB 1 Exhaust-Zone1             OK          37 degrees C / 98 degrees F
SFB 1 IntakeA-Zone0             OK          28 degrees C / 82 degrees F
SFB 1 IntakeB-Zone1             OK          29 degrees C / 84 degrees F
SFB 1 Exhaust-Zone0             OK          31 degrees C / 87 degrees F
SFB 1 SFB-XF2-Zone1             OK          56 degrees C / 132 degrees F
SFB 1 SFB-XF1-Zone0             OK          47 degrees C / 116 degrees F
SFB 1 SFB-XF0-Zone0             OK          47 degrees C / 116 degrees F
SFB 2 Intake-Zone0              OK          33 degrees C / 91 degrees F
SFB 2 Exhaust-Zone1             OK          38 degrees C / 100 degrees F
SFB 2 IntakeA-Zone0             OK          29 degrees C / 84 degrees F
SFB 2 IntakeB-Zone1             OK          29 degrees C / 84 degrees F
SFB 2 Exhaust-Zone0             OK          33 degrees C / 91 degrees F
SFB 2 SFB-XF2-Zone1             OK          58 degrees C / 136 degrees F
SFB 2 SFB-XF1-Zone0             OK          49 degrees C / 120 degrees F
SFB 2 SFB-XF0-Zone0             OK          49 degrees C / 120 degrees F
SFB 3 Intake-Zone0              OK          44 degrees C / 111 degrees F
```

```
SFB 3 Exhaust-Zone1          OK          40 degrees C / 104 degrees F
SFB 3 IntakeA-Zone0          OK          36 degrees C / 96 degrees F
SFB 3 IntakeB-Zone1          OK          31 degrees C / 87 degrees F
SFB 3 Exhaust-Zone0          OK          38 degrees C / 100 degrees F
SFB 3 SFB-XF2-Zone1          OK          60 degrees C / 140 degrees F
SFB 3 SFB-XF1-Zone0          OK          52 degrees C / 125 degrees F
SFB 3 SFB-XF0-Zone0          OK          59 degrees C / 138 degrees F
SFB 4 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 4 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 4 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 4 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 4 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 4 SFB-XF1-Zone0          OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF0-Zone0          OK          45 degrees C / 113 degrees F
SFB 5 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1          OK          36 degrees C / 96 degrees F
SFB 5 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 5 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 5 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
SFB 5 SFB-XF0-Zone0          OK          50 degrees C / 122 degrees F
SFB 6 Intake-Zone0           OK          41 degrees C / 105 degrees F
SFB 6 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 6 IntakeA-Zone0          OK          32 degrees C / 89 degrees F
SFB 6 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 6 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 6 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 6 SFB-XF1-Zone0          OK          60 degrees C / 140 degrees F
SFB 6 SFB-XF0-Zone0          OK          60 degrees C / 140 degrees F
SFB 7 Intake-Zone0           OK          41 degrees C / 105 degrees F
SFB 7 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 7 IntakeA-Zone0          OK          33 degrees C / 91 degrees F
SFB 7 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 7 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 7 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 7 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
SFB 7 SFB-XF0-Zone0          OK          57 degrees C / 134 degrees F
SFB 0 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 0 Exhaust-Zone1          OK          38 degrees C / 100 degrees F
SFB 0 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 0 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
```

```
SFB 0 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 0 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 0 SFB-XF1-Zone0          OK          48 degrees C / 118 degrees F
SFB 0 SFB-XF0-Zone0          OK          47 degrees C / 116 degrees F
SFB 1 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 1 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 1 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 1 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 1 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 1 SFB-XF2-Zone1          OK          56 degrees C / 132 degrees F
SFB 1 SFB-XF1-Zone0          OK          47 degrees C / 116 degrees F
SFB 1 SFB-XF0-Zone0          OK          47 degrees C / 116 degrees F
SFB 2 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 2 Exhaust-Zone1          OK          38 degrees C / 100 degrees F
SFB 2 IntakeA-Zone0          OK          29 degrees C / 84 degrees F
SFB 2 IntakeB-Zone1          OK          29 degrees C / 84 degrees F
SFB 2 Exhaust-Zone0          OK          33 degrees C / 91 degrees F
SFB 2 SFB-XF2-Zone1          OK          58 degrees C / 136 degrees F
SFB 2 SFB-XF1-Zone0          OK          49 degrees C / 120 degrees F
SFB 2 SFB-XF0-Zone0          OK          49 degrees C / 120 degrees F
SFB 3 Intake-Zone0           OK          44 degrees C / 111 degrees F
SFB 3 Exhaust-Zone1          OK          40 degrees C / 104 degrees F
SFB 3 IntakeA-Zone0          OK          36 degrees C / 96 degrees F
SFB 3 IntakeB-Zone1          OK          31 degrees C / 87 degrees F
SFB 3 Exhaust-Zone0          OK          38 degrees C / 100 degrees F
SFB 3 SFB-XF2-Zone1          OK          60 degrees C / 140 degrees F
SFB 3 SFB-XF1-Zone0          OK          52 degrees C / 125 degrees F
SFB 3 SFB-XF0-Zone0          OK          59 degrees C / 138 degrees F
SFB 4 Intake-Zone0           OK          32 degrees C / 89 degrees F
SFB 4 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 4 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 4 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 4 Exhaust-Zone0          OK          31 degrees C / 87 degrees F
SFB 4 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 4 SFB-XF1-Zone0          OK          46 degrees C / 114 degrees F
SFB 4 SFB-XF0-Zone0          OK          45 degrees C / 113 degrees F
SFB 5 Intake-Zone0           OK          33 degrees C / 91 degrees F
SFB 5 Exhaust-Zone1          OK          36 degrees C / 96 degrees F
SFB 5 IntakeA-Zone0          OK          28 degrees C / 82 degrees F
SFB 5 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 5 Exhaust-Zone0          OK          32 degrees C / 89 degrees F
SFB 5 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
```

```
      SFB 5 SFB-XF0-Zone0          OK         50 degrees C / 122 degrees F
      SFB 6 Intake-Zone0           OK         41 degrees C / 105 degrees F
      SFB 6 Exhaust-Zone1          OK         37 degrees C / 98 degrees F
      SFB 6 IntakeA-Zone0          OK         32 degrees C / 89 degrees F
      SFB 6 IntakeB-Zone1          OK         29 degrees C / 84 degrees F
      SFB 6 Exhaust-Zone0          OK         37 degrees C / 98 degrees F
      SFB 6 SFB-XF2-Zone1          OK         55 degrees C / 131 degrees F
      SFB 6 SFB-XF1-Zone0          OK         60 degrees C / 140 degrees F
      SFB 6 SFB-XF0-Zone0          OK         60 degrees C / 140 degrees F
      SFB 7 Intake-Zone0           OK         41 degrees C / 105 degrees F
      SFB 7 Exhaust-Zone1          OK         37 degrees C / 98 degrees F
      SFB 7 IntakeA-Zone0          OK         33 degrees C / 91 degrees F
      SFB 7 IntakeB-Zone1          OK         29 degrees C / 84 degrees F
      SFB 7 Exhaust-Zone0          OK         37 degrees C / 98 degrees F
      SFB 7 SFB-XF2-Zone1          OK         55 degrees C / 131 degrees F
      SFB 7 SFB-XF1-Zone0          OK         50 degrees C / 122 degrees F
      SFB 7 SFB-XF0-Zone0          OK         57 degrees C / 134 degrees F
Fans  Fan Tray 0 Fan 1             OK         3480 RPM
      Fan Tray 0 Fan 2             OK         3600 RPM
      Fan Tray 0 Fan 3             OK         3480 RPM
      Fan Tray 0 Fan 4             OK         3360 RPM
      Fan Tray 0 Fan 5             OK         3360 RPM
      Fan Tray 0 Fan 6             OK         3360 RPM
      Fan Tray 1 Fan 1             OK         3480 RPM
      Fan Tray 1 Fan 2             OK         3480 RPM
      Fan Tray 1 Fan 3             OK         3360 RPM
      Fan Tray 1 Fan 4             OK         3480 RPM
      Fan Tray 1 Fan 5             OK         3480 RPM
      Fan Tray 1 Fan 6             OK         3360 RPM
      Fan Tray 2 Fan 1             OK         2760 RPM
      Fan Tray 2 Fan 2             OK         2760 RPM
      Fan Tray 2 Fan 3             OK         2760 RPM
      Fan Tray 2 Fan 4             OK         2640 RPM
      Fan Tray 2 Fan 5             OK         2760 RPM
      Fan Tray 2 Fan 6             OK         2640 RPM
      Fan Tray 3 Fan 1             OK         3600 RPM
      Fan Tray 3 Fan 2             OK         3600 RPM
      Fan Tray 3 Fan 3             OK         3480 RPM
      Fan Tray 3 Fan 4             OK         3480 RPM
      Fan Tray 3 Fan 5             OK         3360 RPM
      Fan Tray 3 Fan 6             OK         3480 RPM
```

For monitoring the temperature of specific items in the MX2020 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         23 degrees C / 73 degrees F
      CB 0 IntakeB-Zone1             OK         29 degrees C / 84 degrees F
      CB 0 IntakeC-Zone0             OK         26 degrees C / 78 degrees F
      CB 0 ExhaustA-Zone0            OK         25 degrees C / 77 degrees F
      CB 0 ExhaustB-Zone1            OK         27 degrees C / 80 degrees F
      CB 0 TCBC-Zone0                OK         32 degrees C / 89 degrees F
      CB 1 IntakeA-Zone0             OK         22 degrees C / 71 degrees F
      CB 1 IntakeB-Zone1             OK         23 degrees C / 73 degrees F
      CB 1 IntakeC-Zone0             OK         26 degrees C / 78 degrees F
      CB 1 ExhaustA-Zone0            OK         25 degrees C / 77 degrees F
      CB 1 ExhaustB-Zone1            OK         24 degrees C / 75 degrees F
      CB 1 TCBC-Zone0                OK         28 degrees C / 82 degrees F
      SPMB 0 Intake                  OK         30 degrees C / 86 degrees F
      SPMB 1 Intake                  OK         23 degrees C / 73 degrees F
      Routing Engine 0 CPU           OK         31 degrees C / 87 degrees F
      Routing Engine 1 CPU           OK         25 degrees C / 77 degrees F
      SFB 3 Intake-Zone0             OK         42 degrees C / 107 degrees F
      SFB 3 Exhaust-Zone1            OK         41 degrees C / 105 degrees F
      SFB 3 IntakeA-Zone0            OK         35 degrees C / 95 degrees F
      SFB 3 IntakeB-Zone1            OK         31 degrees C / 87 degrees F
      SFB 3 Exhaust-Zone0            OK         39 degrees C / 102 degrees F
      SFB 3 SFB-XF2-Zone1            OK         64 degrees C / 147 degrees F
      SFB 3 SFB-XF1-Zone0            OK         55 degrees C / 131 degrees F
      SFB 3 SFB-XF0-Zone0            OK         62 degrees C / 143 degrees F
      SFB 4 Intake-Zone0             OK         33 degrees C / 91 degrees F
      SFB 4 Exhaust-Zone1            OK         39 degrees C / 102 degrees F
      SFB 4 IntakeA-Zone0            OK         29 degrees C / 84 degrees F
      SFB 4 IntakeB-Zone1            OK         29 degrees C / 84 degrees F
      SFB 4 Exhaust-Zone0            OK         33 degrees C / 91 degrees F
      SFB 4 SFB-XF2-Zone1            OK         58 degrees C / 136 degrees F
      SFB 4 SFB-XF1-Zone0            OK         48 degrees C / 118 degrees F
      SFB 4 SFB-XF0-Zone0            OK         46 degrees C / 114 degrees F
      SFB 5 Intake-Zone0             OK         33 degrees C / 91 degrees F
      SFB 5 Exhaust-Zone1            OK         37 degrees C / 98 degrees F
      SFB 5 IntakeA-Zone0            OK         27 degrees C / 80 degrees F
      SFB 5 IntakeB-Zone1            OK         28 degrees C / 82 degrees F
      SFB 5 Exhaust-Zone0            OK         32 degrees C / 89 degrees F
```

```
SFB 5 SFB-XF2-Zone1          OK          54 degrees C / 129 degrees F
SFB 5 SFB-XF1-Zone0          OK          50 degrees C / 122 degrees F
SFB 5 SFB-XF0-Zone0          OK          51 degrees C / 123 degrees F
SFB 6 Intake-Zone0           OK          39 degrees C / 102 degrees F
SFB 6 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 6 IntakeA-Zone0          OK          30 degrees C / 86 degrees F
SFB 6 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 6 Exhaust-Zone0          OK          37 degrees C / 98 degrees F
SFB 6 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 6 SFB-XF1-Zone0          OK          61 degrees C / 141 degrees F
SFB 6 SFB-XF0-Zone0          OK          62 degrees C / 143 degrees F
SFB 7 Intake-Zone0           OK          35 degrees C / 95 degrees F
SFB 7 Exhaust-Zone1          OK          37 degrees C / 98 degrees F
SFB 7 IntakeA-Zone0          OK          32 degrees C / 89 degrees F
SFB 7 IntakeB-Zone1          OK          28 degrees C / 82 degrees F
SFB 7 Exhaust-Zone0          OK          33 degrees C / 91 degrees F
SFB 7 SFB-XF2-Zone1          OK          55 degrees C / 131 degrees F
SFB 7 SFB-XF1-Zone0          OK          49 degrees C / 120 degrees F
SFB 7 SFB-XF0-Zone0          OK          48 degrees C / 118 degrees F
FPC 4 Intake                 OK          28 degrees C / 82 degrees F
FPC 4 Exhaust A              OK          28 degrees C / 82 degrees F
FPC 4 Exhaust B              OK          29 degrees C / 84 degrees F
FPC 4 LU 0 TSen              OK          47 degrees C / 116 degrees F
FPC 4 LU 0 Chip              OK          46 degrees C / 114 degrees F
FPC 4 LU 1 TSen              OK          47 degrees C / 116 degrees F
FPC 4 LU 1 Chip              OK          48 degrees C / 118 degrees F
FPC 4 LU 2 TSen              OK          47 degrees C / 116 degrees F
FPC 4 LU 2 Chip              OK          37 degrees C / 98 degrees F
FPC 4 LU 3 TSen              OK          47 degrees C / 116 degrees F
FPC 4 LU 3 Chip              OK          42 degrees C / 107 degrees F
FPC 4 XM 0 TSen              OK          47 degrees C / 116 degrees F
FPC 4 XM 0 Chip              OK          57 degrees C / 134 degrees F
FPC 4 XM 1 TSen              OK          47 degrees C / 116 degrees F
FPC 4 XM 1 Chip              OK          46 degrees C / 114 degrees F
FPC 4 PLX Switch TSen        OK          47 degrees C / 116 degrees F
FPC 4 PLX Switch Chip        OK          40 degrees C / 104 degrees F
FPC 7 Intake                 OK          30 degrees C / 86 degrees F
FPC 7 Exhaust A              OK          44 degrees C / 111 degrees F
FPC 7 Exhaust B              OK          53 degrees C / 127 degrees F
FPC 7 LU 0 TSen              OK          42 degrees C / 107 degrees F
FPC 7 LU 0 Chip              OK          55 degrees C / 131 degrees F
FPC 7 LU 1 TSen              OK          42 degrees C / 107 degrees F
FPC 7 LU 1 Chip              OK          43 degrees C / 109 degrees F
```

```
        FPC 7 LU 2 TSen               OK          42 degrees C / 107 degrees F
        FPC 7 LU 2 Chip               OK          50 degrees C / 122 degrees F
        FPC 7 LU 3 TSen               OK          42 degrees C / 107 degrees F
        FPC 7 LU 3 Chip               OK          59 degrees C / 138 degrees F
        FPC 7 XM 0 TSen               OK          42 degrees C / 107 degrees F
        FPC 7 XM 0 Chip               OK          51 degrees C / 123 degrees F
        FPC 7 XF 0 TSen               OK          42 degrees C / 107 degrees F
        FPC 7 XF 0 Chip               OK          65 degrees C / 149 degrees F
        FPC 7 PLX Switch TSen         OK          42 degrees C / 107 degrees F
        FPC 7 PLX Switch Chip         OK          44 degrees C / 111 degrees F
        FPC 11 Intake                 OK          32 degrees C / 89 degrees F
        FPC 11 Exhaust A              OK          37 degrees C / 98 degrees F
        FPC 11 Exhaust B              OK          35 degrees C / 95 degrees F
        FPC 11 QX 0 TSen              OK          48 degrees C / 118 degrees F
        FPC 11 QX 0 Chip              OK          53 degrees C / 127 degrees F
        FPC 11 LU 0 TCAM TSen         OK          48 degrees C / 118 degrees F
        FPC 11 LU 0 TCAM Chip         OK          45 degrees C / 113 degrees F
        FPC 11 LU 0 TSen              OK          48 degrees C / 118 degrees F
        FPC 11 LU 0 Chip              OK          48 degrees C / 118 degrees F
        FPC 11 MQ 0 TSen              OK          48 degrees C / 118 degrees F
        FPC 11 MQ 0 Chip              OK          47 degrees C / 116 degrees F
        FPC 11 QX 1 TSen              OK          42 degrees C / 107 degrees F
        FPC 11 QX 1 Chip              OK          44 degrees C / 111 degrees F
        FPC 11 LU 1 TCAM TSen         OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 TCAM Chip         OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 TSen              OK          42 degrees C / 107 degrees F
        FPC 11 LU 1 Chip              OK          44 degrees C / 111 degrees F
        FPC 11 MQ 1 TSen              OK          42 degrees C / 107 degrees F
        FPC 11 MQ 1 Chip              OK          45 degrees C / 113 degrees F
        FPC 16 Intake                 OK          35 degrees C / 95 degrees F
        FPC 16 Exhaust A              OK          44 degrees C / 111 degrees F
        FPC 16 Exhaust B              Absent
        FPC 16 LU TSen                OK          50 degrees C / 122 degrees F
        FPC 16 LU Chip                OK          55 degrees C / 131 degrees F
        FPC 16 XM TSen                OK          50 degrees C / 122 degrees F
        FPC 16 XM Chip                OK          63 degrees C / 145 degrees F
        FPC 16 PCIe TSen              OK          50 degrees C / 122 degrees F
        FPC 16 PCIe Chip              OK          63 degrees C / 145 degrees F
        FPC 18 Intake                 OK          31 degrees C / 87 degrees F
        FPC 18 Exhaust A              OK          39 degrees C / 102 degrees F
        FPC 18 Exhaust B              OK          40 degrees C / 104 degrees F
        FPC 18 LU 0 TSen              OK          43 degrees C / 109 degrees F
        FPC 18 LU 0 Chip              OK          41 degrees C / 105 degrees F
```

```
      FPC 18 LU 1 TSen              OK          43 degrees C / 109 degrees F
      FPC 18 LU 1 Chip              OK          48 degrees C / 118 degrees F
      FPC 18 LU 2 TSen              OK          43 degrees C / 109 degrees F
      FPC 18 LU 2 Chip              OK          41 degrees C / 105 degrees F
      FPC 18 LU 3 TSen              OK          43 degrees C / 109 degrees F
      FPC 18 LU 3 Chip              OK          42 degrees C / 107 degrees F
      FPC 18 MQ 0 TSen              OK          38 degrees C / 100 degrees F
      FPC 18 MQ 0 Chip              OK          39 degrees C / 102 degrees F
      FPC 18 MQ 1 TSen              OK          38 degrees C / 100 degrees F
      FPC 18 MQ 1 Chip              OK          43 degrees C / 109 degrees F
      FPC 18 MQ 2 TSen              OK          38 degrees C / 100 degrees F
      FPC 18 MQ 2 Chip              OK          35 degrees C / 95 degrees F
      FPC 18 MQ 3 TSen              OK          38 degrees C / 100 degrees F
      FPC 18 MQ 3 Chip              OK          39 degrees C / 102 degrees F
      ADC 4 Intake                  OK          28 degrees C / 82 degrees F
      ADC 4 Exhaust                 OK          36 degrees C / 96 degrees F
      ADC 4 ADC-XF1                 OK          44 degrees C / 111 degrees F
      ADC 4 ADC-XF0                 OK          50 degrees C / 122 degrees F
      ADC 7 Intake                  OK          28 degrees C / 82 degrees F
      ADC 7 Exhaust                 OK          39 degrees C / 102 degrees F
      ADC 7 ADC-XF1                 OK          41 degrees C / 105 degrees F
      ADC 7 ADC-XF0                 OK          51 degrees C / 123 degrees F
      ADC 11 Intake                 OK          34 degrees C / 93 degrees F
      ADC 11 Exhaust                OK          32 degrees C / 89 degrees F
      ADC 11 ADC-XF1                OK          45 degrees C / 113 degrees F
      ADC 11 ADC-XF0                OK          49 degrees C / 120 degrees F
      ADC 16 Intake                 OK          43 degrees C / 109 degrees F
      ADC 16 Exhaust                OK          33 degrees C / 91 degrees F
      ADC 16 ADC-XF1                OK          52 degrees C / 125 degrees F
      ADC 16 ADC-XF0                OK          54 degrees C / 129 degrees F
      ADC 18 Intake                 OK          39 degrees C / 102 degrees F
      ADC 18 Exhaust                OK          34 degrees C / 93 degrees F
      ADC 18 ADC-XF1                OK          49 degrees C / 120 degrees F
      ADC 18 ADC-XF0                OK          54 degrees C / 129 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
SPMB 1 Intake	56	62	75	63	83	76	95
SFB 0 Intake-Zone0	56	62	75	63	90	76	95
SFB 0 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 0 IntakeA-Zone0	56	62	75	63	90	76	95
SFB 0 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 0 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 0 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 0 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 0 SFB-XF0-Zone0	70	80	90	90	107	107	115
SFB 1 Intake-Zone0	56	62	75	63	90	76	95
SFB 1 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 1 IntakeA-Zone0	56	62	75	63	90	76	95
SFB 1 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 1 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 1 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 1 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 1 SFB-XF0-Zone0	70	80	90	90	107	107	115
SFB 2 Intake-Zone0	56	62	75	63	90	76	95
SFB 2 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 2 IntakeA-Zone0	56	62	75	63	90	76	95
SFB 2 IntakeB-Zone1	56	62	75	63	90	76	95
SFB 2 Exhaust-Zone0	56	62	75	63	90	76	95
SFB 2 SFB-XF2-Zone1	70	80	90	90	107	107	115
SFB 2 SFB-XF1-Zone0	70	80	90	90	107	107	115
SFB 2 SFB-XF0-Zone0	70	80	90	90	107	107	115
SFB 3 Intake-Zone0	56	62	75	63	90	76	95
SFB 3 Exhaust-Zone1	56	62	75	63	90	76	95
SFB 3 IntakeA-Zone0	56	62	75	63	90	76	95

```
SFB 3 IntakeB-Zone1          56   62   75   63    90    76    95
SFB 3 Exhaust-Zone0          56   62   75   63    90    76    95
SFB 3 SFB-XF2-Zone1          70   80   90   90   107   107   115
SFB 3 SFB-XF1-Zone0          70   80   90   90   107   107   115
SFB 3 SFB-XF0-Zone0          70   80   90   90   107   107   115
SFB 4 Intake-Zone0           56   62   75   63    90    76    95
SFB 4 Exhaust-Zone1          56   62   75   63    90    76    95
SFB 4 IntakeA-Zone0          56   62   75   63    90    76    95
SFB 4 IntakeB-Zone1          56   62   75   63    90    76    95
SFB 4 Exhaust-Zone0          56   62   75   63    90    76    95
SFB 4 SFB-XF2-Zone1          70   80   90   90   107   107   115
SFB 4 SFB-XF1-Zone0          70   80   90   90   107   107   115
SFB 4 SFB-XF0-Zone0          70   80   90   90   107   107   115
SFB 5 Intake-Zone0           56   62   75   63    90    76    95
SFB 5 Exhaust-Zone1          56   62   75   63    90    76    95
SFB 5 IntakeA-Zone0          56   62   75   63    90    76    95
SFB 5 IntakeB-Zone1          56   62   75   63    90    76    95
SFB 5 Exhaust-Zone0          56   62   75   63    90    76    95
SFB 5 SFB-XF2-Zone1          70   80   90   90   107   107   115
SFB 5 SFB-XF1-Zone0          70   80   90   90   107   107   115
SFB 5 SFB-XF0-Zone0          70   80   90   90   107   107   115
SFB 6 Intake-Zone0           56   62   75   63    90    76    95
SFB 6 Exhaust-Zone1          56   62   75   63    90    76    95
SFB 6 IntakeA-Zone0          56   62   75   63    90    76    95
SFB 6 IntakeB-Zone1          56   62   75   63    90    76    95
SFB 6 Exhaust-Zone0          56   62   75   63    90    76    95
SFB 6 SFB-XF2-Zone1          70   80   90   90   107   107   115
SFB 6 SFB-XF1-Zone0          70   80   90   90   107   107   115
SFB 6 SFB-XF0-Zone0          70   80   90   90   107   107   115
SFB 7 Intake-Zone0           56   62   75   63    90    76    95
SFB 7 Exhaust-Zone1          56   62   75   63    90    76    95
SFB 7 IntakeA-Zone0          56   62   75   63    90    76    95
SFB 7 IntakeB-Zone1          56   62   75   63    90    76    95
SFB 7 Exhaust-Zone0          56   62   75   63    90    76    95
SFB 7 SFB-XF2-Zone1          70   80   90   90   107   107   115
SFB 7 SFB-XF1-Zone0          70   80   90   90   107   107   115
SFB 7 SFB-XF0-Zone0          70   80   90   90   107   107   115
FPC 4                        55   60   75   65    95    80   100
FPC 7                        55   60   75   65    90    80    95
FPC 11                       55   60   75   65    90    80    95
FPC 16                       55   60   75   65    90    80    95
FPC 18                       55   60   75   65    90    80    95
ADC 4 Intake                 56   62   75   63    83    76    95
```

```
ADC 4 Exhaust                 56    62       75       63       83       76       95
ADC 4 ADC-XF1                 70    80       90       90      107      107      115
ADC 4 ADC-XF0                 70    80       90       90      107      107      115
ADC 7 Intake                  56    62       75       63       83       76       95
ADC 7 Exhaust                 56    62       75       63       83       76       95
ADC 7 ADC-XF1                 70    80       90       90      107      107      115
ADC 7 ADC-XF0                 70    80       90       90      107      107      115
ADC 11 Intake                 56    62       75       63       83       76       95
ADC 11 Exhaust                56    62       75       63       83       76       95
ADC 11 ADC-XF1                70    80       90       90      107      107      115
ADC 11 ADC-XF0                70    80       90       90      107      107      115
ADC 16 Intake                 56    62       75       63       83       76       95
ADC 16 Exhaust                56    62       75       63       83       76       95
ADC 16 ADC-XF1                70    80       90       90      107      107      115
ADC 16 ADC-XF0                70    80       90       90      107      107      115
ADC 18 Intake                 56    62       75       63       83       76       95
ADC 18 Exhaust                56    62       75       63       83       76       95
ADC 18 ADC-XF1                70    80       90       90      107      107      115
ADC 18 ADC-XF0                70    80       90       90      107      107      115
```

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       38%       3480 RPM
      Fan Tray 0 Fan 2          OK       37%       3360 RPM
      Fan Tray 0 Fan 3          OK       37%       3360 RPM
      Fan Tray 0 Fan 4          OK       37%       3360 RPM
      Fan Tray 0 Fan 5          OK       37%       3360 RPM
      Fan Tray 0 Fan 6          OK       37%       3360 RPM
      Fan Tray 1 Fan 1          OK       37%       3360 RPM
      Fan Tray 1 Fan 2          OK       38%       3480 RPM
      Fan Tray 1 Fan 3          OK       37%       3360 RPM
      Fan Tray 1 Fan 4          OK       37%       3360 RPM
      Fan Tray 1 Fan 5          OK       38%       3480 RPM
      Fan Tray 1 Fan 6          OK       38%       3480 RPM
      Fan Tray 2 Fan 1          OK       30%       2760 RPM
      Fan Tray 2 Fan 2          OK       29%       2640 RPM
      Fan Tray 2 Fan 3          OK       30%       2760 RPM
      Fan Tray 2 Fan 4          OK       29%       2640 RPM
      Fan Tray 2 Fan 5          OK       29%       2640 RPM
      Fan Tray 2 Fan 6          OK       29%       2640 RPM
```

```
Fan Tray 3 Fan 1          OK        38%       3480 RPM
Fan Tray 3 Fan 2          OK        40%       3600 RPM
Fan Tray 3 Fan 3          OK        38%       3480 RPM
Fan Tray 3 Fan 4          OK        38%       3480 RPM
Fan Tray 3 Fan 5          OK        38%       3480 RPM
Fan Tray 3 Fan 6          OK        38%       3480 RPM
```

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

- MX2020 Cooling System Description | **83**
- Troubleshooting the MX2020 Cooling System | **851**
- MX2020 Component LEDs on the Craft Interface
- Replacing an MX2020 Fan Tray | **588**

Maintaining the MX2020 Cooling System Zones

IN THIS SECTION

Purpose

For optimum router performance, verify the status of the two cooling zones of the chassis. Both Zone 0 and Zone 1 cool the Control Board and Routing Engine (CB-RE). Zone 1 consist of ten MPCs (**10** through **19**) and their respective MICs, along with the top half of the CB-REs and SFBs. Zone 1 is cooled by fan trays **2** and **3**. Zone 0 consists of ten MPCs (**0** through **9**), and their respective MICs, along with the bottom half of CB-REs and SFBs. Zone 0 is cooled by fan trays **0** and **1**. 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.

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                 FPC 9
    Temperature                 62 degrees C / 143 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              30

ZONE 1 Status
    Driving FRU                 FPC 19
    Temperature                 64 degrees C / 147 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              30
```

SEE ALSO

MX2020 Cooling System Description | 83

RELATED DOCUMENTATION

MX2020 Cooling System Description | 83

Maintaining the MX2020 Cooling System Zones

IN THIS SECTION

Purpose

For optimum router performance, verify the status of the two cooling zones of the chassis. Both Zone 0 and Zone 1 cool the Control Board and Routing Engine (CB-RE). Zone 1 consist of ten MPCs (**10** through **19**) and their respective MICs, along with the top half of the CB-REs and SFBs. Zone 1 is cooled by fan trays **2** and **3**. Zone 0 consists of ten MPCs (**0** through **9**), and their respective MICs, along with the bottom half of CB-REs and SFBs. Zone 0 is cooled by fan trays **0** and **1**. 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.

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                 FPC 9
    Temperature                 62 degrees C / 143 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
```

```
    Fan Duty Cycle              30

ZONE 1 Status
    Driving FRU                 FPC 19
    Temperature                 64 degrees C / 147 degrees F
    Condition                   WARM TEMP
    Num Fans Missing            0
    Num Fans Failed             0
    Fan Duty Cycle              30
```

RELATED DOCUMENTATION

MX2020 Cooling System Description | 83

CHAPTER 26

Installing, Removing, and Maintaining Host Subsystem Components

IN THIS CHAPTER

Maintaining the MX2020 Host Subsystem

IN THIS SECTION

Maintaining the MX2020 Routing Engines

IN THIS SECTION

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 "MX2020 Craft Interface Description" on page 68.

> **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 Board.

For optimum router performance, verify the condition of the Routing Engines and the CB-REs.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs, and the display, see "MX2020 Craft Interface Description" on page 68. 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 Board.

  - 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                 36 degrees C / 96 degrees F
    CPU temperature             31 degrees C / 87 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                     9009099715
    Start time                    2012-12-02 23:37:00 PST
    Uptime                        10 hours, 16 minutes, 36 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                 28 degrees C / 82 degrees F
    CPU temperature             26 degrees C / 78 degrees F
    DRAM                      3313
    Memory utilization          22 percent
    CPU utilization:
      User                        0 percent
      Background                  0 percent
      Kernel                      0 percent
      Interrupt                   0 percent
      Idle                      100 percent
    Model                         RE-S-1800x4
    Serial ID                     9009099711
```

```
Start time                    2012-11-30 15:56:39 PST
Uptime                        2 days, 17 hours, 56 minutes, 36 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 output from the command, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

- *MX2000 Host Subsystem CB-RE Description*
- *MX2000 Switch Fabric Board LED*
- Troubleshooting the MX2020 Host Subsystems | **853**

Maintaining the MX2020 Control Boards

IN THIS SECTION

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 *MX2000 Switch Fabric Board LED*.

  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  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
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- *MX2000 Host Subsystem CB-RE Description*
- MX2020 Component LEDs on the Craft Interface
- Troubleshooting the MX2020 Host Subsystems | **853**

Replacing an MX2000 SFB

IN THIS SECTION

Removing an MX2000 SFB

To remove an SFB (see Figure 287 on page 652 and Figure 288 on page 653):

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 287: Removing an SFB (MX2010)

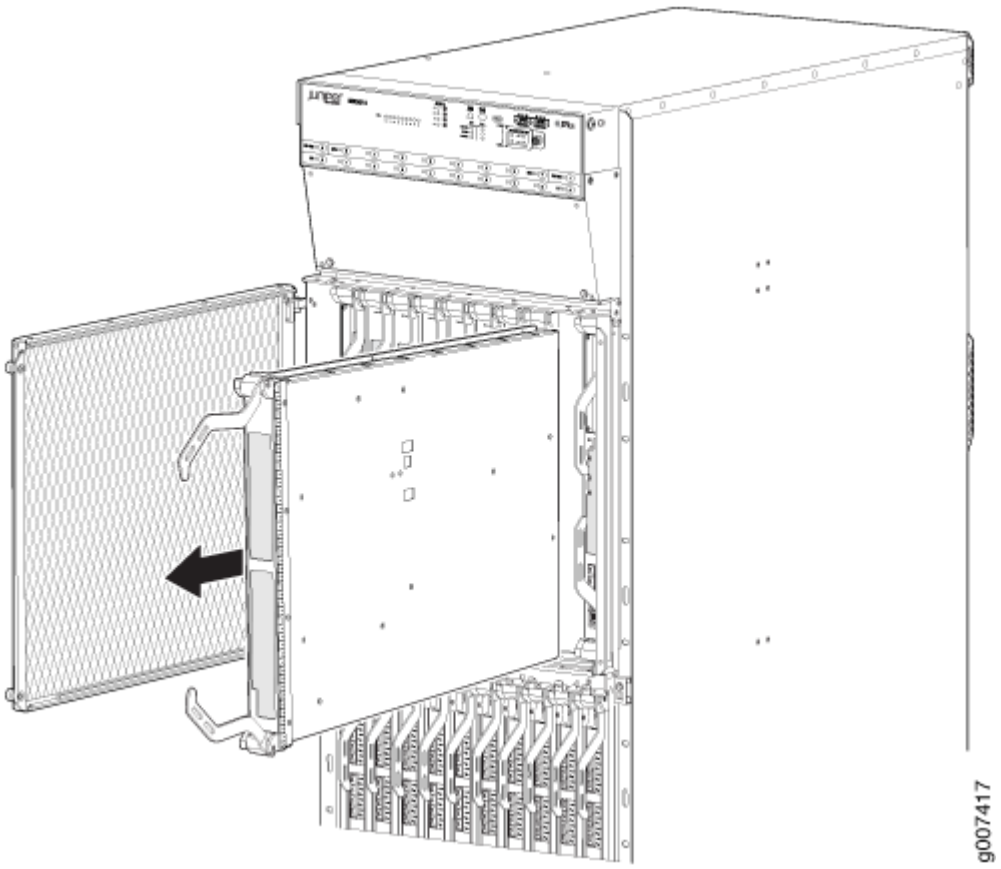
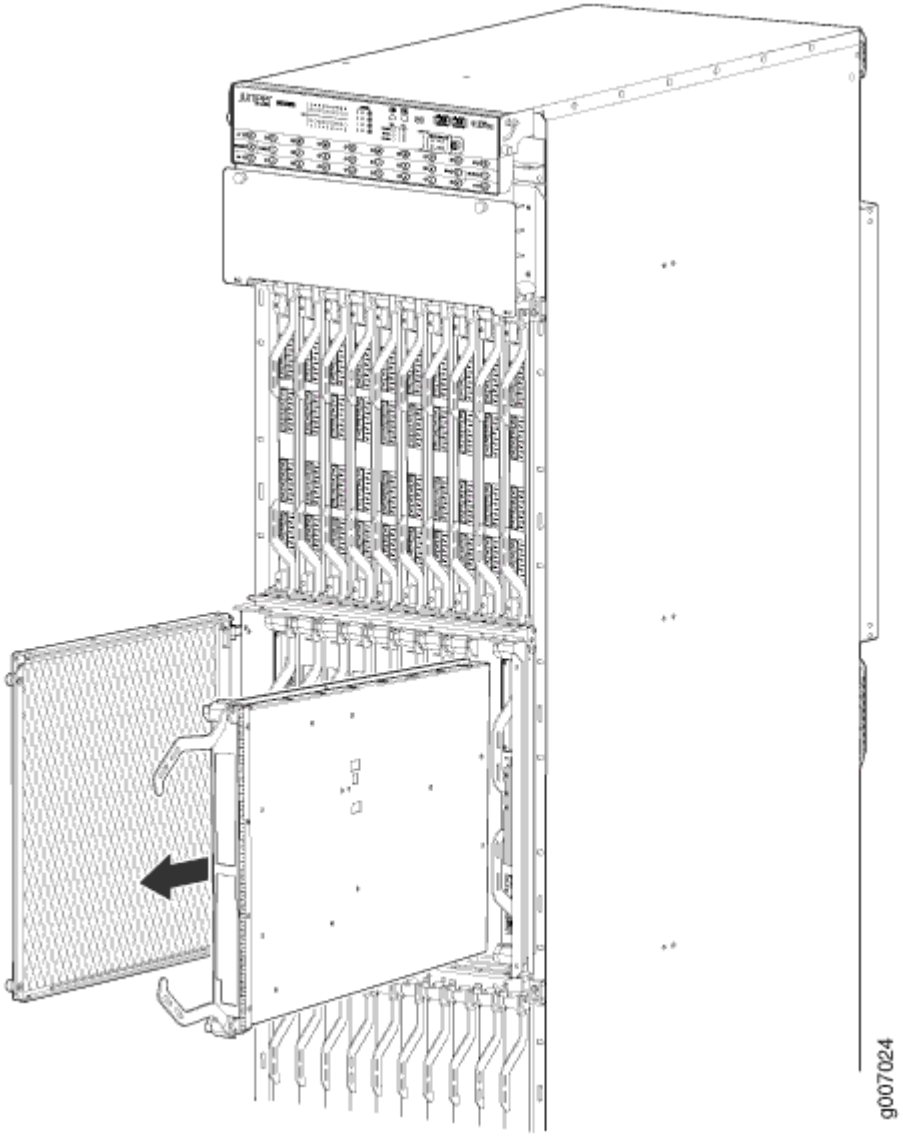


Figure 288: Removing an SFB (MX2020)



SEE ALSO

Maintaining the MX2010 SFB

Installing an MX2000 SFB

Installing an MX2000 SFB

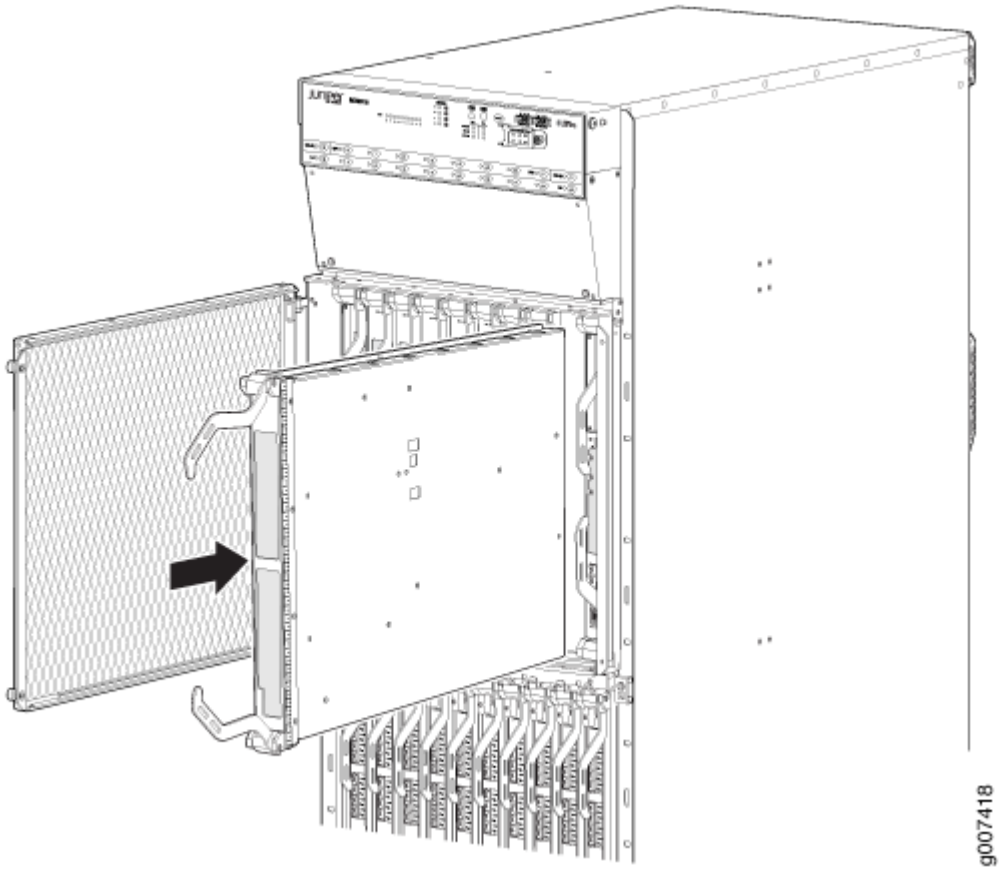
To install an SFB (see Figure 289 on page 654):

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 289: 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 870.
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*
- *MX2000-SFB2-S Enhanced Switch Fabric Board Description*
- MX2000-SFB3 Switch Fabric Board Description

Maintaining the Switch Fabric Board (SFB)

IN THIS SECTION

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 bi-color **OK/FAIL** LED on the SFB faceplate is lit green steadily.
- The bi-color **OK/FAIL** LED on the SFB faceplate is blinking green.
- The bi-color **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              1 hour, 11 minutes, 22 seconds
 1    Online              1 hour, 11 minutes, 11 seconds
 2    Online              1 hour, 11 minutes, 1 second
 3    Online              1 hour, 10 minutes, 50 seconds
 4    Online              1 hour, 10 minutes, 39 seconds
 5    Online              1 hour, 10 minutes, 28 seconds
 6    Online              1 hour, 10 minutes, 18 seconds
 7    Online              1 hour, 10 minutes, 7 seconds
```

For further description of the output from the commands, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Removing a Switch Fabric Board (SFB)

Replacing an MX2000 CB-RE

IN THIS SECTION

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 290: Removing a CB-RE (MX2010)

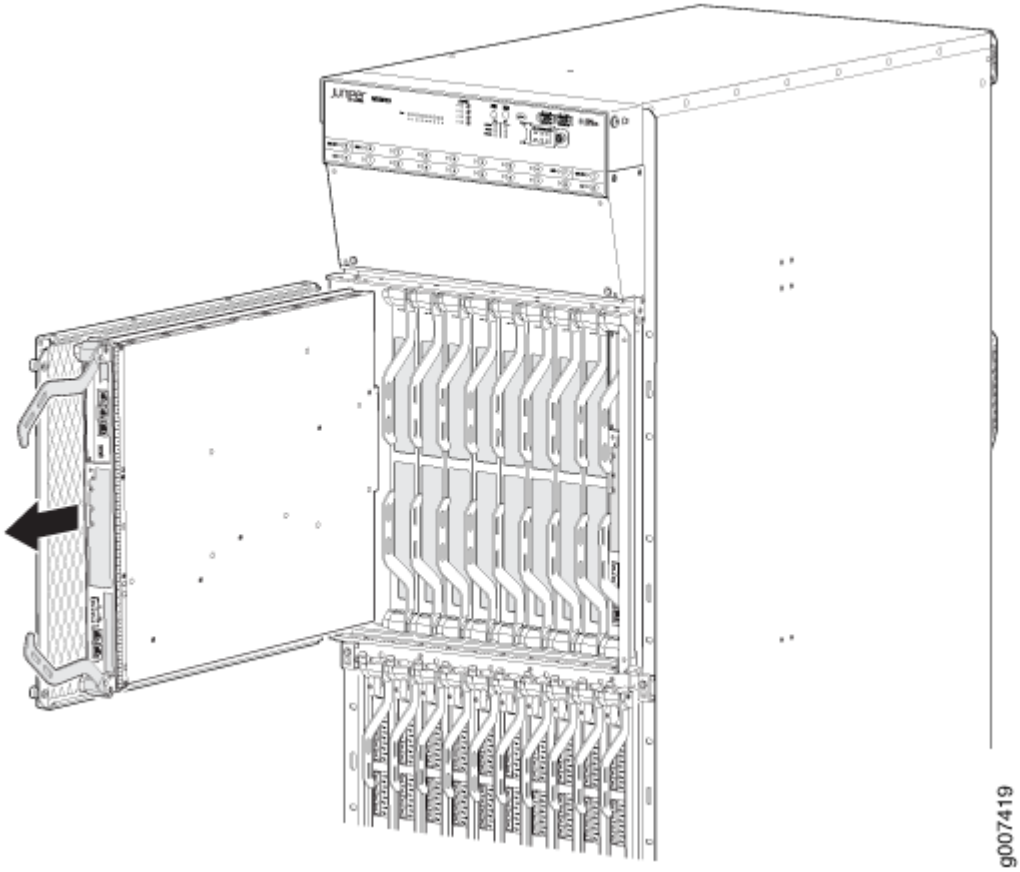
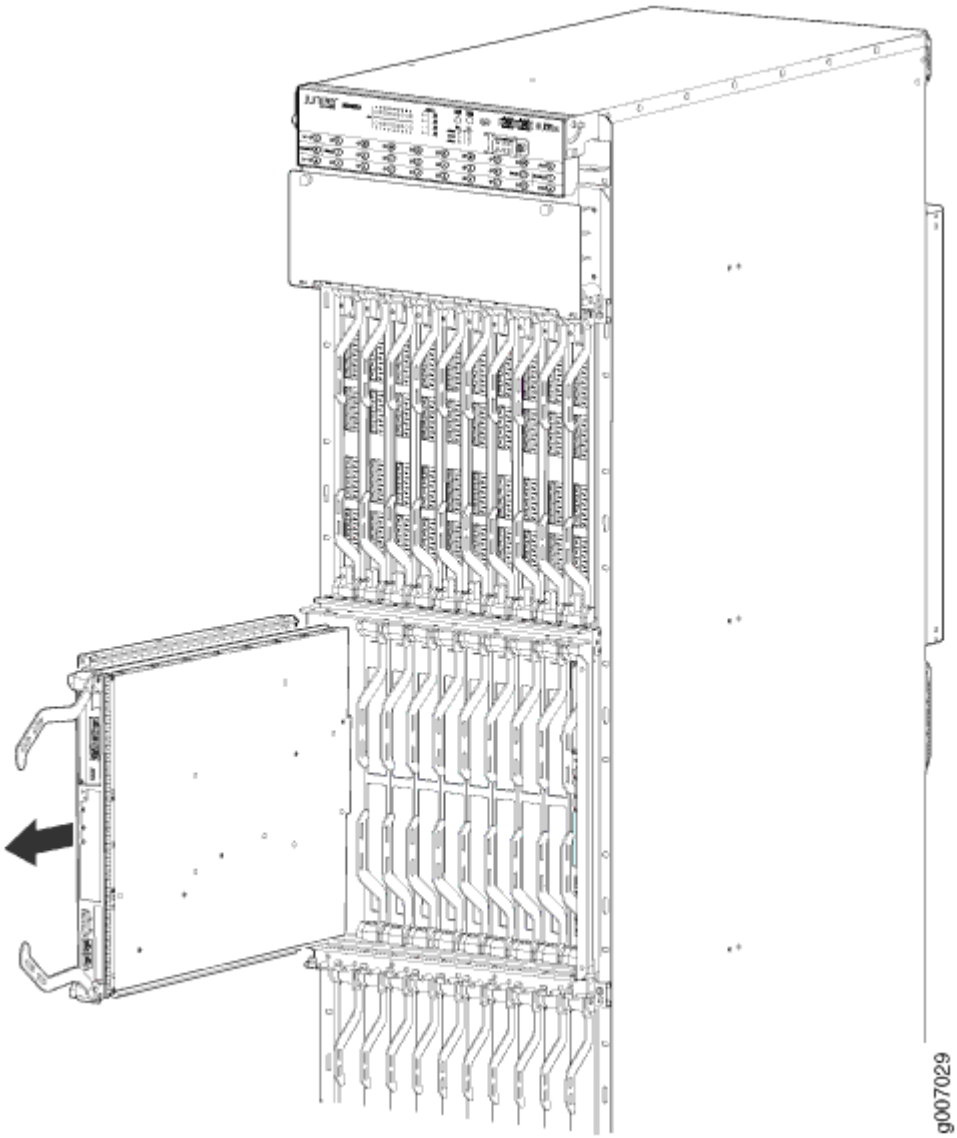


Figure 291: Removing a CB-RE (MX2020)



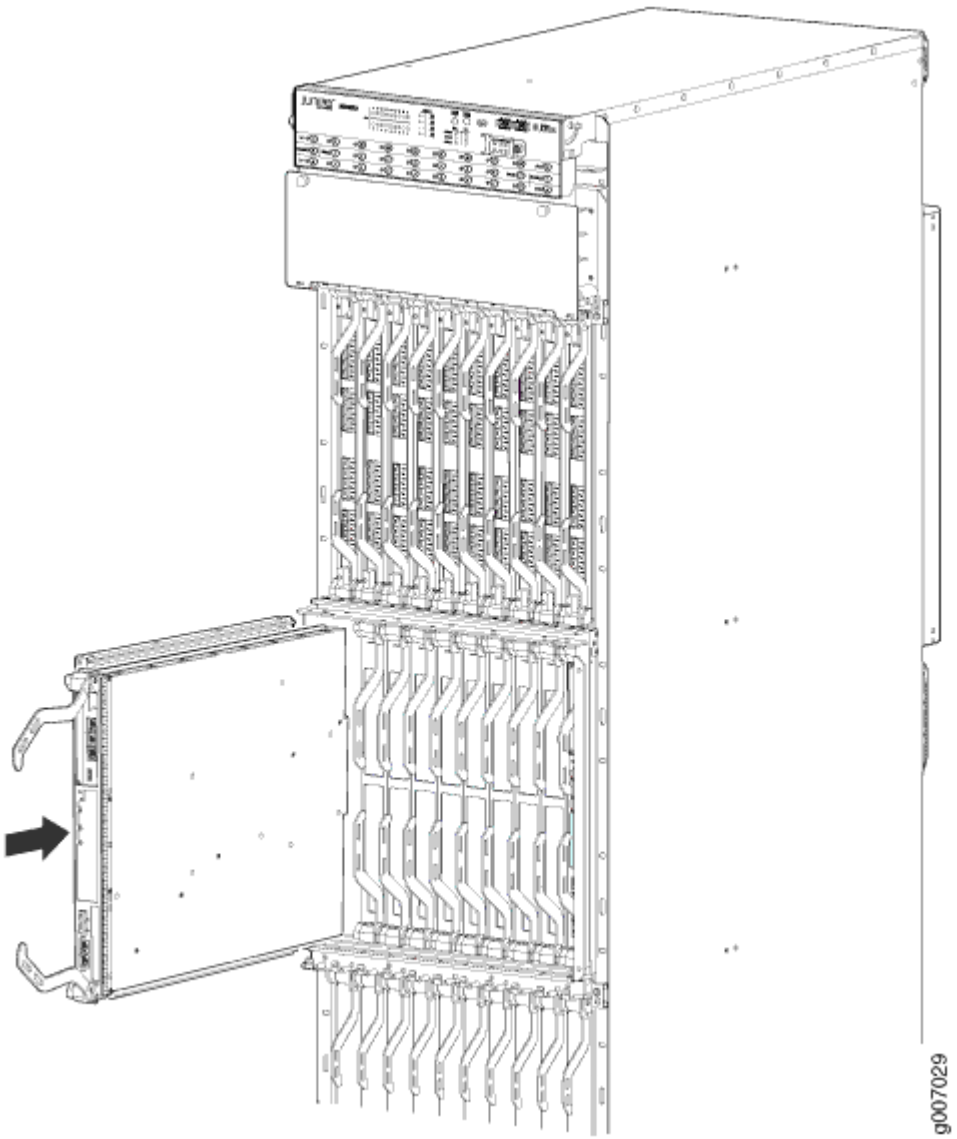
Installing an MX2020 CB-RE

To install a CB-RE (see Figure 292 on page 666):

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 292: 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

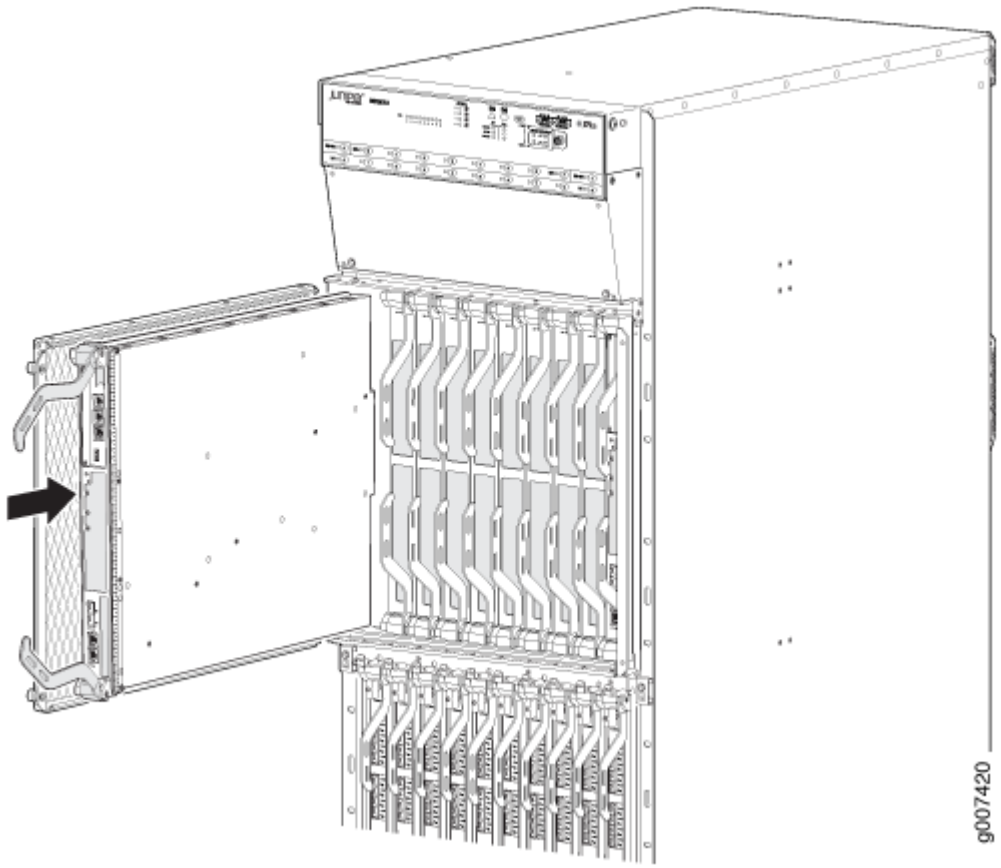
To install a CB-RE (seeFigure 293 on page 670):

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 293: Installing an MX2010 CB-RE



RELATED DOCUMENTATION

- *MX2000 Host Subsystem CB-RE Description*
- *CB-RE LEDs*
- *Taking an MX2000 Host Subsystem Offline*
- *RE-MX2000-1800x4 CB-RE Description*
- *REMX2K-X8-64G and REMX2K-X8-64G-LT CB-RE Description*
- *Prevention of Electrostatic Discharge Damage*

Maintaining the MX2020 Control Boards

IN THIS SECTION

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 *MX2000 Switch Fabric Board LED*.

  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  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
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

Maintaining the MX2020 Routing Engines

IN THIS SECTION

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 "MX2020 Craft Interface Description" on page 68.

> **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 Board.

For optimum router performance, verify the condition of the Routing Engines and the CB-REs.

Action

On a regular basis:

- Check the host subsystem LEDs on the craft interface. For more information about the LEDs, and the display, see "MX2020 Craft Interface Description" on page 68. 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 Board.

  - 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                 36 degrees C / 96 degrees F
    CPU temperature             31 degrees C / 87 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                     9009099715
    Start time                    2012-12-02 23:37:00 PST
    Uptime                        10 hours, 16 minutes, 36 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                 28 degrees C / 82 degrees F
    CPU temperature             26 degrees C / 78 degrees F
    DRAM                      3313
    Memory utilization          22 percent
    CPU utilization:
      User                        0 percent
      Background                  0 percent
      Kernel                      0 percent
      Interrupt                   0 percent
      Idle                      100 percent
    Model                         RE-S-1800x4
    Serial ID                     9009099711
```

```
Start time                    2012-11-30 15:56:39 PST
Uptime                        2 days, 17 hours, 56 minutes, 36 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 output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description

MX2000 Switch Fabric Board LED

Troubleshooting the MX2020 Host Subsystems | **853**

Upgrading to the Control Board-Routing Engine REMX2K-X8-64G in a Redundant Host Subsystem

IN THIS SECTION

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 294 on page 677):

NOTE: Remove the CB-RE as a unit.

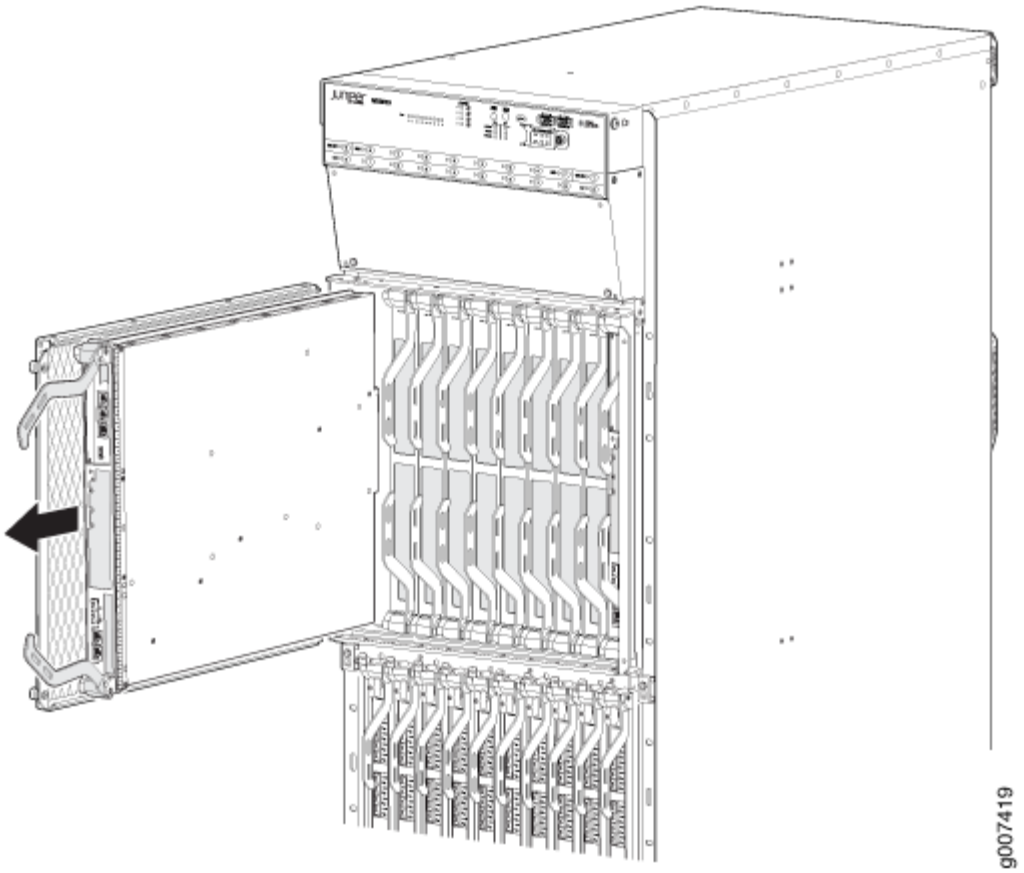
CAUTION: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

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 294: 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

Upgrading to the REMX2K-X8-64G CB-RE in a Nonredundant Host Subsystem

IN THIS SECTION

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 295 on page 681):

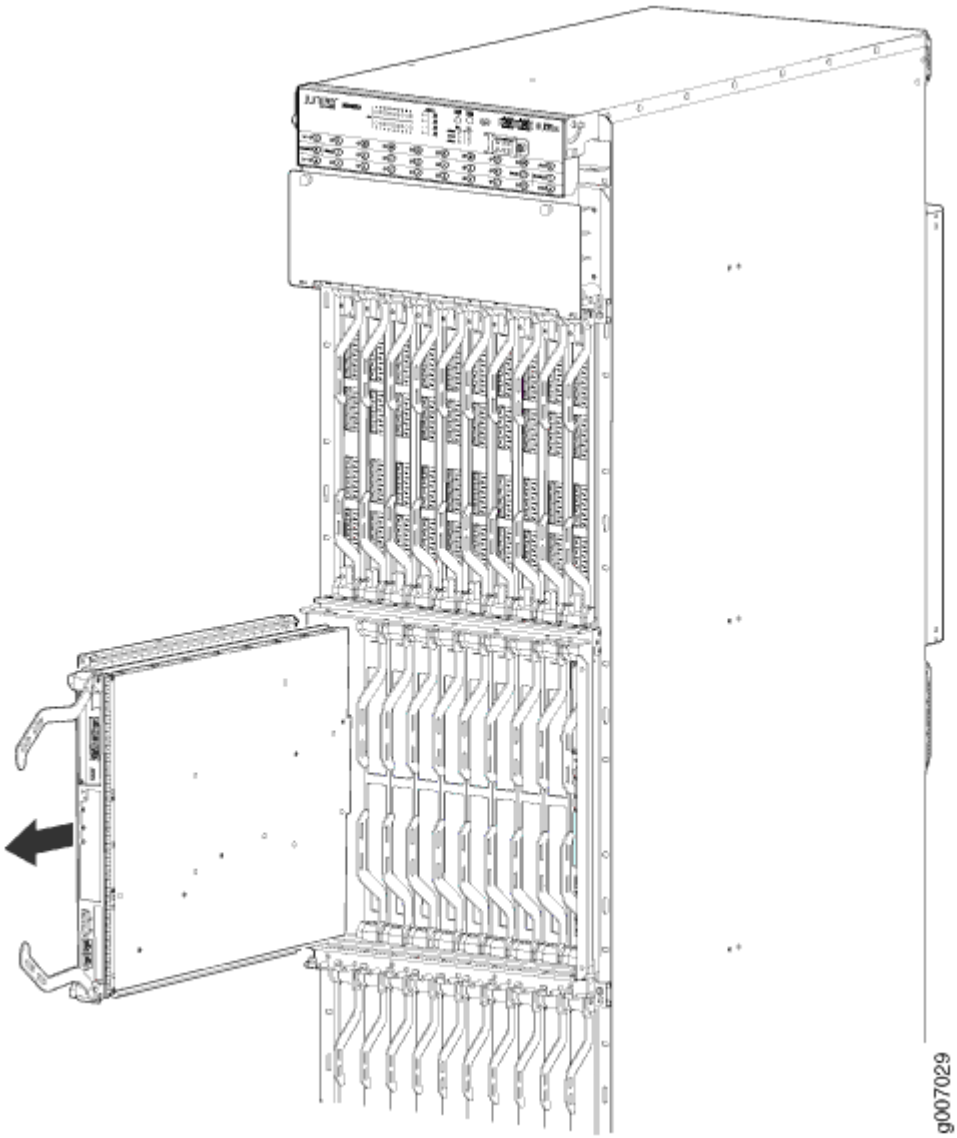
NOTE: Remove the CB-RE as a unit.

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 295: Removing a CB-RE



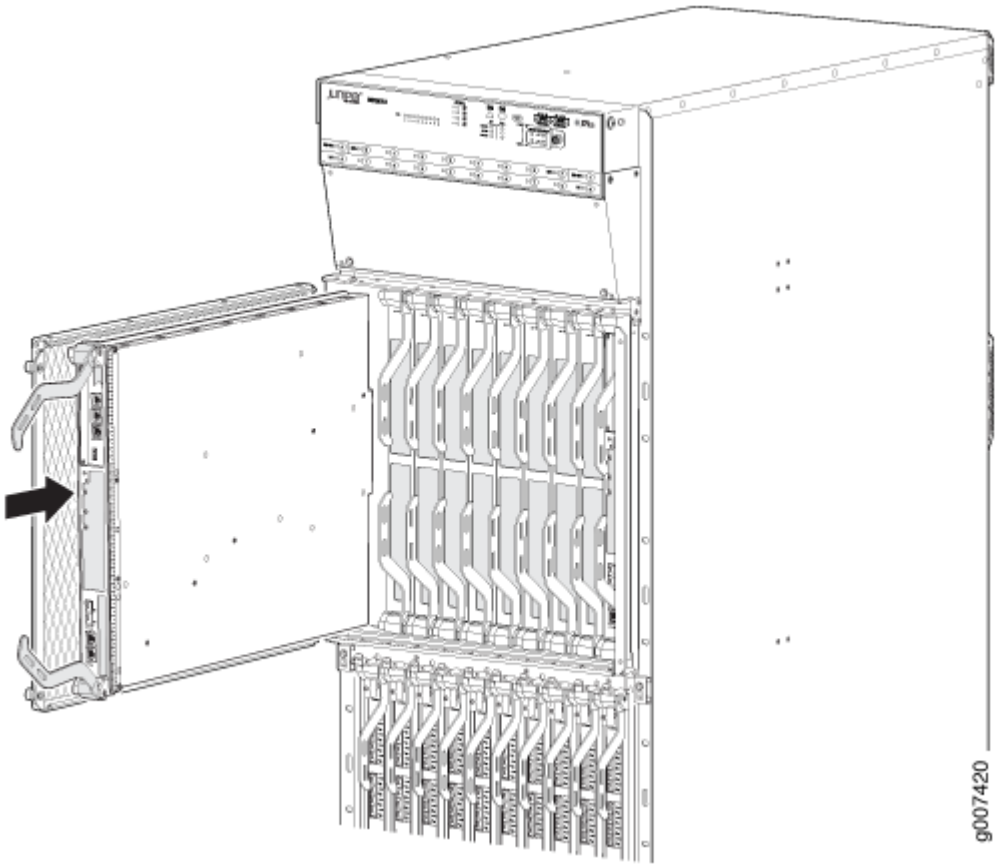
Installing the REMX2K-X8-64G CB-RE

To install the new REMX2K-X8-64G CB-RE (see Figure 296 on page 682):

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 296: 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*

Maintaining the MX2020 Switch Processor Mezzanine Board (SPMB)

IN THIS SECTION

Purpose

For optimum router performance, verify the switch processor mezzanine board status (SPMB).

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 output from the commands, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

Maintaining MX2020 Packet Forwarding Engine Components

IN THIS SECTION

Maintaining MX2020 MPCs

IN THIS SECTION

Purpose

The router can have up to 20 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  Empty
  1  Empty
  2  Empty
  3  Empty
  4  Online           28     11          0       2048       15         14
  5  Empty
  6  Empty
  7  Online           30      8          0       2048       14         13
  8  Online           29     10          0       2048       11         13
  9  Online           31     12          0       2048       16         14
 10  Present          28
```

```
 11  Online           38     16          2       2048       16         14
 12  Empty
 13  Empty
 14  Empty
 15  Online           36     11          0       2048       15         14
 16  Empty
 17  Empty
 18  Online           31     10          0       2048       18         13
 19  Empty
```

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 4 information:
  State                               Online
  Temperature                      28
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                11264 MB
  Start time:                         2012-11-26 16:20:07 PST
  Uptime:                             18 hours, 6 minutes, 1 second
  Max Power Consumption           610 Watts
Slot 7 information:
  State                               Online
  Temperature                      30
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                 6656 MB
  Start time:                         2012-11-26 16:20:12 PST
  Uptime:                             18 hours, 5 minutes, 56 seconds
  Max Power Consumption           520 Watts
Slot 8 information:
  State                               Online
  Temperature                      29
  Total CPU DRAM                 2048 MB
  Total RLDRAM                    662 MB
  Total DDR DRAM                 2560 MB
  Start time:                         2012-11-26 16:20:18 PST
  Uptime:                             18 hours, 5 minutes, 50 seconds
  Max Power Consumption           348 Watts
```

```
Slot 9 information:
  State                                Online
  Temperature                           31
  Total CPU DRAM                     2048 MB
  Total RLDRAM                       1036 MB
  Total DDR DRAM                    11264 MB
  Start time:                          2012-11-26 17:34:36 PST
  Uptime:                              16 hours, 51 minutes, 32 seconds
  Max Power Consumption               610 Watts
Slot 10 information:
  State                                Present
  Temperature                           28
  Total CPU DRAM                        0 MB
  Total RLDRAM                          0 MB
  Total DDR DRAM                        0 MB
  Max Power Consumption               440 Watts
Slot 11 information:
  State                                Online
  Temperature                           38
  Total CPU DRAM                     2048 MB
  Total RLDRAM                       1036 MB
  Total DDR DRAM                    11264 MB
  Start time:                          2012-11-26 16:20:33 PST
  Uptime:                              18 hours, 5 minutes, 35 seconds
  Max Power Consumption               610 Watts
Slot 15 information:
  State                                Online
  Temperature                           36
  Total CPU DRAM                     2048 MB
  Total RLDRAM                       1036 MB
  Total DDR DRAM                    11264 MB
  Start time:                          2012-11-26 16:20:40 PST
  Uptime:                              18 hours, 5 minutes, 28 seconds
  Max Power Consumption               610 Watts
Slot 18 information:
  State                                Online
  Temperature                           31
  Total CPU DRAM                     2048 MB
  Total RLDRAM                       1324 MB
  Total DDR DRAM                     5120 MB
  Start time:                          2012-11-26 16:20:46 PST
```

```
  Uptime:                                18 hours, 5 minutes, 22 seconds
  Max Power Consumption             440 Watts
```

- Issue the CLI `show chassis fpc pic-status` command. The MPC slots are numbered from **0** through **9** (bottom), and **10** through **19** (top), left to right:

```
user@host> show chassis fpc pic-status

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 7   Online       MPCE Type 3 3D
  PIC 0  Online       1X100GE CFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 8   Online       MPC Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       10x 1GE(LAN) SFP
  PIC 3  Online       10x 1GE(LAN) SFP
Slot 9   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 10  Present      MPC 3D 16x 10GE
Slot 11  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 15  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 18  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+
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

Tools and Parts Required to Maintain the MX2020 Hardware Components | **330**

MX2020 Chassis Description | **36**

MX2020 Modular Port Concentrator (MPC) Description | **138**

MX2020 Component LEDs on the Craft Interface

Troubleshooting a Modular Port Concentrator (MPC) | **856**

Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

Maintaining MX2020 MICs

IN THIS SECTION

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 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 7   Online       MPCE Type 3 3D
  PIC 0  Online       1X100GE CFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 8   Online       MPC Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       10x 1GE(LAN) SFP
  PIC 3  Online       10x 1GE(LAN) SFP
Slot 9   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 10  Present      MPC 3D 16x 10GE
Slot 11  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 15  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 18  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+
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

- Tools and Parts Required to Maintain the MX2020 Hardware Components | 330
- MX2000 Modular Interface Card (MIC) Description | 123
- Maintaining the MX2020 Ethernet Switch | 840
- MX2020 Modular Interface Card LEDs | 138
- Troubleshooting the MX2020 MICs | 854
- Replacing an MX2020 MIC | 720

Maintaining the MX2020 Ethernet Switch

IN THIS SECTION

Purpose

For optimum router performance, verify the status of the Gigabit Ethernet ports connected to MPC devices.

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 down on GE port 0 connected to device: FPC0
```

```
Link is down on GE port 1 connected to device: FPC1

Link is down on GE port 2 connected to device: FPC3

Link is down on GE port 3 connected to device: FPC2

Link is down on GE port 4 connected to device: FPC5

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 down on GE port 6 connected to device: FPC6

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 down on GE port 9 connected to device: FPC9

Link is down on GE port 10 connected to device: FPC10

Link is good on GE port 11 connected to device: FPC11
  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 12 connected to device: FPC13

Link is down on GE port 13 connected to device: FPC12

Link is down on GE port 14 connected to device: FPC14

Link is down on GE port 15 connected to device: FPC15

Link is down on GE port 16 connected to device: FPC17

Link is good on GE port 17 connected to device: FPC16
  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 18 connected to device: FPC18
  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 19 connected to device: FPC19

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 output from the command, see the *Junos OS System Basics and Services Command Reference*.

SEE ALSO

MX2000 Host Subsystem CB-RE Description

Troubleshooting the MX2020 Host Subsystems | 853

Maintaining Cables That Connect to MX2020 MPCs or MICs

IN THIS SECTION

Purpose

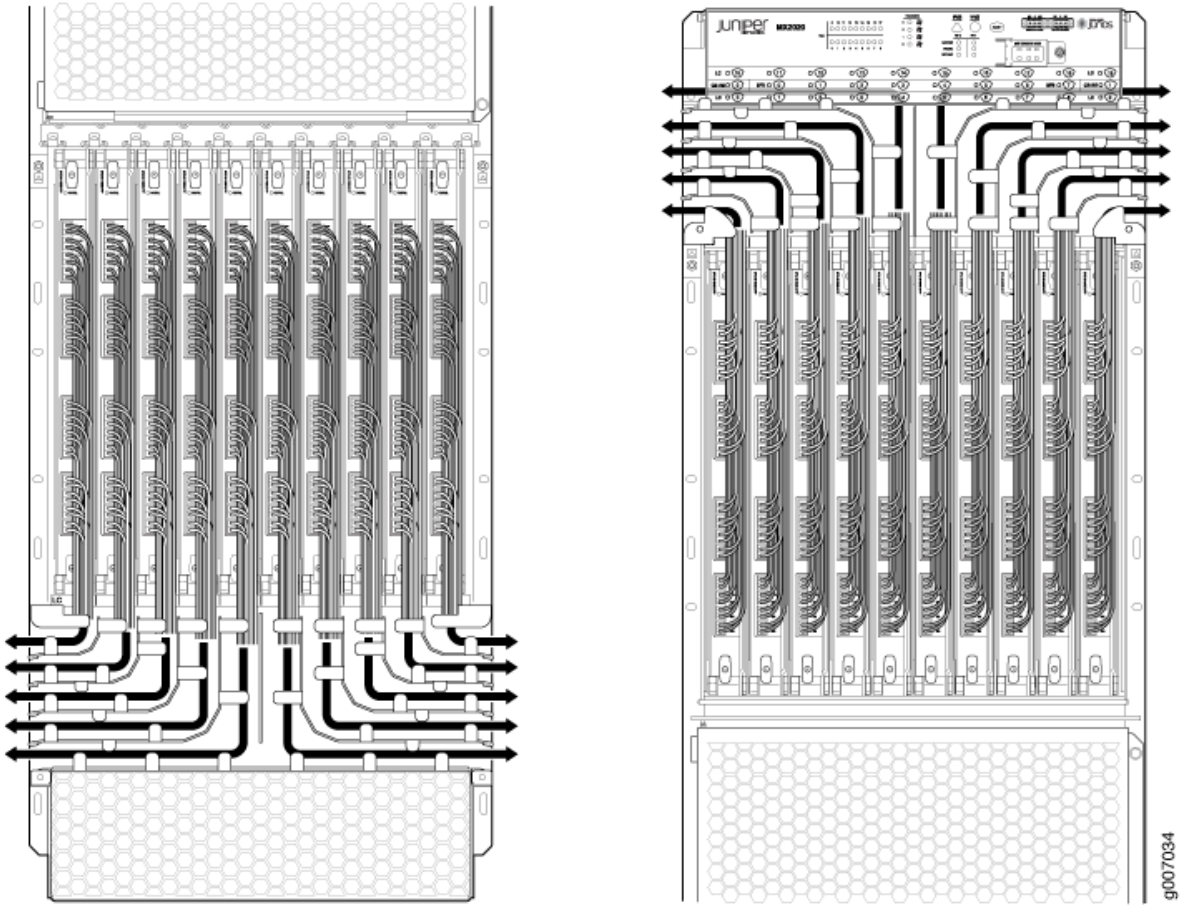
For optimum router performance, verify the condition of the cables that connect to the MPCs or MICs.

Action

On a regular basis:

- Use an upper cable manager and a lower cable manager (shown in Figure 297 on page 695) to support cables and prevent cables from dislodging or developing stress points.

Figure 297: Upper and Lower Cable Manager Cable Routing



NOTE: The MX2020 supports both standard and extended upper and lower cable management.

- Place excess cable out of the way in the upper and lower cable managers. 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 MX2020 Hardware Components | 330

MX2020 Cable Management Description | 74

Maintaining MX2020 MPCs | 714

Maintaining MX2020 MICs | 732

CHAPTER 27

Installing, Removing, and Maintaining Interface Modules— ADCs, MPCs, and MICs

IN THIS CHAPTER

Holding an MPC

When carrying a Modular Port Concentrator (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:

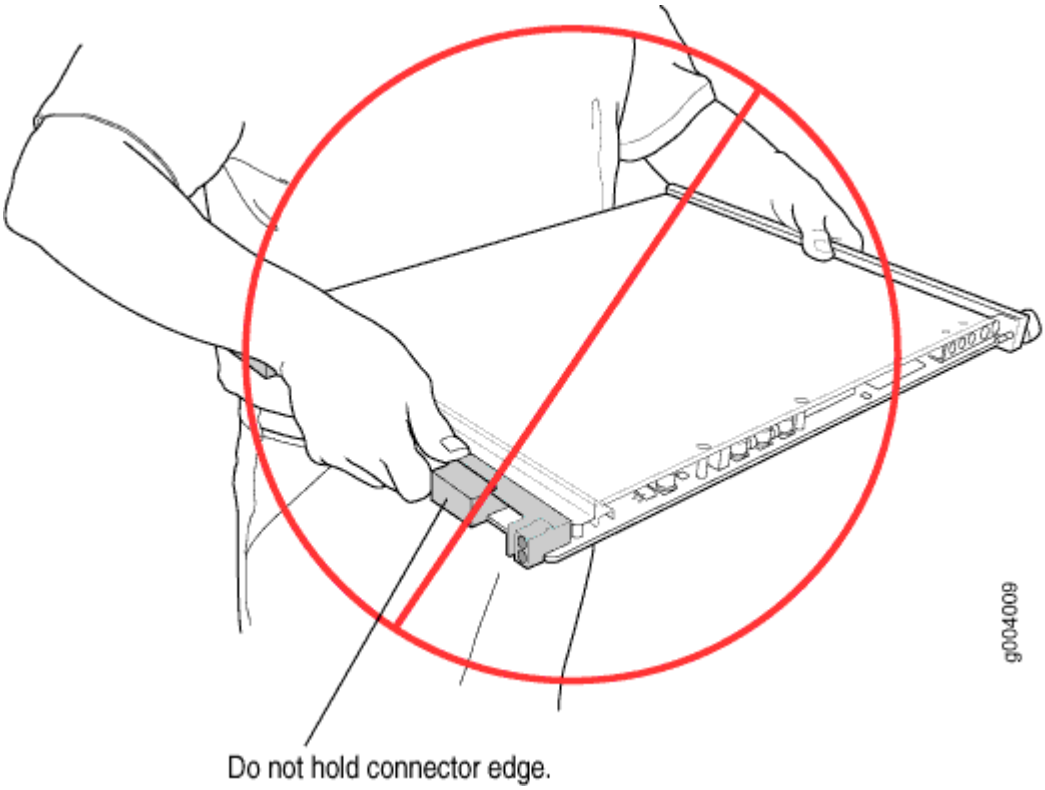
1. Orient the MPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

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 298: Do Not Grasp the Connector Edge

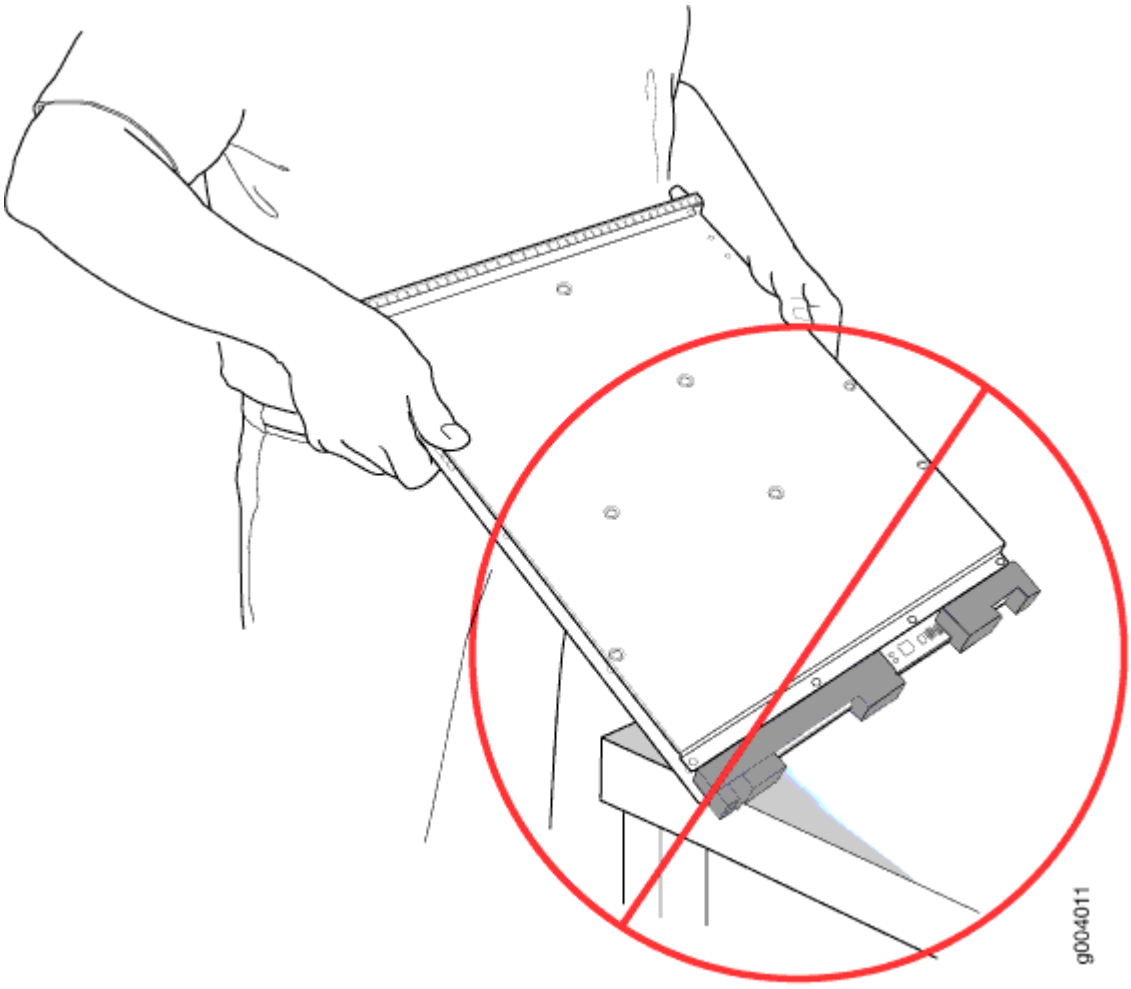


Never carry the MPC by the faceplate with only one hand.

Do not rest any edge of an MPC directly against a hard surface (see Figure 299 on page 700).

Do not stack MPCs.

Figure 299: 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

MPC Terminology | **150**

Storing an MX2020 MPC | **701**

Troubleshooting a Modular Port Concentrator (MPC) | **856**

Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

Storing an MX2020 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

MPC Terminology | **150**

Holding an MPC | **697**

Maintaining MX2020 MPCs | **714**

Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

Troubleshooting a Modular Port Concentrator (MPC) | **856**

Replacing an MX2020 MPC and Adapter Card (ADC)

IN THIS SECTION

The following MPCs require an Adapter Card (ADC):

- MPC1E
- MPC2E
- MPC3E
- MPC5E
- MPC7E

Removing an MX2020 MPC with Adapter Card

An MPC with an adapter card (ADC) weighs up to 25 lb (11.34 kg). Be prepared to accept its full weight.

To remove an MPC with an ADC:

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 issuing the `request chassis fpc offline` command, the FRU will lose power, and the system total power will increase.

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 ejector handles outward to unseat the MPC along with the ADC.
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 ADC 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 it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack the combined cards on top of one another after removal.

11. Place each one 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 ADC into the emptied slot within a short time, install a blank ADC 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 ADC from a different slot, or inserting an MPC and ADC into a different slot.

SEE ALSO

Installing an MX2020 MPC into an Adapter Card | 710

Removing an MX2020 MPC from the Adapter Card

An MPC without the ADC weighs up to 18.35 lb (8.32 kg). Be prepared to accept its full weight.

To remove an MPC from the ADC (see Figure 300 on page 706):

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 issuing the `request chassis fpc offline` command, the FRU will lose power, and the system total power will increase.

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 ADC.
9. Grasp both the knobs, and slide the MPC straight out of the ADC.
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 ADC.

CAUTION: The weight of the MPC without the ADC 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 ADC.

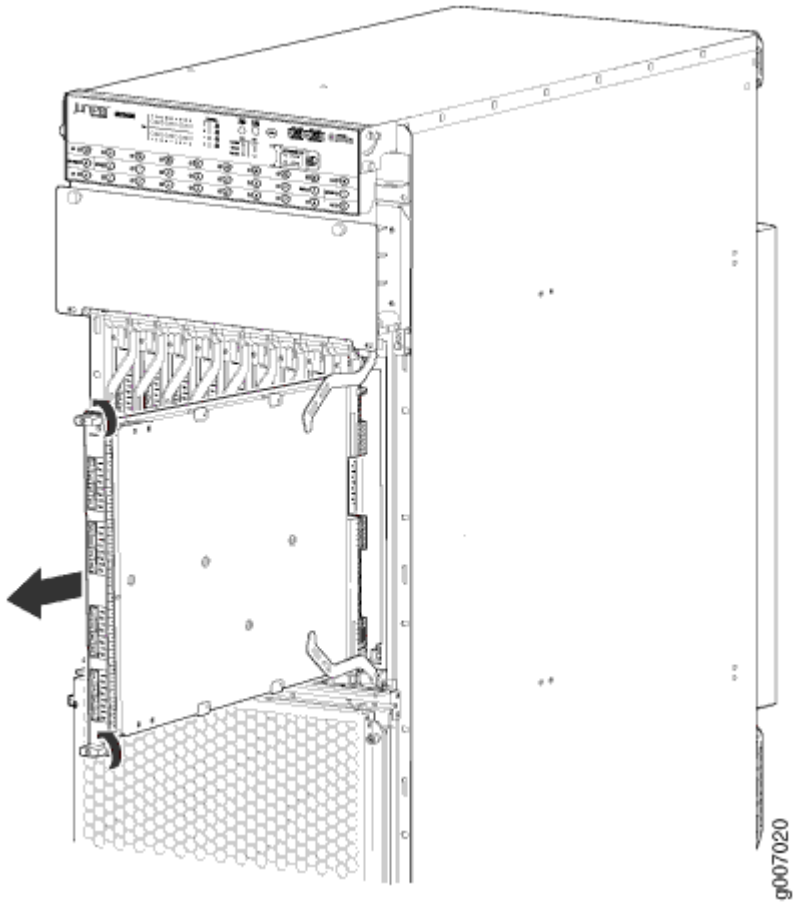
When the MPC is out of the ADC, do not hold it by the knobs, bus bars, or edge connectors. They cannot support its weight.

Do not stack MPCs on top of one another after removal.

11. Place each ADC 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 ADC, wait at least 30 seconds before reinserting it, removing an MPC from a different slot, or inserting an MPC into a different slot.

Figure 300: Removing an MPC from the ADC



SEE ALSO

Installing an MX2020 MPC into an Adapter Card | **710**

Removing an MX2020 Adapter Card

An ADC weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To remove an ADC:

1. Have ready a replacement ADC and an antistatic mat for the ADC.
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 MX2020 MPC from the Adapter Card" on page 704.
3. Issue the following CLI command to take the ADC offline:

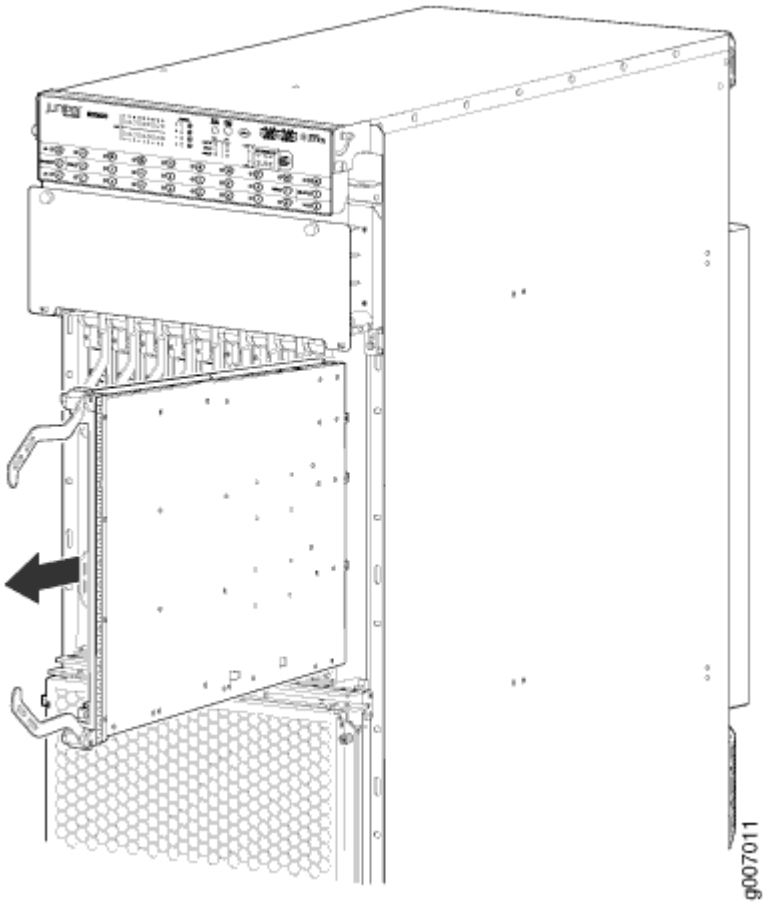
   ```
   user@host>request chassis fpc slot slot-number offline
   ```

   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

   NOTE: When issuing the `request chassis fpc offline` command, the FRU will lose power, and the system total power will increase.

4. Open the ejector handles outward simultaneously to unseat the ADC.
5. Grasp the ejector handles, and slide the ADC about halfway out of the chassis.
6. Place one hand underneath the ADC to support it, and slide it completely out of the chassis.
7. Place the ADC on the antistatic mat or into an antistatic bag.
8. If you are not replacing the ADC immediately, install a blank panel over the empty slot.

Figure 301: Removing an ADC



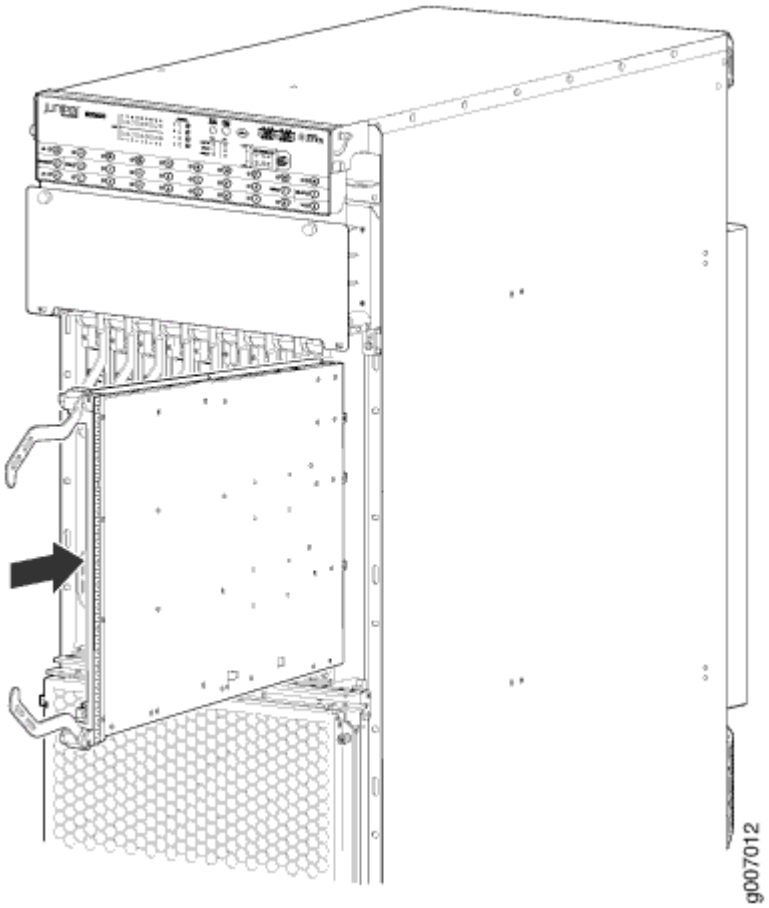
Installing an MX2020 Adapter Card (ADC)

An ADC weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To install an ADC (see Figure 302 on page 709):

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 ADC to be installed out of its electrostatic bag, and locate the slot in the card cage in which you plan to install the ADC..
3. Ensure that the ADC is right-side up, with the text on the faceplate facing upward.
4. Lift the ADC into place, and carefully align the sides of the ADC with the guides inside the card cage.
5. Slide the ADC all the way into the card cage until you feel resistance.
6. Grasp both ejector handles, and gently close them inward simultaneously until the ADC is fully seated.

Figure 302: Installing an ADC



7. Issue the following CLI command to bring the ADC online:

```
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 issuing the `request chassis fpc online` command, the FRU will gain power, and the system total power will decrease.

SEE ALSO

MX2000 Adapter Card (ADC) Description | 148

Maintaining MX2020 Adapter Cards | 718

Removing an MX2020 Adapter Card | 706

Installing an MX2020 MPC into an Adapter Card

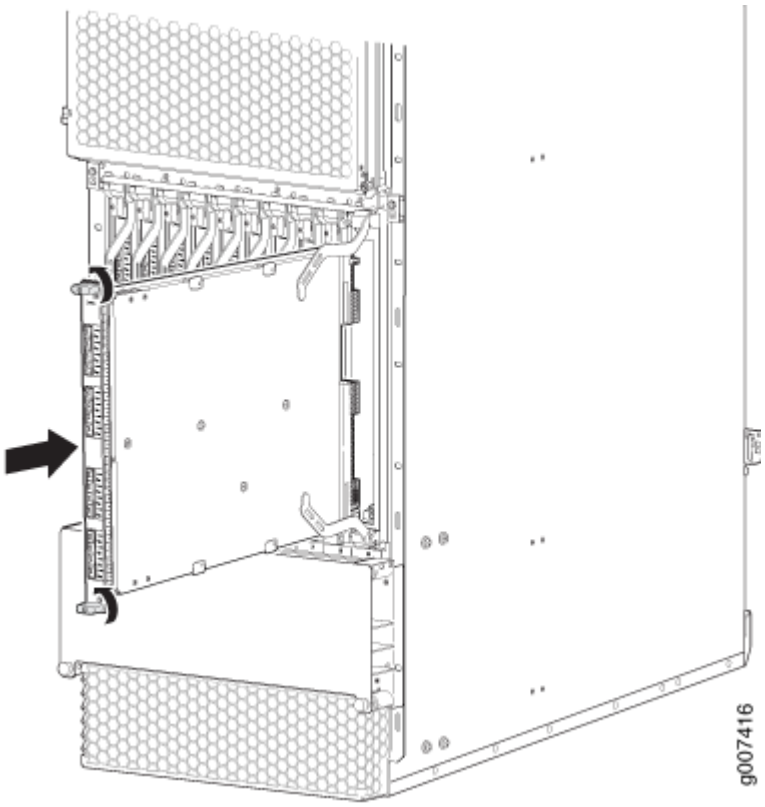
An MPC weighs up to 25 lb (11.34 kg). Be prepared to accept its full weight.

To install an MPC (see Figure 303 on page 711):

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 MPC has a rubber safety cap covering the transceiver. If it does not, cover the transceiver with a safety cap.
5. Locate the slot in the ADC in which you plan to install the MPC.
6. Ensure that the MPC is right-side up, with the text on the faceplate facing upward.
7. Lift the MPC into place, and carefully align first the bottom, then the top of the MPC with the guides inside the ADC.
8. Slide the MPC all the way into the ADC until you feel resistance.
9. Grasp both knobs, and rotate them clockwise simultaneously until the MPC is fully seated into the ADC.
10. Remove the rubber safety cap from each fiber-optic transceiver and cable.

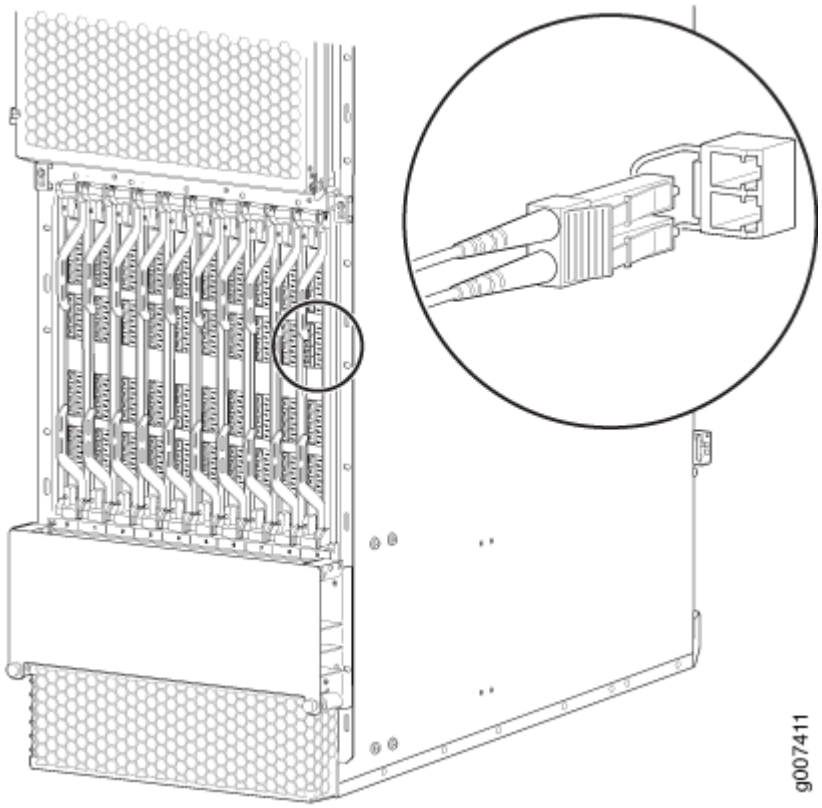
LASER WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

Figure 303: Installing an MPC into an ADC



11. Insert the cables into the cable connector ports on each MPC (see Figure 304 on page 712).

Figure 304: Attaching a Cable to an MPC



12. 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.

13. 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 fpc slot slot-number online
```

For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

NOTE: When issuing the `request chassis fpc online` command, the FRU will get power, and the system total power will decrease.

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.

SEE ALSO

Removing an MX2020 MPC from the Adapter Card | **704**

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

MPC Terminology | **150**

Maintaining MX2020 MPCs | **714**

Troubleshooting a Modular Port Concentrator (MPC) | **856**

Maintaining MX2020 MPCs

IN THIS SECTION

Purpose

The router can have up to 20 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  Empty
  1  Empty
  2  Empty
  3  Empty
  4  Online            28     11          0       2048       15         14
  5  Empty
  6  Empty
  7  Online            30      8          0       2048       14         13
  8  Online            29     10          0       2048       11         13
```

```
  9  Online           31     12          0       2048       16         14
 10  Present          28
 11  Online           38     16          2       2048       16         14
 12  Empty
 13  Empty
 14  Empty
 15  Online           36     11          0       2048       15         14
 16  Empty
 17  Empty
 18  Online           31     10          0       2048       18         13
 19  Empty
```

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 4 information:
  State                               Online
  Temperature                      28
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                11264 MB
  Start time:                         2012-11-26 16:20:07 PST
  Uptime:                             18 hours, 6 minutes, 1 second
  Max Power Consumption           610 Watts
Slot 7 information:
  State                               Online
  Temperature                      30
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                 6656 MB
  Start time:                         2012-11-26 16:20:12 PST
  Uptime:                             18 hours, 5 minutes, 56 seconds
  Max Power Consumption           520 Watts
Slot 8 information:
  State                               Online
  Temperature                      29
  Total CPU DRAM                 2048 MB
  Total RLDRAM                    662 MB
  Total DDR DRAM                 2560 MB
  Start time:                         2012-11-26 16:20:18 PST
```

```
  Uptime:                              18 hours, 5 minutes, 50 seconds
  Max Power Consumption             348 Watts
Slot 9 information:
  State                                Online
  Temperature                       31
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1036 MB
  Total DDR DRAM                 11264 MB
  Start time:                          2012-11-26 17:34:36 PST
  Uptime:                              16 hours, 51 minutes, 32 seconds
  Max Power Consumption             610 Watts
Slot 10 information:
  State                                Present
  Temperature                       28
  Total CPU DRAM                    0 MB
  Total RLDRAM                      0 MB
  Total DDR DRAM                    0 MB
  Max Power Consumption             440 Watts
Slot 11 information:
  State                                Online
  Temperature                       38
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1036 MB
  Total DDR DRAM                 11264 MB
  Start time:                          2012-11-26 16:20:33 PST
  Uptime:                              18 hours, 5 minutes, 35 seconds
  Max Power Consumption             610 Watts
Slot 15 information:
  State                                Online
  Temperature                       36
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1036 MB
  Total DDR DRAM                 11264 MB
  Start time:                          2012-11-26 16:20:40 PST
  Uptime:                              18 hours, 5 minutes, 28 seconds
  Max Power Consumption             610 Watts
Slot 18 information:
  State                                Online
  Temperature                       31
  Total CPU DRAM                  2048 MB
  Total RLDRAM                    1324 MB
  Total DDR DRAM                  5120 MB
  Start time:                          2012-11-26 16:20:46 PST
```

```
  Uptime:                                 18 hours, 5 minutes, 22 seconds
  Max Power Consumption             440 Watts
```

- Issue the CLI `show chassis fpc pic-status` command. The MPC slots are numbered from **0** through **9** (bottom), and **10** through **19** (top), left to right:

```
user@host> show chassis fpc pic-status

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 7   Online       MPCE Type 3 3D
  PIC 0  Online       1X100GE CFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 8   Online       MPC Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       10x 1GE(LAN) SFP
  PIC 3  Online       10x 1GE(LAN) SFP
Slot 9   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 10  Present      MPC 3D 16x 10GE
Slot 11  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 15  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 18  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+
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- Tools and Parts Required to Maintain the MX2020 Hardware Components | 330
- MX2020 Chassis Description | 36
- MX2020 Modular Port Concentrator (MPC) Description | 138
- MX2020 Component LEDs on the Craft Interface
- Troubleshooting a Modular Port Concentrator (MPC) | 856
- Replacing an MX2020 MPC and Adapter Card (ADC) | 701

Maintaining MX2020 Adapter Cards

IN THIS SECTION

Purpose

For optimum router performance, verify the condition of the ADCs. The router can have up to twenty ADCs mounted vertically in the line card cage at the front of the chassis. The MPCs are installed vertically into the ADCs.

Action

On a regular basis:

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

```
user@host> show chassis adc
Slot  State                          Uptime
 0    Empty
 1    Empty
 2    Empty
 3    Empty
 4    Online 1 hour, 26 minutes, 59 seconds
 5    Empty
 6    Empty
 7    Online 1 hour, 26 minutes, 51 seconds
 8    Online 1 hour, 26 minutes, 43 seconds
 9    Empty
10    Offline--- No power ---
11    Online 1 hour, 26 minutes, 33 seconds
12    Empty
13    Empty
14    Empty
15    Present
16    Online 1 hour, 26 minutes, 25 seconds
17    Empty
18    Online 1 hour, 26 minutes, 16 seconds
19    Empty
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- MX2020 Chassis Description | **36**
- Installing an MX2020 MPC into an Adapter Card | **710**
- Connecting MPC or MIC Cables to the MX2020 Router | **471**
- Installing a Cable on an MX2020 MPC or MIC | **777**

Replacing an MX2020 MIC

IN THIS SECTION

Removing an MX2020 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 305 on page 722):

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.

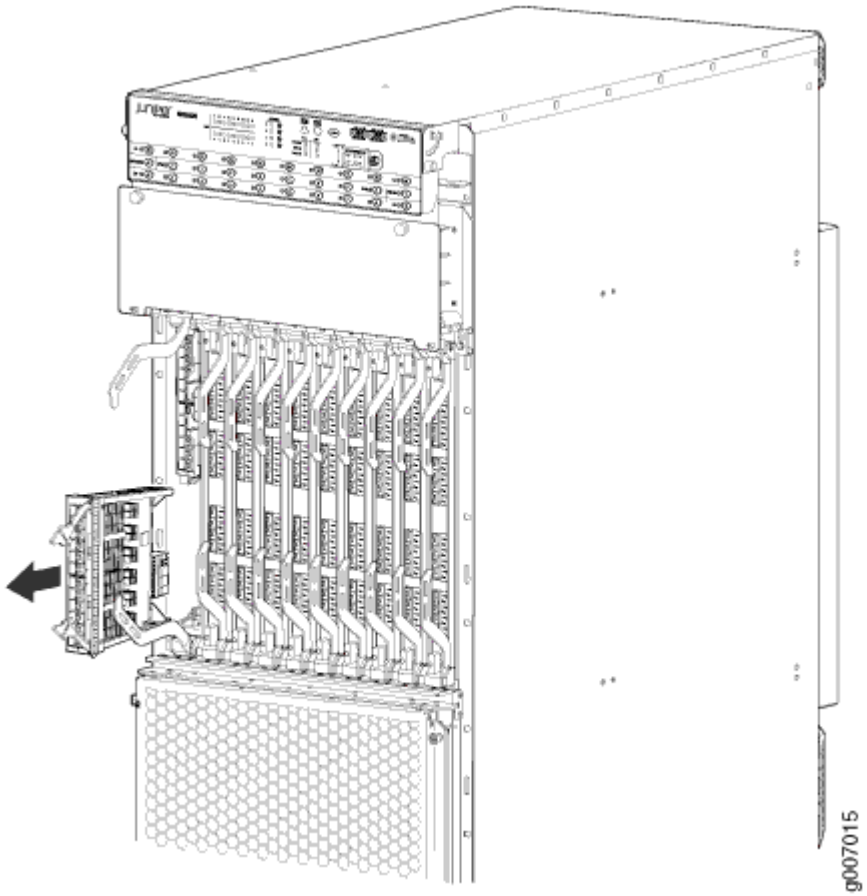
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

7. On the MPC, pull the ejector levers that are located on 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 305: Removing a Single-Wide MIC



SEE ALSO

Prevention of Electrostatic Discharge Damage | **924**

Installing an MX2020 MIC | **722**

Installing an MX2020 Dual-Wide MIC | **738**

Installing an MX2020 MIC

To install a MIC (see Figure 307 on page 726):

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 306 on page 724):

a. Place the MPC on a flat surface (if necessary, remove the MPC from the ADC as described in "Removing an MX2020 MPC from the Adapter Card" on page 704.

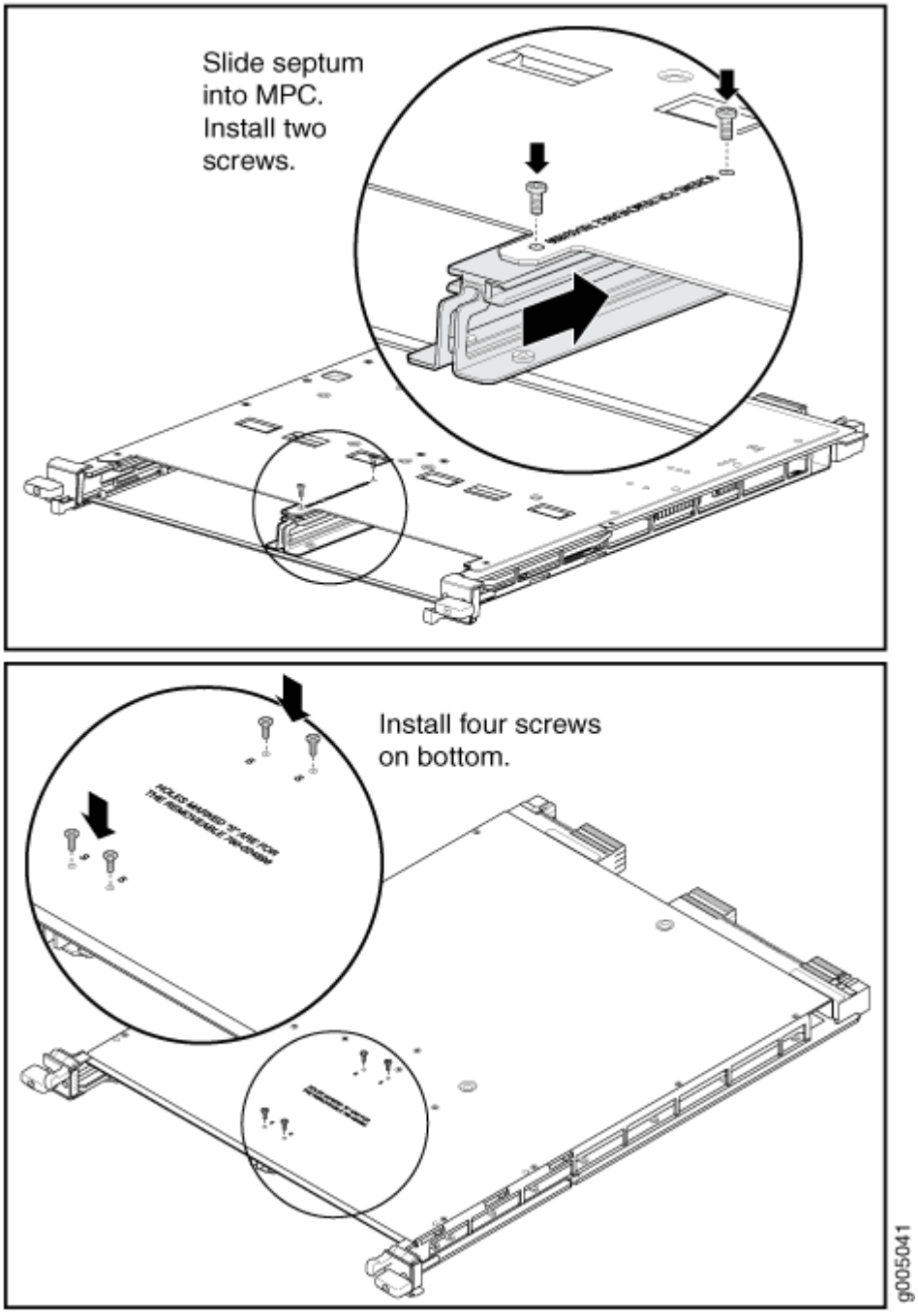
b. Position the septum in the center of the MPC so that it lines up with holes labeled **S** on the top of the MPC.

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 MX2020 MPC into an Adapter Card" on page 710.

Figure 306: 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.

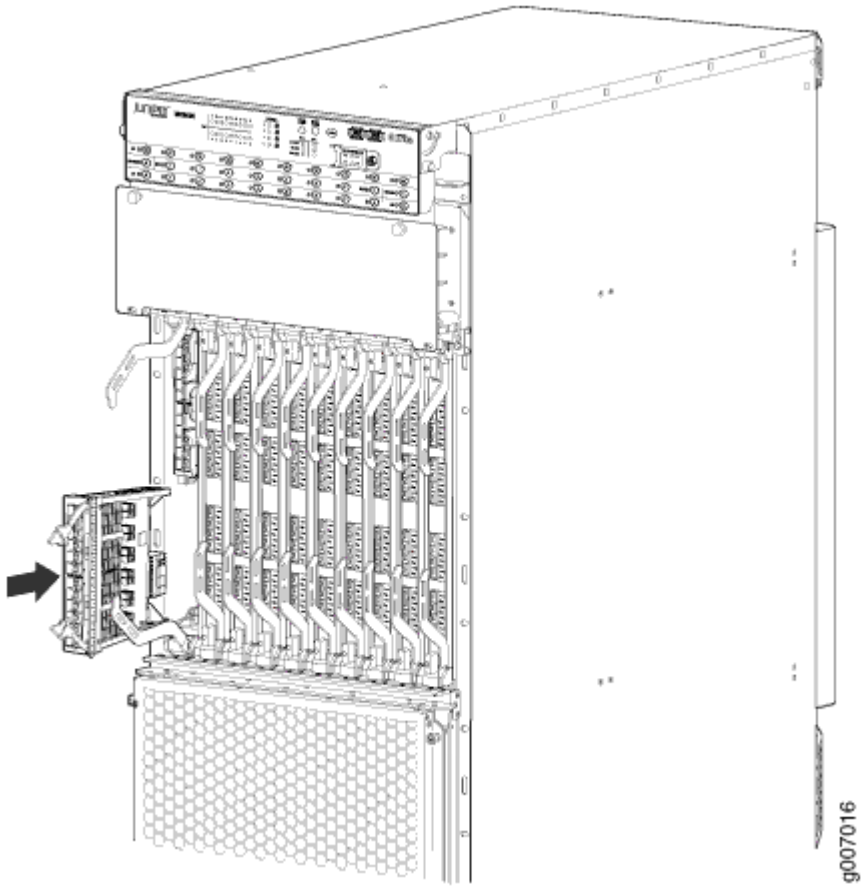
11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

```
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 MX2020 MICs" on page 732.

Figure 307: Installing a MIC



SEE ALSO

Prevention of Electrostatic Discharge Damage | **924**

Removing an MX2020 MIC | **720**

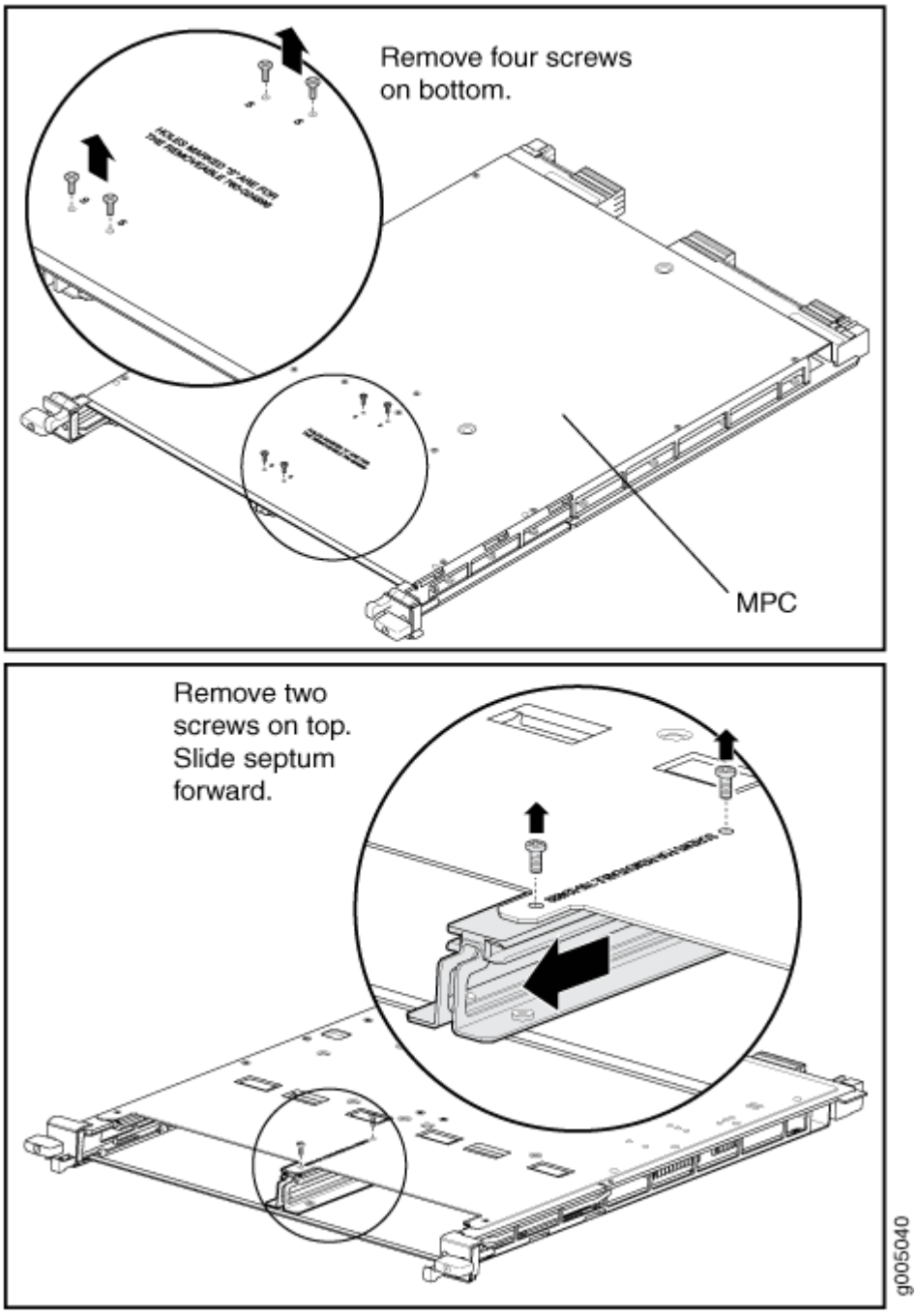
Installing an MX2020 Dual-Wide MIC | **738**

Installing an MX2020 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 308 on page 728):
   a. Place the MPC on a flat surface. If necessary, remove the MPC from the ADC as described in "Removing an MX2020 MPC from the Adapter Card" on page 704.
   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 MX2020 MPC into an Adapter Card" on page 710.

Figure 308: 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 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 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 MX2020 MICs" on page 732.

SEE ALSO

Prevention of Electrostatic Discharge Damage

Removing an MX2020 MIC | **720**

Installing an MX2020 MIC | **722**

Replacing a MIC Installed on an MPC6E

IN THIS SECTION

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

Replacing an MX2020 MIC | **720**

MIC/MPC Compatibility

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

MX2000 Modular Interface Card (MIC) Description | **123**

Maintaining MX2020 MICs | **732**

Troubleshooting the MX2020 MICs | **854**

Maintaining MX2020 MICs

IN THIS SECTION

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 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 7   Online       MPCE Type 3 3D
  PIC 0  Online       1X100GE CFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 8   Online       MPC Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       10x 1GE(LAN) SFP
  PIC 3  Online       10x 1GE(LAN) SFP
Slot 9   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 10  Present      MPC 3D 16x 10GE
Slot 11  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 15  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 18  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+
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- Tools and Parts Required to Maintain the MX2020 Hardware Components | **330**
- MX2000 Modular Interface Card (MIC) Description | **123**
- Maintaining the MX2020 Ethernet Switch | **840**
- MX2020 Modular Interface Card LEDs | **138**
- Troubleshooting the MX2020 MICs | **854**
- Replacing an MX2020 MIC | **720**

Replacing an SFP or XFP Transceiver on an MX2020 MPC or MIC

IN THIS SECTION

Small form-factor pluggables (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 Transceiver from an MX2020 MPC or MIC

Removing an SFP or XFP does not interrupt MPC or MIC functioning, but the removed SFP or XFP no longer receives or transmits data.

To remove an SFP or XFP transceiver (see Figure 309 on page 736):

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.

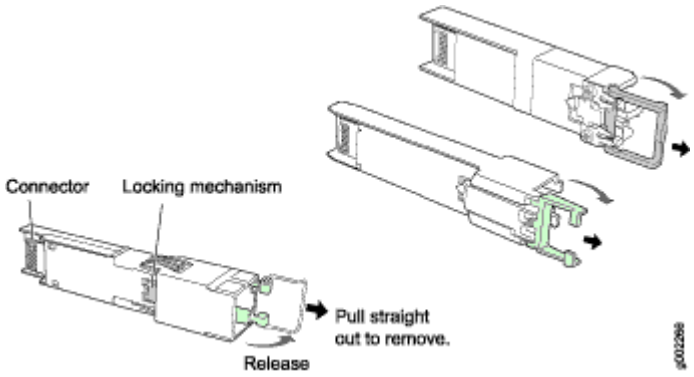
6. Pull the ejector handle out from the transceiver to unlock the transceiver.

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 309: 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 Transceiver into an MX2020 MPC or MIC | 736

Installing an SFP or XFP Transceiver into an MX2020 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 Transceiver from an MX2020 MPC or MIC | **734**

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

Replacing an MX2020 MIC | **720**

Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

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

Removing an SFP or XFP Transceiver from an MX2020 MPC or MIC | **734**

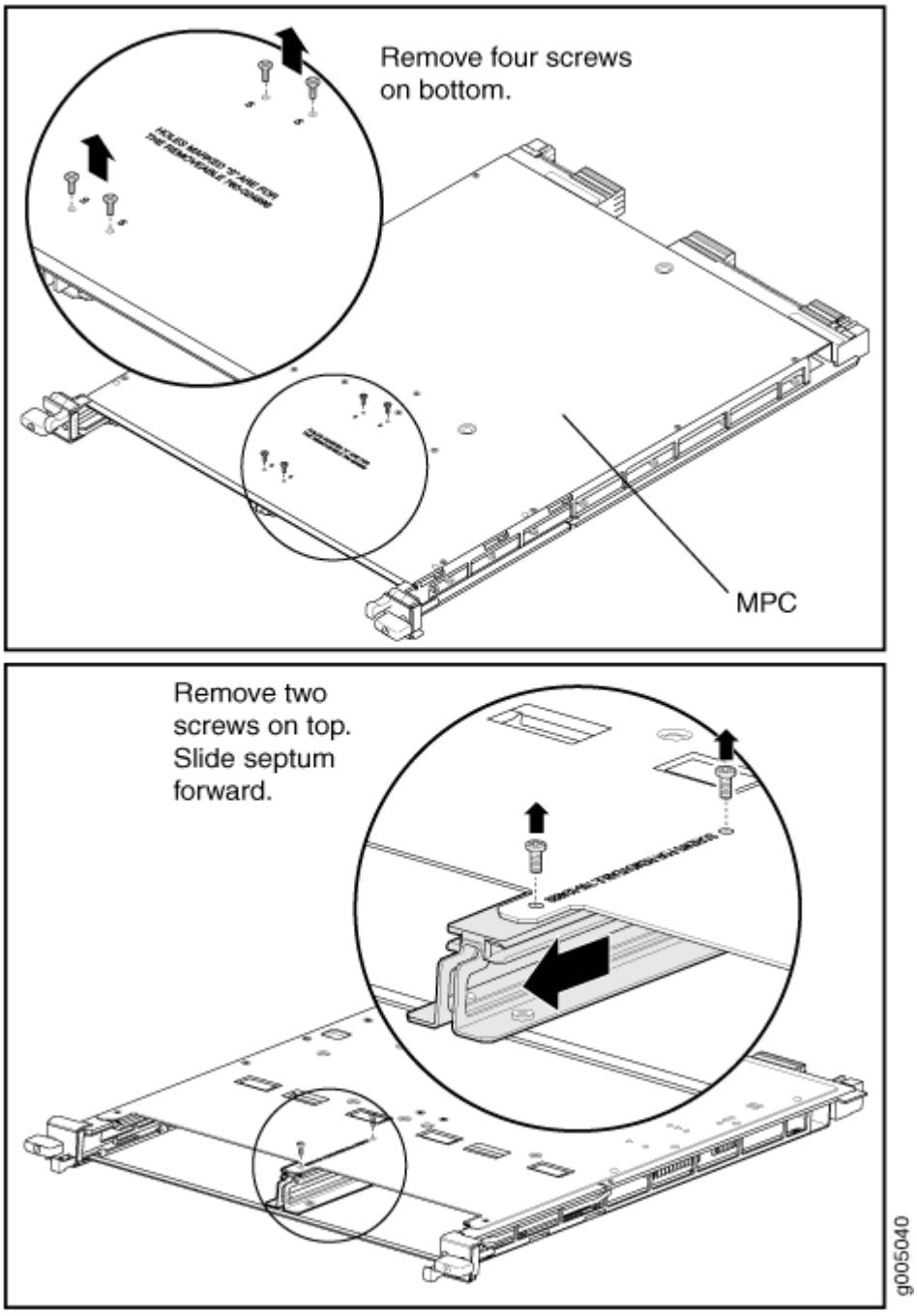
Prevention of Electrostatic Discharge Damage

Installing an MX2020 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 310 on page 739):
   a. Place the MPC on a flat surface. If necessary, remove the MPC from the ADC as described in "Removing an MX2020 MPC from the Adapter Card" on page 704.
   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 MX2020 MPC into an Adapter Card" on page 710.

Figure 310: 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 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 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 MX2020 MICs" on page 732.

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

Removing an MX2020 MIC | **720**

Installing an MX2020 MIC | **722**

Install a Transceiver

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

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

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

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

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

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

third-party optical module or cable and, if required, replace it with an equivalent Juniper-qualified component.

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

Figure 311 on page 744 shows how to install a QSFP+ transceiver. The procedure is the same for all types of transceivers except the QSFP28 and CFP transceivers.

To install a transceiver:

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

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

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

4. If the port in which you want to install the transceiver is covered with a dust cover, remove the dust cover and save it in case you need to cover the port later. If you are hot-swapping a transceiver, wait for at least 10 seconds after removing the transceiver from the port before installing a new transceiver.
5. Using both hands, carefully place the transceiver in the empty port. The connectors must face the chassis.

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

6. Slide the transceiver in gently until it is fully seated. If you are installing a CFP transceiver, use your fingers to tighten the captive screws on the transceiver.

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

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

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

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

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

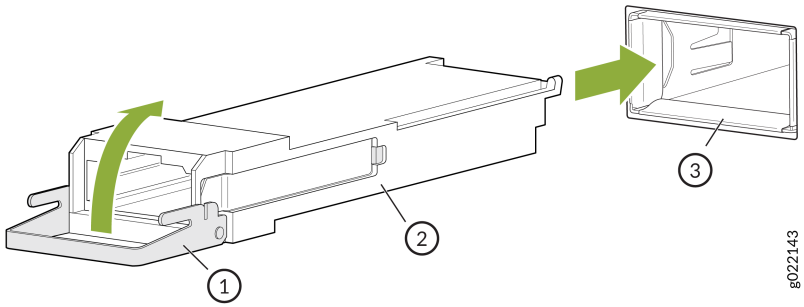
   CAUTION: Avoid bending the fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

   NOTE: When you install SFP-DD transceivers, push it hard until you hear a click sound. Use a long nose plier to pull the SFP-DD transceiver connected on the top and bottom rows of the chassis where the pull tabs face each other.

   NOTE: Make sure to use a dust cap to cover ports that are unused.

   NOTE: While using Finisar AOC SFP+ optical module with the QFX5130-48C switch, you may need to pull the module upwards to pull out the module smoothly from the cage.

Figure 311: Install a Transceiver



1– Ejector lever	3– Port
2– Transceiver	

Remove a Transceiver

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

Ensure that you have the following parts and tools available:

- An antistatic bag or an antistatic mat
- Rubber safety caps to cover the transceiver and fiber-optic cable connector
- A dust cover to cover the port or a replacement transceiver

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

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

Figure 312 on page 746 shows how to remove a quad small form-factor pluggable plus (QSFP+) transceiver. The procedure is the same for all types of transceivers except the QSFP28 and C form-factor pluggable (CFP) transceivers.

To remove a transceiver from a device:

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

2. Wrap and fasten one end of the ESD wrist strap around your bare wrist, and connect the other end of the strap to the ESD point on the rack.
3. Label the cable connected to the transceiver so that you can reconnect it correctly.

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

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

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

4. Remove the cable connected to the transceiver (see *Disconnect a Fiber-Optic Cable*). Cover the transceiver and the end of each fiber-optic cable connector with a rubber safety cap immediately after disconnecting the fiber-optic cables.
5. If there is a cable management system, arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it does not support its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.
6. To remove an SFP56-DD, SFP, SFP+, XFP, a QSFP+, or QSFP56-DD transceiver:
   a. Using your fingers, pull open the ejector lever on the transceiver to unlock the transceiver.

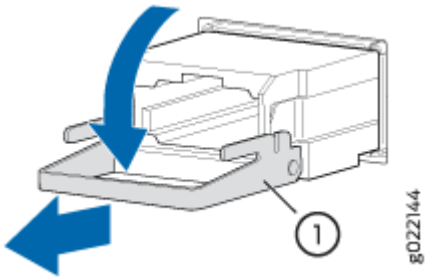
      Note that QSFP-DD and SFP-DD transceivers don't have ejector levers, instead they have a pull tab which can be used to unlock and remove the transceiver.

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

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

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

Figure 312: Remove a QSFP+ Transceiver



1– Ejector lever

To remove a CFP transceiver:

a. Using your fingers, loosen the screws on the transceiver.

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

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

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

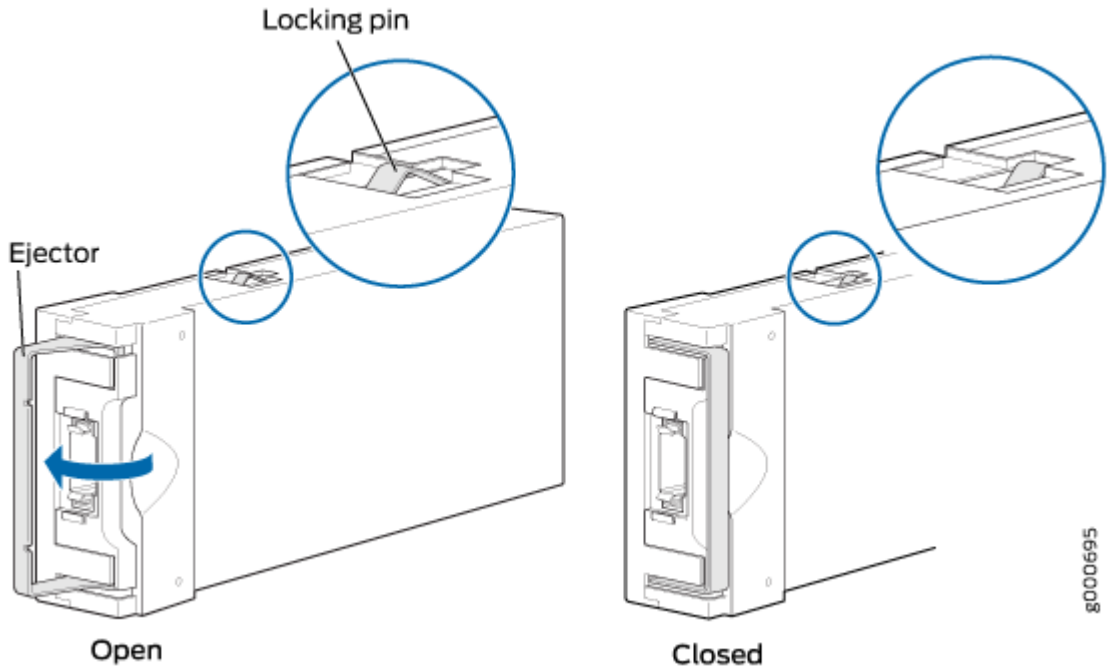
Replacing a CFP2 Transceiver

IN THIS SECTION

Removing a CFP2 Transceiver

C form-factor pluggables (CFPs) are transceivers that can be removed from a PIC. CFP2 transceivers are hot-insertable and hot-removable. Removing a CFP2 transceiver does not interrupt PIC functioning, but the removed CFP2 transceiver no longer receives or transmits data.

Figure 313: Form-Factor Pluggable (CFP2)



To remove a CFP2 transceiver (see Figure 313 on page 747):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the CFP transceiver. Have ready a rubber safety cap for the CFP2 transceiver and the cable.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Label the cable connected to the CFP2 transceiver so that you can later reconnect it to the correct CFP2 transceiver.
4. Disconnect the cable from the CFP2 transceiver. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

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

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

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

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

6. Pull the ejector latch to the extreme end away from the CFP2 transceiver faceplate to unseat the CFP2 transceiver from the PIC. Pull the CFP2 transceiver out of the PIC and place it on the antistatic mat or in the electrostatic bag.

   NOTE: You cannot remove the transceiver until you move the ejector latch to the extreme end.

Installing a CFP2 Transceiver

To install a replacement CFP2:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Verify that a rubber safety cap covers the CFP transceiver, installing one if necessary.
3. Orient the CFP2 over the port in the PIC so that the connector end will enter the slot first and the CFP2 connector faces the appropriate direction.
4. Slide the CFP2 into the slot. If there is resistance, remove the CFP2 and flip it so that the connector faces the other direction.
5. Remove the rubber safety cap from the transceiver and the end of the cable, and insert the cable into the transceiver.

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

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

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

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

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

7. Verify that the status LEDs on the PIC faceplate indicate that the CFP2 is functioning correctly. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command.

CHAPTER 28

Installing, Replacing, and Maintaining the Craft Interface

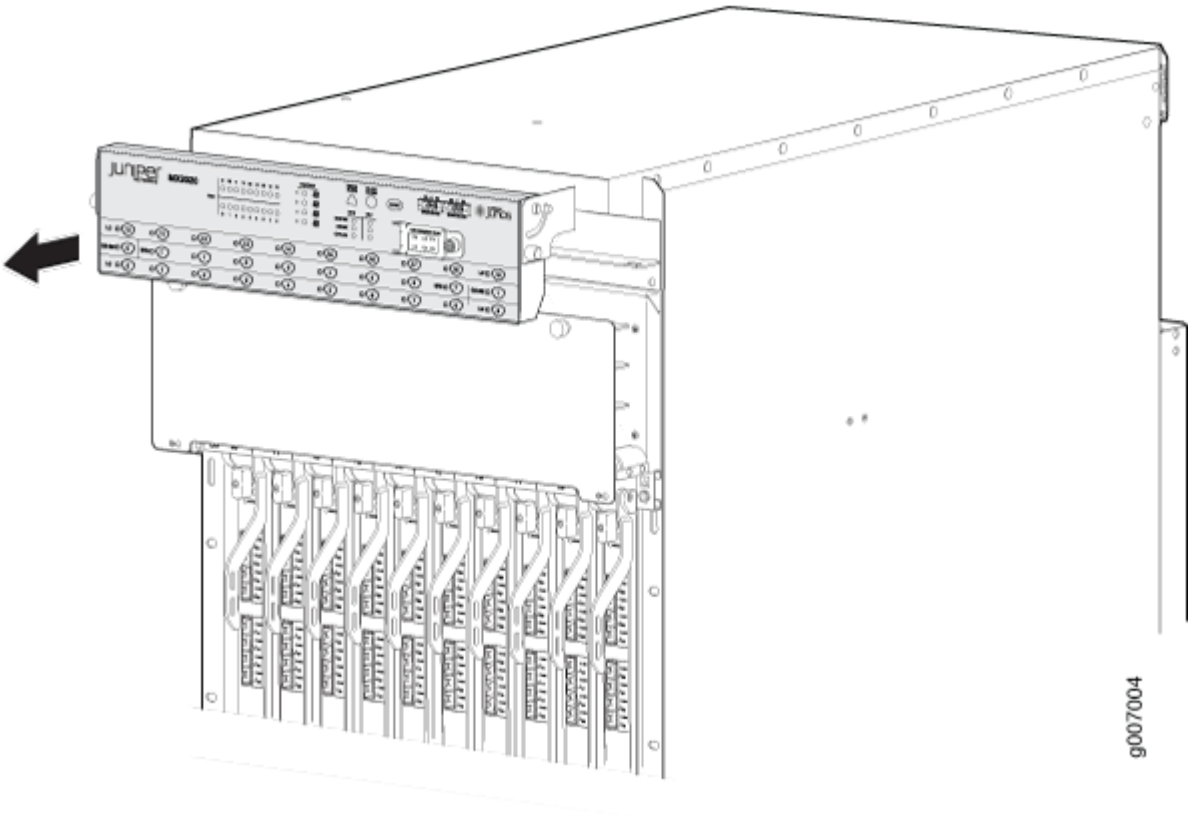
IN THIS CHAPTER

Removing the MX2020 Craft Interface

To remove the craft interface (see Figure 314 on page 751):

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. Loosen the captive screws at the left and right corners of the craft interface faceplate by using the Torx (T10) screwdriver.
4. Grasp the craft interface faceplate and carefully tilt it toward you until it is horizontal.
5. Disconnect the ribbon cable from the back of the faceplate by gently pressing on both sides of the latch with your thumb and forefinger. Remove the craft interface from the chassis.

Figure 314: Removing the Craft Interface



RELATED DOCUMENTATION

MX2020 Craft Interface Description | 68

Maintaining and Verifying the Status of the MX2020 Craft Interface | 759

Installing the MX2020 Craft Interface | 751

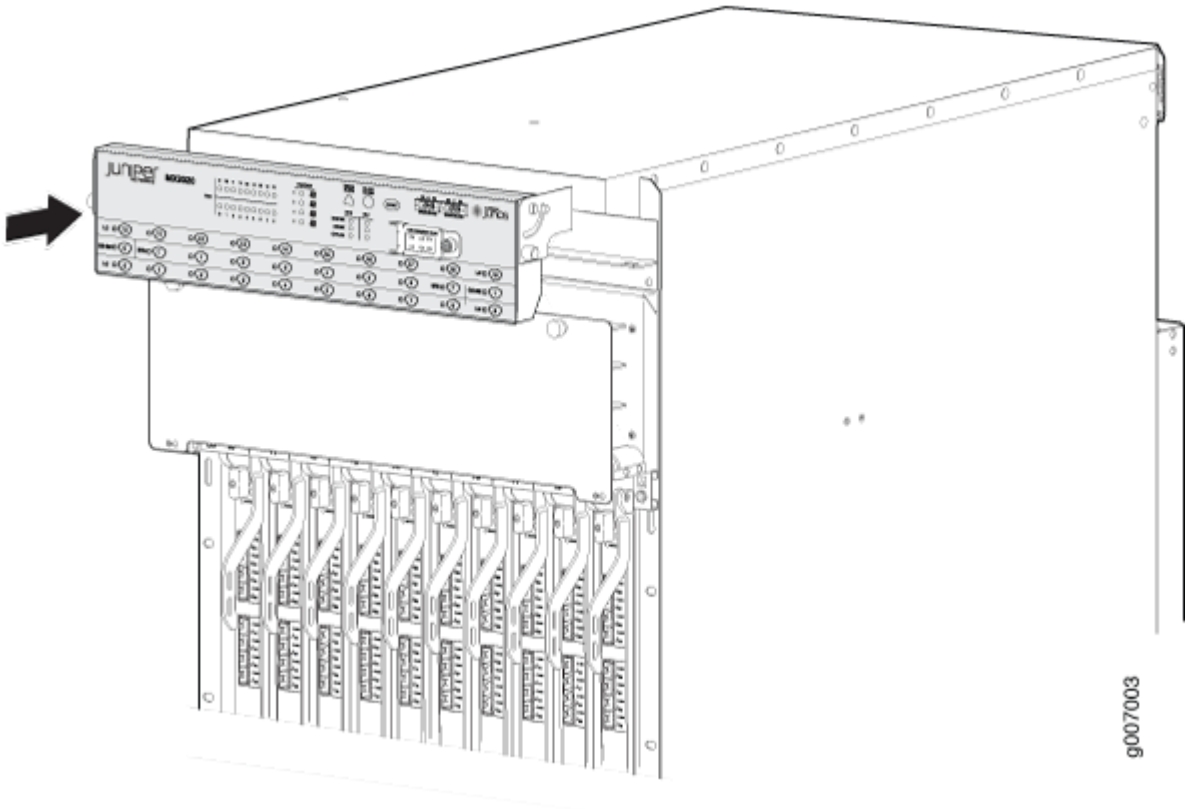
Installing the MX2020 Craft Interface

To install the craft interface (see Figure 315 on page 752):

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.
4. Align the bottom of the craft interface with the sheet metal above the card cage, and press it into place.
5. Tighten the screws on the left and right corners of the craft interface faceplate by using the Torx (T10) screwdriver.
6. Reattach any external devices connected to the craft interface.

Figure 315: Installing the Craft Interface



RELATED DOCUMENTATION

MX2020 Craft Interface Description | 68

Maintaining and Verifying the Status of the MX2020 Craft Interface | 759

Removing the MX2020 Craft Interface | 750

Replacing an MX2020 Extended Craft Interface

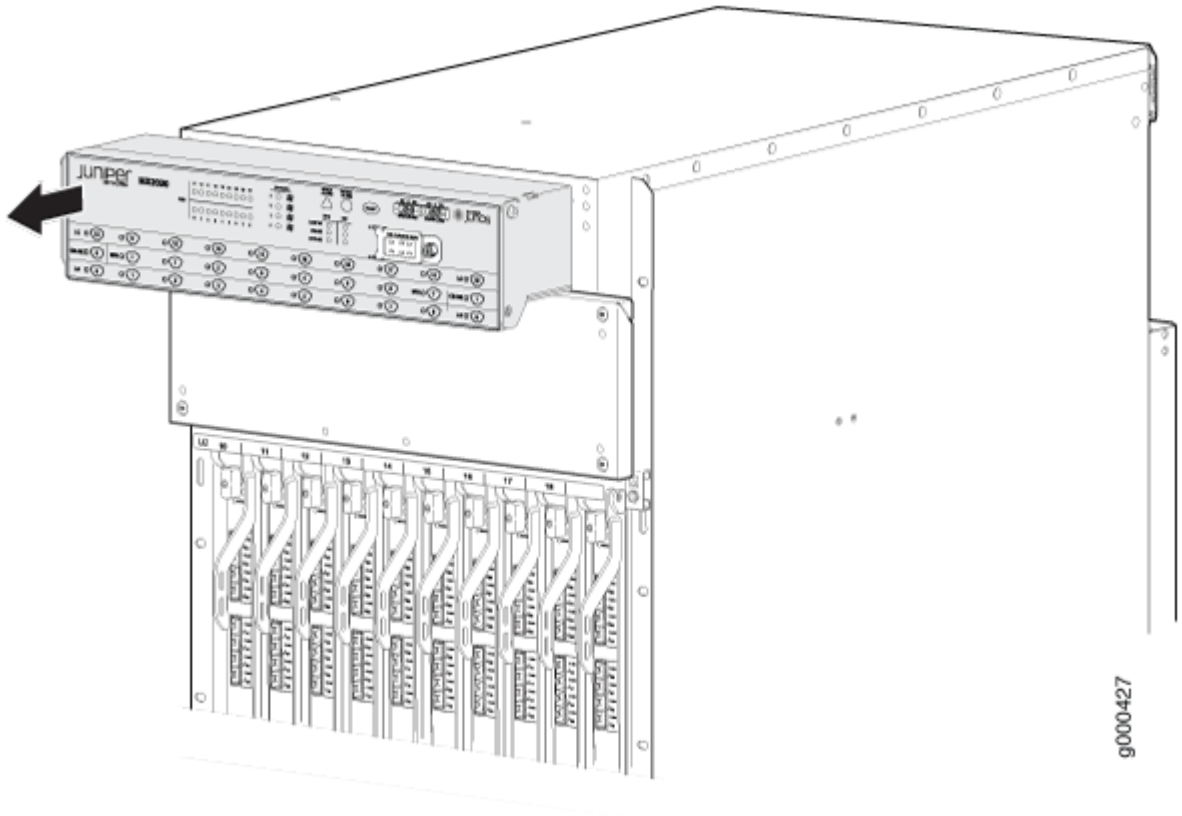
IN THIS SECTION

Removing an MX2020 Extended Craft Interface

To remove the extended craft interface (see Figure 316 on page 754):

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. Flip the extended craft interface panel up to access the ribbon cable. Use two fingers to squeeze the release latches on the sides of the connector to disconnect it from the backside of the extended craft interface.
4. Remove the screws from the top corners on each side of the extended craft interface using a 4-mm Allen wrench.
5. Remove the remaining screw from the lower corner on each side using a a Phillips (+) screwdriver (number 1 or 2).
6. Pull the extended craft interface panel away from the router and set aside.
7. Squeeze the release latches on the sides of the ribbon cable connector to disconnect the cable from the chassis, if necessary.

Figure 316: Removing the Extended Craft Interface



SEE ALSO

- MX2020 Craft Interface Description | **68**
- Maintaining and Verifying the Status of the MX2020 Craft Interface | **759**
- Installing an MX2020 Extended Craft Interface | **754**
- Replacing the MX2020 Craft Interface

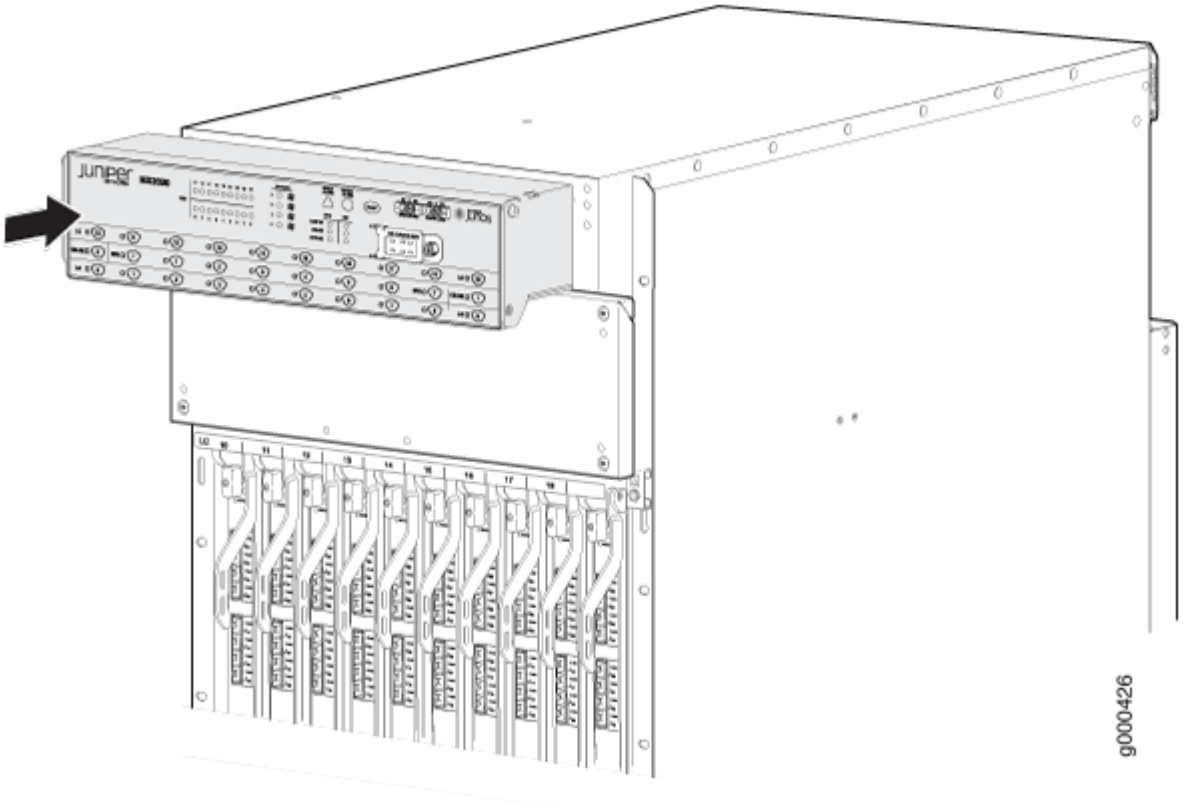
Installing an MX2020 Extended Craft Interface

To install the extended craft interface (see Figure 317 on page 755):

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. Insert a ribbon cable into the port on the chassis behind the extended craft interface
3. Grasp the craft interface with one hand, and hold the bottom edge of the craft interface with the other hand to support its weight.

4. Orient the other end of the ribbon cable so that it plugs into the connector socket underneath the extended craft interface. The connector is keyed and can be inserted only one way.
5. Align the bottom of the craft interface with the sheet metal above the card cage, and press it into place.
6. Tighten the screws on the upper left and right corners of the craft interface faceplate using a 4-mm Allen wrench.
7. Tighten the screws on the lower left and right corners of the craft interface faceplate using a Phillips (+) screwdriver (number 1 or 2).
8. Reattach any external devices connected to the extended craft interface.

Figure 317: Installing the Extended Craft Interface



SEE ALSO

MX2020 Craft Interface Description | 68

Maintaining and Verifying the Status of the MX2020 Craft Interface | 759

Replacing the Alarm Relay Wires from the MX2020 Craft Interface

IN THIS SECTION

Disconnecting the Alarm Relay Wires from the MX2020 Craft Interface

To disconnect the alarm relay wires from the router and an alarm-reporting device (see Figure 318 on page 756):

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 120 on page 757).

Figure 318: Alarm Relay Contacts

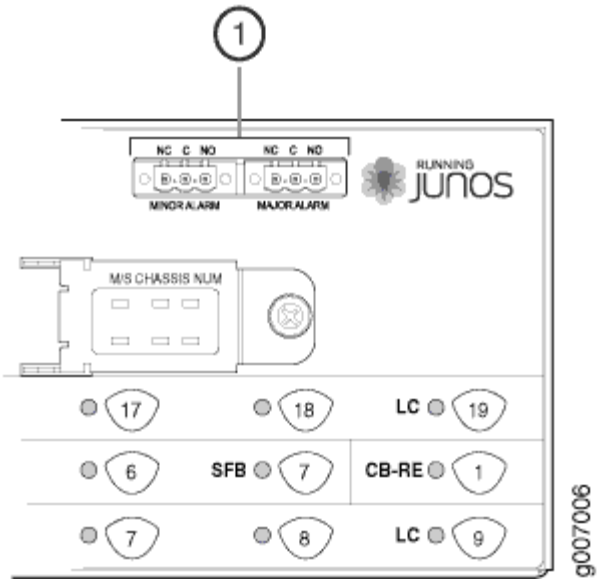


Table 120: Alarm Relay Contacts on the Craft Interface

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.

SEE ALSO

Installing the MX2020 Craft Interface | **751**

Removing the MX2020 Craft Interface | **750**

Maintaining and Verifying the Status of the MX2020 Craft Interface | **759**

Connecting the Alarm Relay Wires to the MX2020 Craft Interface

To connect the alarm relay wires between a router and an alarm-reporting device (see Figure 319 on page 758):

1. Prepare the required length of replacement wire with gauge between 28 AWG and 14 AWG (0.08 and 2.08 mm^2).
2. Insert the replacement wires into the slots in the front of the block (see Table 121 on page 758). 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 319: Alarm Relay Contacts

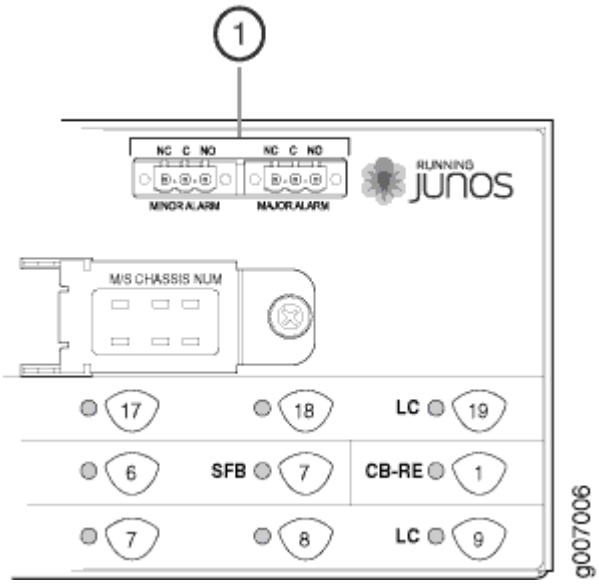


Table 121: Connecting Alarm Relay Contacts

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), common (C), and normal open (NO) relays that signal a minor or major alarm when broken.

SEE ALSO

- Installing the MX2020 Craft Interface | **751**
- Removing the MX2020 Craft Interface | **750**
- Maintaining and Verifying the Status of the MX2020 Craft Interface | **759**

Maintaining and Verifying the Status of the MX2020 Craft Interface

IN THIS SECTION

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  .    .    .    .    *    .    .    *    *    .
```

```
Front Panel FPC LEDs:
FPC    10   11   12   13   14   15   16   17   18   19
-----------------------------------------------------
Red    .    .    .    .    .    .    .    .    .    .
Green  .    *    .    .    .    .    *    .    *    .

CB LEDs:
 CB    0   1
------------
Amber  .   .
Green  *   *

PS LEDs:
  PS    0    1    2    3    4    5    6    7    8
-----------------------------------------------
Red     .    .    .    .    .    .    .    .    .
Green   .    .    .    .    *    *    *    *    *

PS LEDs:
  PS    9   10   11   12   13   14   15   16   17
-----------------------------------------------
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    0x91
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 MX2020 Hardware Components | **330**
- Maintaining the MX2020 Cooling System Components | **625**
- Maintaining the MX2020 Fan Trays | **593**
- Maintaining the MX2020 Control Boards | **671**
- Maintaining the MX2020 Power Supply Modules

CHAPTER 29

Installing, Removing, and Replacing EMI Covers

IN THIS CHAPTER

Removing the MX2020 Standard EMI Covers

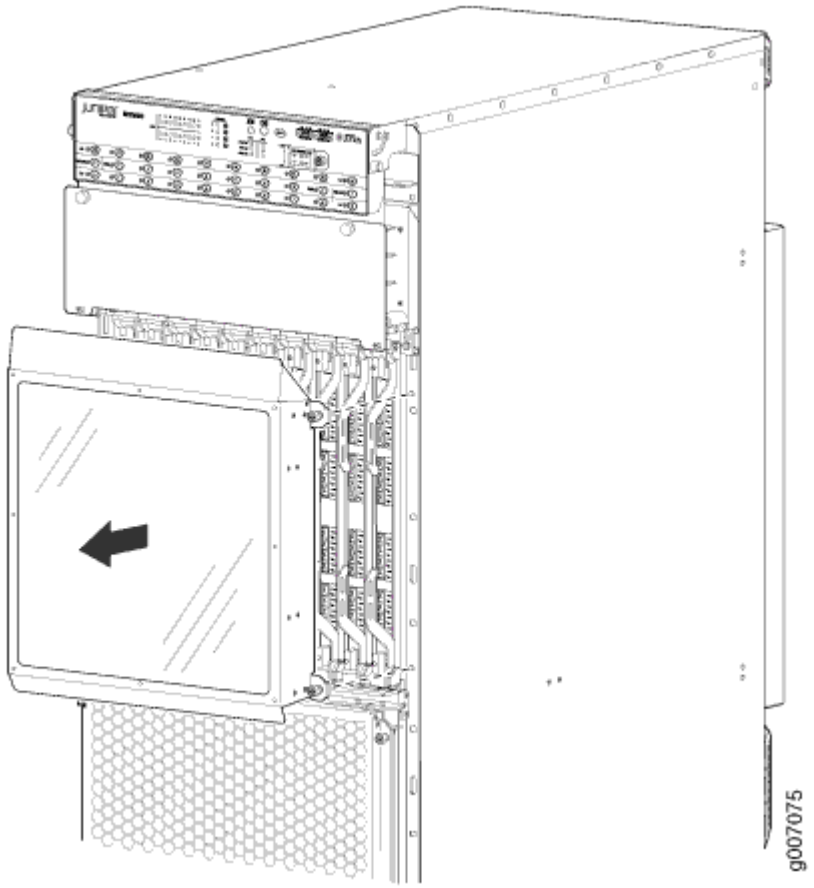
The MX2020 router supports a standard or extended set of EMI covers that you can order from Juniper Networks.

To remove the standard electromagnetic interference (EMI) card cage cover (see Figure 320 on page 763):

NOTE:

1. Loosen the four captive screws that secure the standard EMI cover to the router.
2. Pull the cover away from the router toward you to remove it.

Figure 320: Removing the Standard EMI Card Cage Cover



RELATED DOCUMENTATION

Installing the MX2020 Standard EMI Covers | 763

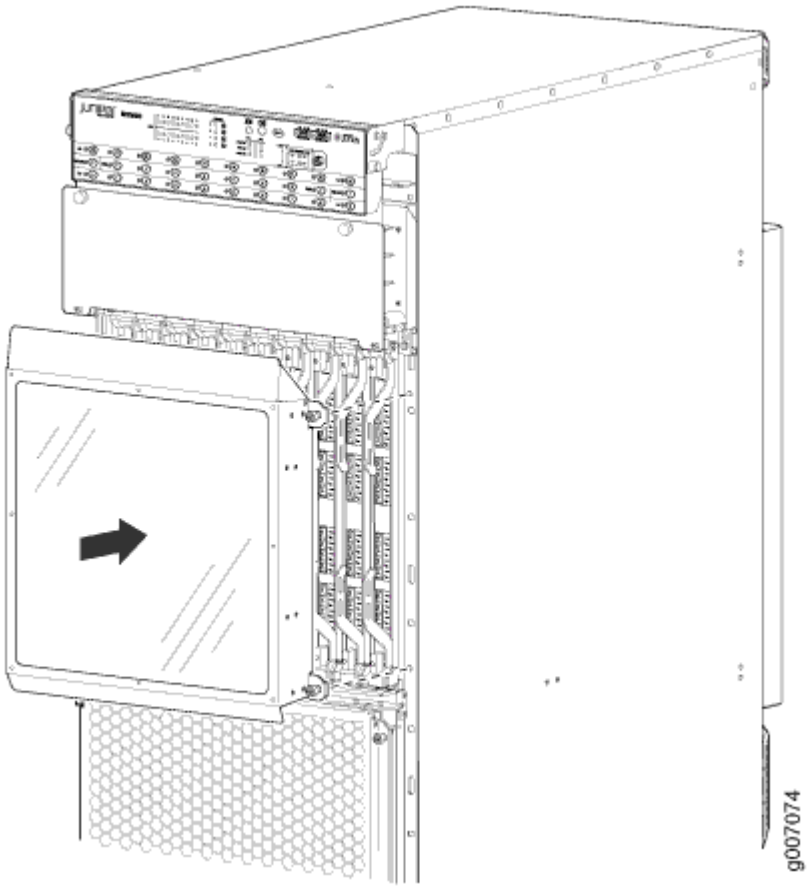
Installing the MX2020 Standard EMI Covers

The upper and lower MPCs require an EMI cover to reduce the risk of radio frequency interference disturbance that affects an electrical circuit due to electromagnetic interference emitted from an external source. The two EMI covers are designed to reduce the electromagnetic interference (EMI) to comply with the Federal Communications Commission (FCC) requirements.

To install the standard electromagnetic interference (EMI) card cage cover—MX2000-EMI-COVER-S (see Figure 321 on page 764).

1. Align the four captive screws on either side of the EMI cover with the chassis front-mounting flanges on the outside of the card cage.
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 321: Installing the Standard EMI Card Cage Cover



RELATED DOCUMENTATION

Removing the MX2020 Standard EMI Covers | **762**

Replacing the MX2020 Extended EMI Covers

IN THIS SECTION

Removing the MX2020 Extended EMI Covers

Two extended electromagnetic interference (EMI) covers attach to the router over the upper and lower card cages.

To remove the extended electromagnetic interference (EMI) card cage cover (see Figure 322 on page 766):

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. The upper extended EMI cover tilts from the top. The lower extended EMI cover tilts from the bottom.
3. Holding the cover on both sides, lift so that the points on the cover come 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 323 on page 767).

Figure 322: Removing the Extended EMI Card Cage Cover

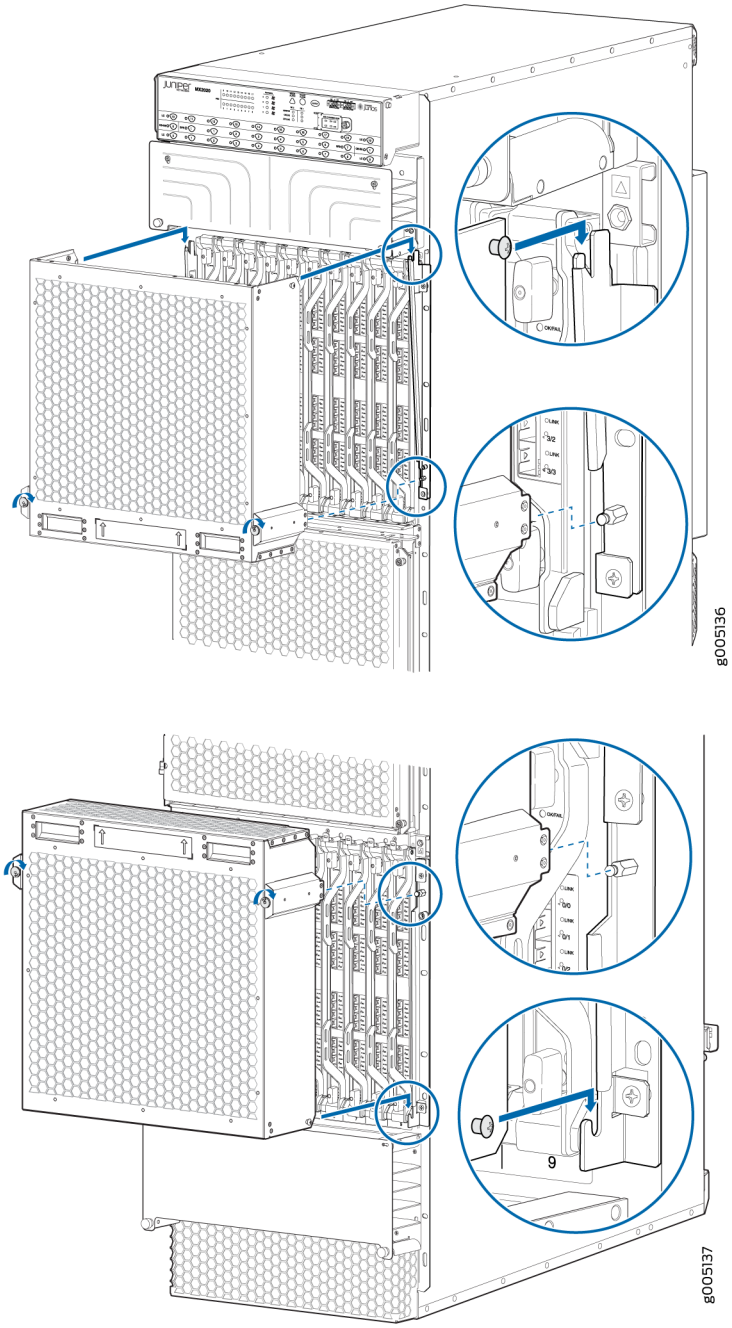
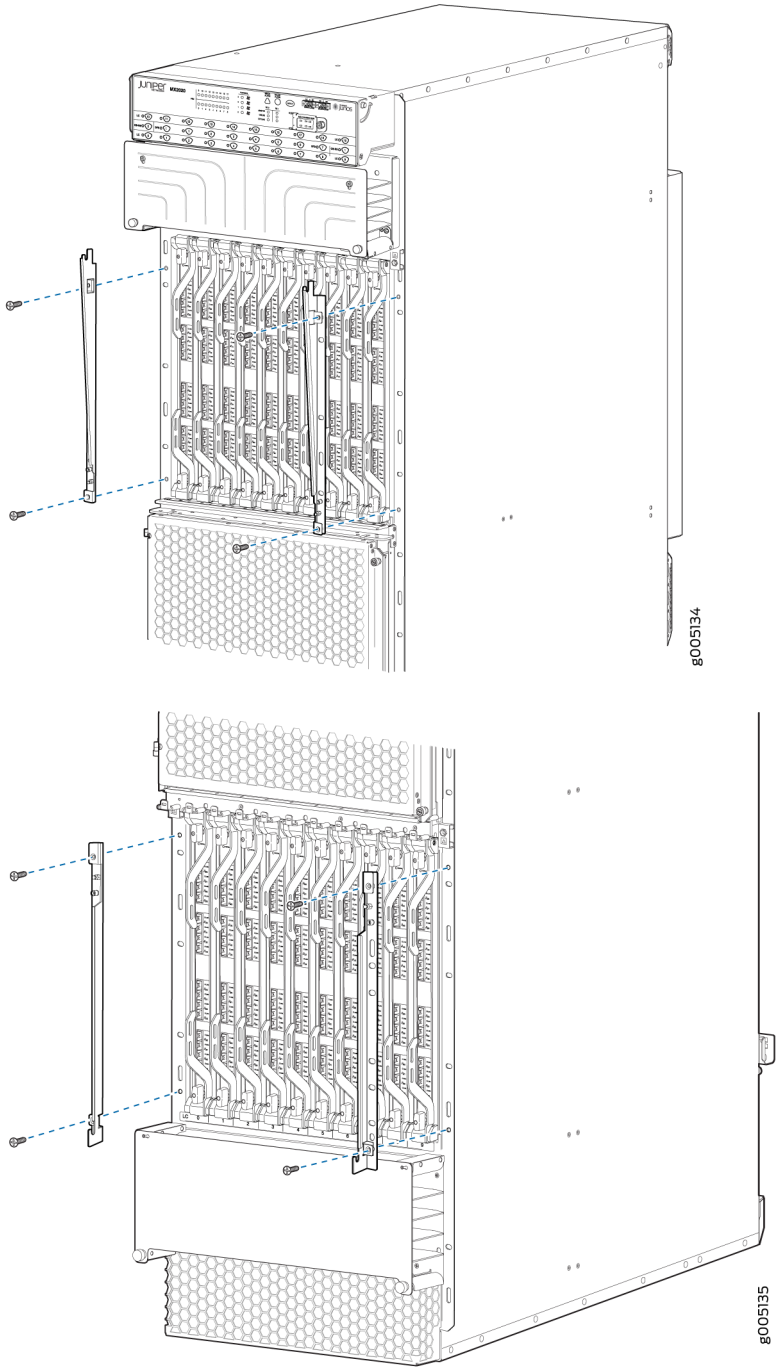


Figure 323: Removing the Extended EMI Cover Mounting Brackets

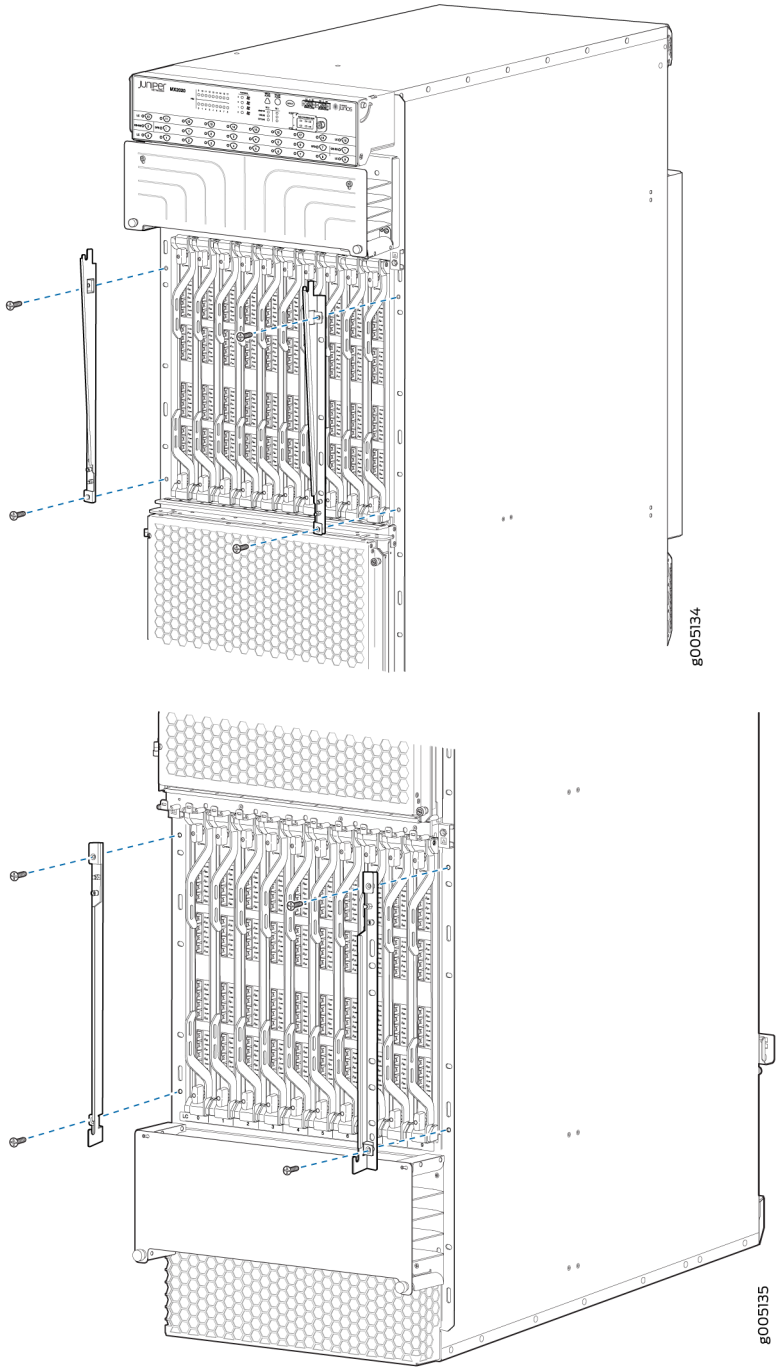


Installing the MX2020 Extended EMI Cover

Two extended electromagnetic interference (EMI) covers attach to the router over the upper and lower card cages.

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 upper and lower card cage, orient the extended EMI cover mounting brackets so that they line up with the mounting holes.
   - For the upper extended EMI card cover, the groove that holds the points on the cover should be at the top.
   - For the lower extended EMI card cover, the groove that holds the points on the cover should be at the bottom.
3. Secure the extended EMI cover mounting brackets using the four screws provided (two on each side) (see Figure 324 on page 769).

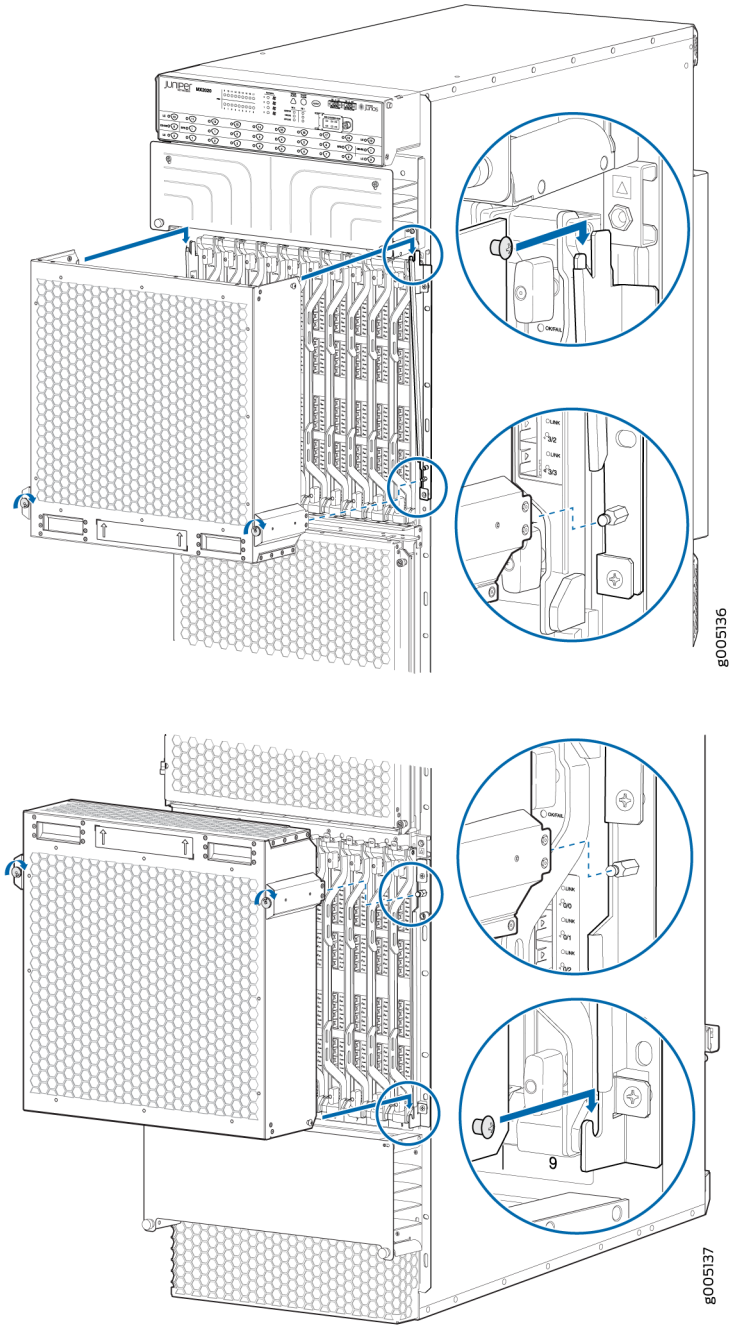
Figure 324: Installing the Extended EMI Cover Mounting Brackets



4. Orient the cover so that the arrows point up in front of the card cage.
5. Angle the cover so that the points on each side of the extended EMI cover fit into the grooves on the EMI cover mounting brackets.
6. Tilt the extended EMI cover into place and press firmly until the sides contact the EMI cover mounting brackets:

- The upper extended EMI cover tilts from the top.
- The lower extended EMI cover tilts from the bottom.

Figure 325: Installing the Extended EMI Card Cage Cover



SEE ALSO

Replacing the MX2020 Standard EMI Covers

RELATED DOCUMENTATION

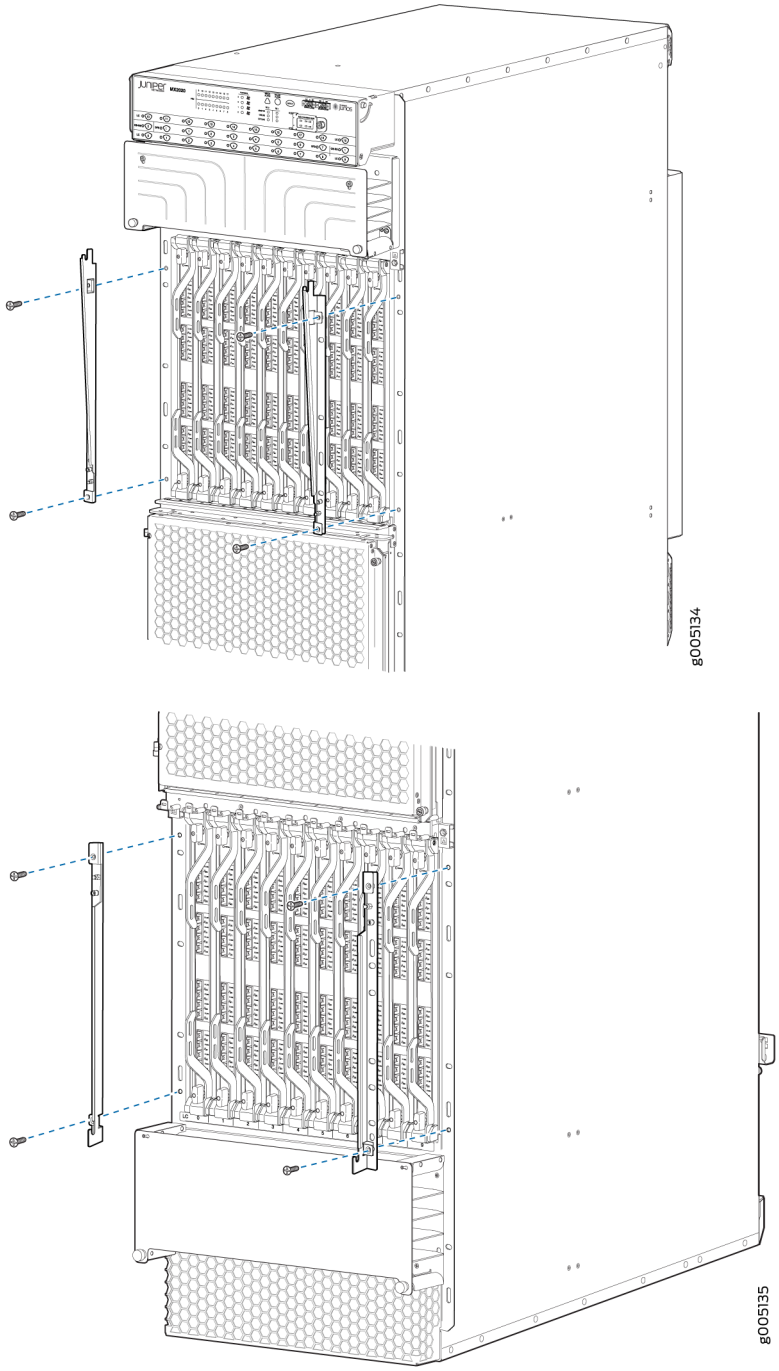
Replacing the MX2020 Standard EMI Covers

Installing the MX2020 Extended EMI Cover

Two extended electromagnetic interference (EMI) covers attach to the router over the upper and lower card cages.

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 upper and lower card cage, orient the extended EMI cover mounting brackets so that they line up with the mounting holes.
   - For the upper extended EMI card cover, the groove that holds the points on the cover should be at the top.
   - For the lower extended EMI card cover, the groove that holds the points on the cover should be at the bottom.
3. Secure the extended EMI cover mounting brackets using the four screws provided (two on each side) (see Figure 326 on page 772).

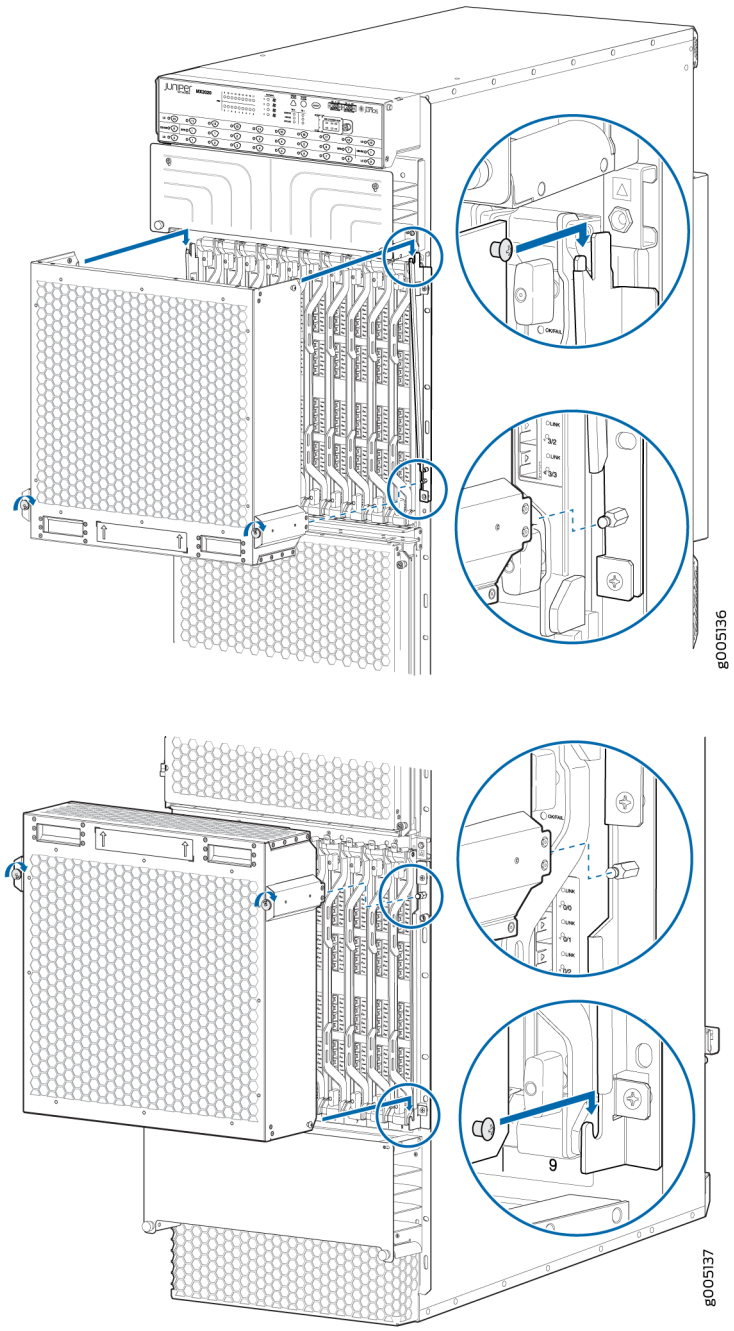
Figure 326: Installing the Extended EMI Cover Mounting Brackets



4. Orient the cover so that the arrows point up in front of the card cage.
5. Angle the cover so that the points on each side of the extended EMI cover fit into the grooves on the EMI cover mounting brackets.
6. Tilt the extended EMI cover into place and press firmly until the sides contact the EMI cover mounting brackets:

- The upper extended EMI cover tilts from the top.
- The lower extended EMI cover tilts from the bottom.

Figure 327: Installing the Extended EMI Card Cage Cover



RELATED DOCUMENTATION

- Replacing the MX2020 Standard EMI Covers

CHAPTER 30

Installing, Replacing, and Maintaining Cables and Cable Managers

IN THIS CHAPTER

Replacing a Cable on an MX2020 MPC or MIC

IN THIS SECTION

Removing a Cable on an MX2020 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 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 issuing the `request chassis fpc offline` command, the FRU will lose power, and the system total power will increase.

   - 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 MX2020 MPC or MIC | 777

Installing a Cable on an MX2020 MPC or MIC

To install a MIC or an MPC cable (see Figure 328 on page 778 and Figure 329 on page 779):

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 328: Installing a MIC Cable

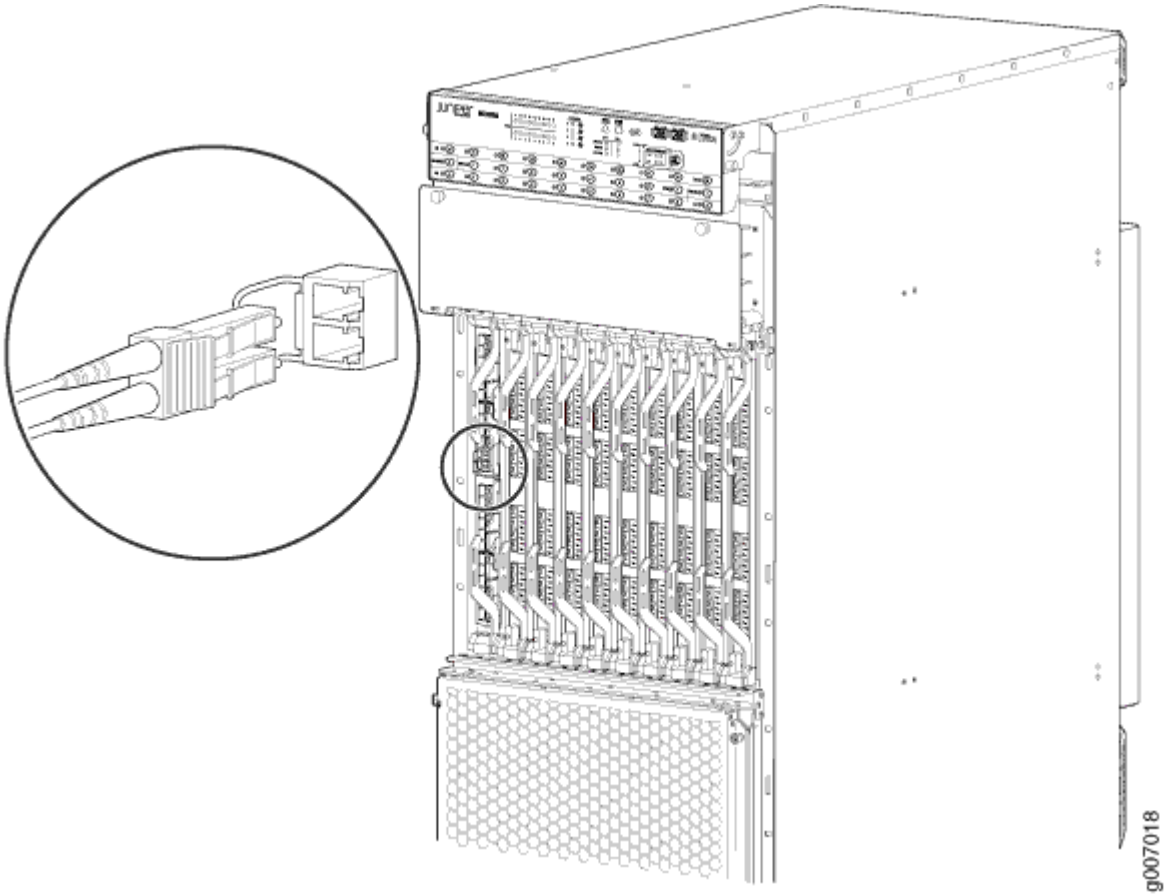
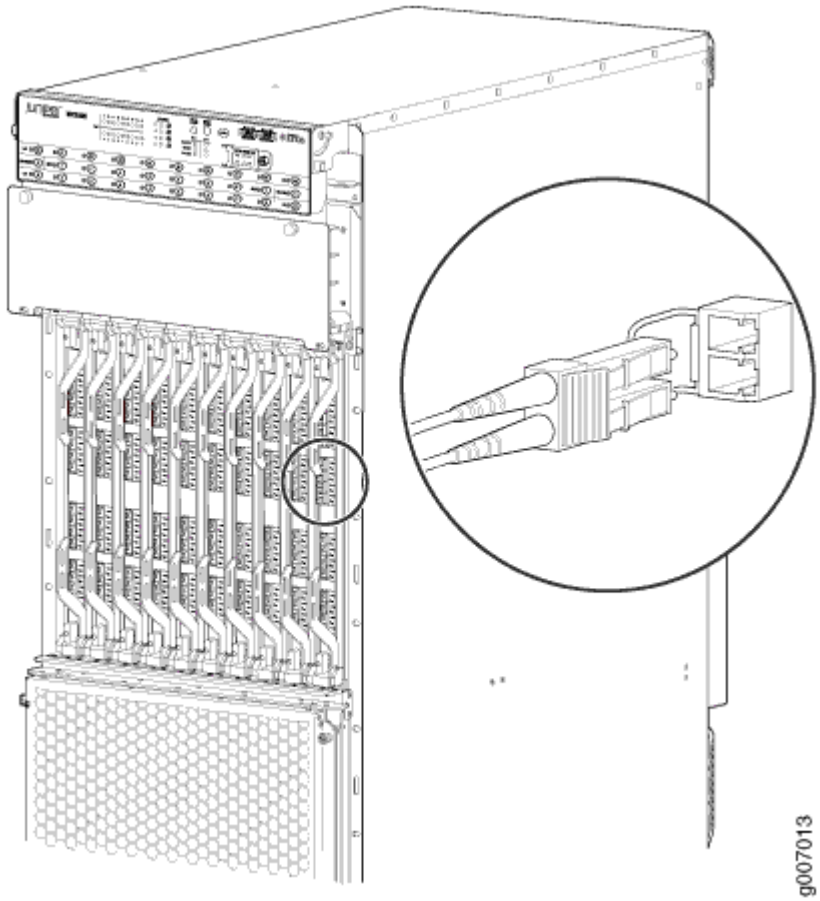


Figure 329: Installing an MPC Cable



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 issuing the `request chassis fpc online` command, the FRU will get power, and the system total power will decrease.

   - 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 MX2020 MPC or MIC | 776

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

Maintaining Cables That Connect to MX2020 MPCs or MICs

IN THIS SECTION

Purpose

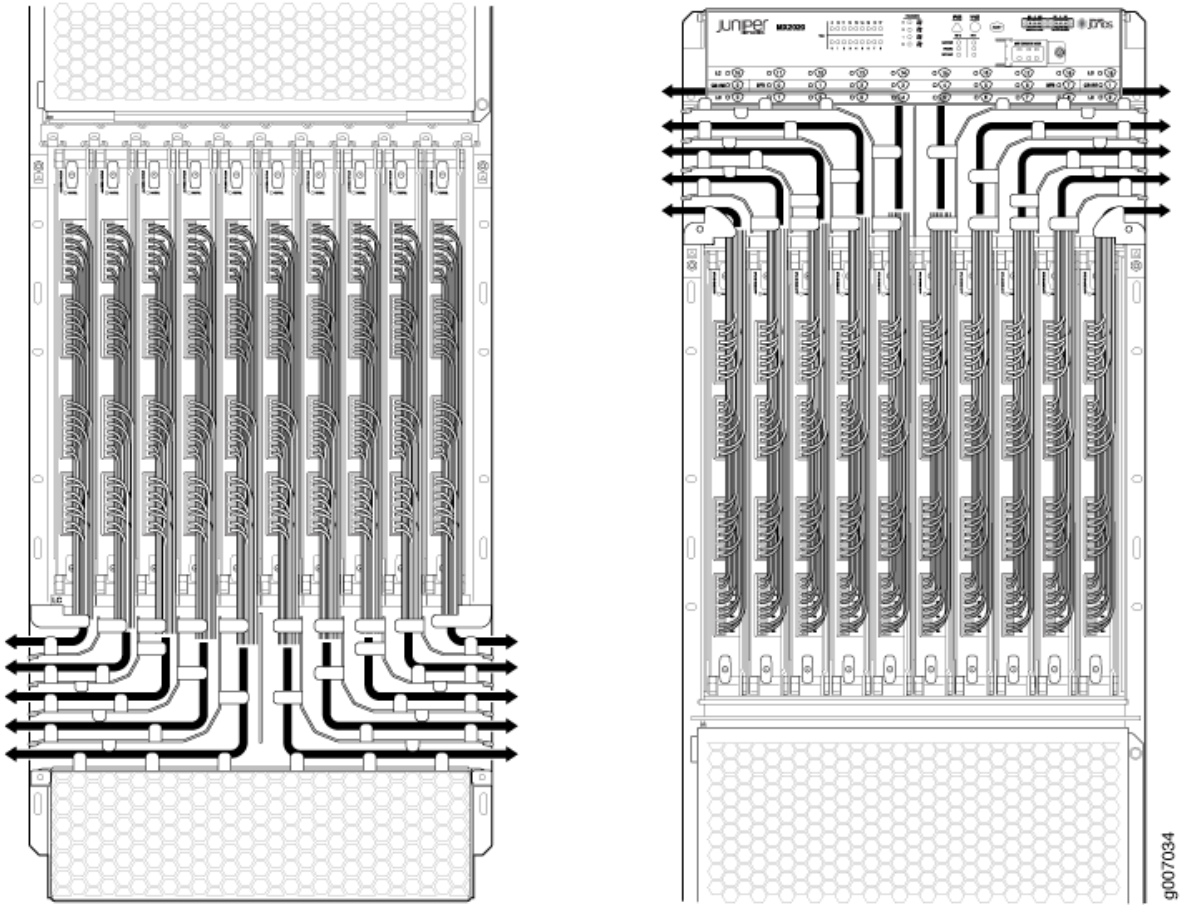
For optimum router performance, verify the condition of the cables that connect to the MPCs or MICs.

Action

On a regular basis:

- Use an upper cable manager and a lower cable manager (shown in Figure 330 on page 782) to support cables and prevent cables from dislodging or developing stress points.

Figure 330: Upper and Lower Cable Manager Cable Routing



NOTE: The MX2020 supports both standard and extended upper and lower cable management.

- Place excess cable out of the way in the upper and lower cable managers. 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 MX2020 Hardware Components | 330

MX2020 Cable Management Description | 74

Maintaining MX2020 MPCs | 714

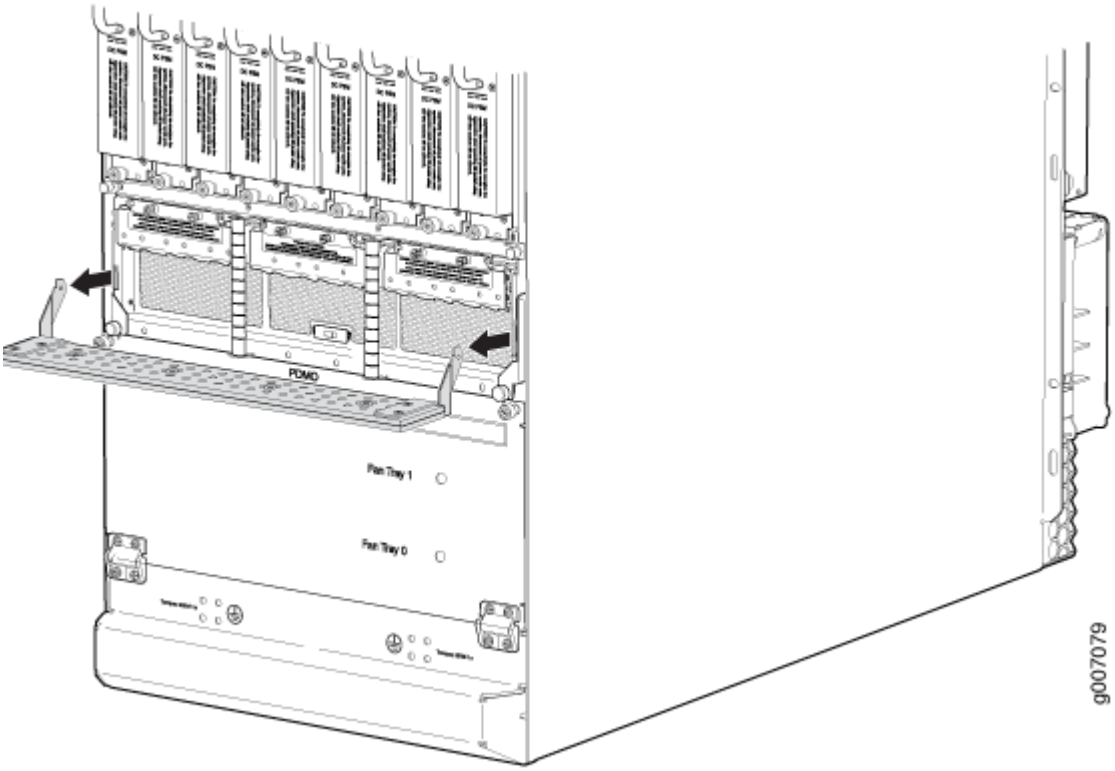
Maintaining MX2020 MICs | 732

Removing the MX2020 DC Cable Manager

To remove the standard DC cable manager (see Figure 331 on page 784):

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 331: Removing the Standard DC Cable Manager

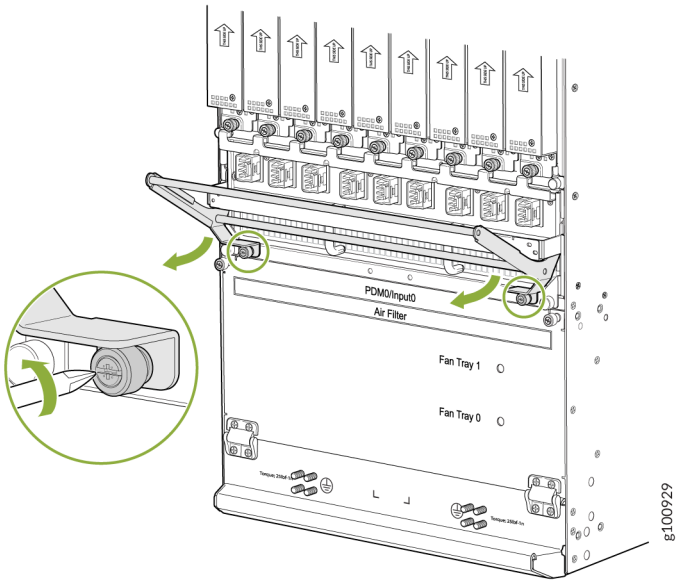


To remove the cable manager for the DC PDM (240 V China) and the universal (HVAC/HVDC) PDM (see Figure 332 on page 785):

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 332 on page 785

Figure 332: Removing the DC Cable Manager for DC PDM (240 V China) and the Universal (HVAC/ HVDC) PDM



3. Grasp the DC cable manager, lift up and pull straight out from the DC PDM on the rear of the chassis.
4. Place the DC cable manager into an electrostatic bag and set it aside.

RELATED DOCUMENTATION

Installing the MX2020 DC Cable Manager | 785

Installing the MX2020 DC Cable Manager

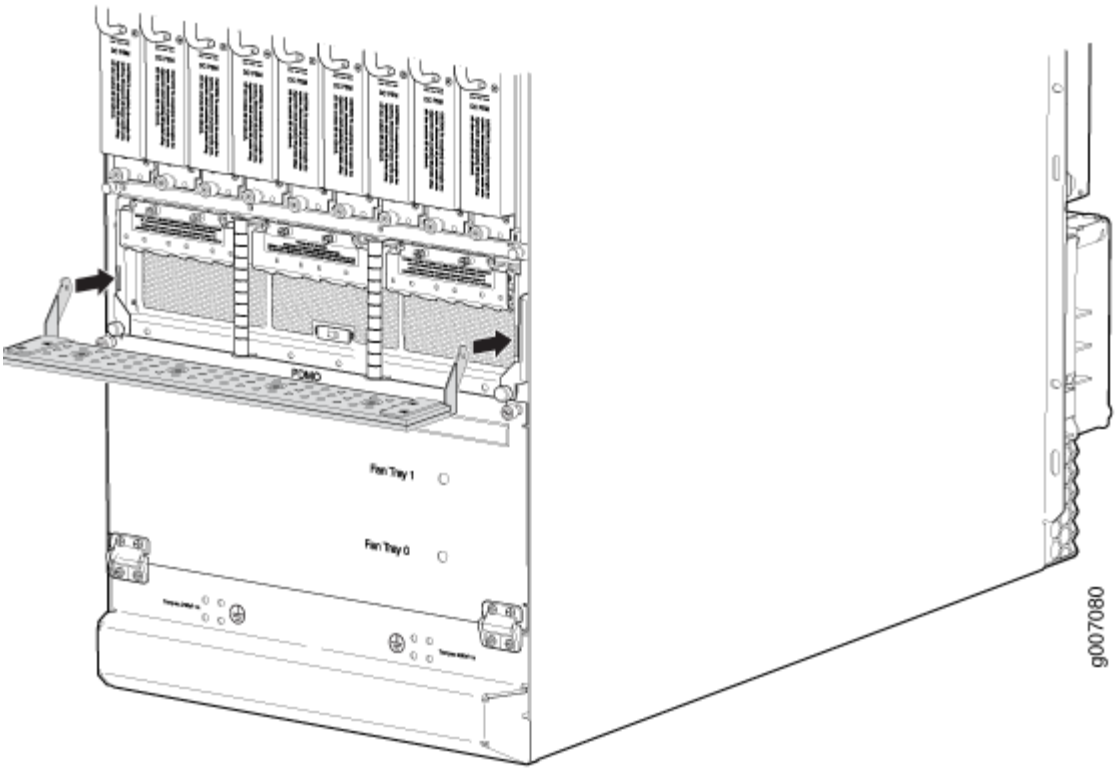
NOTE: To accommodate additional clearance, you may order an extended DC cable manager from Juniper Networks.

To install the DC cable manager (see Figure 333 on page 786):

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.

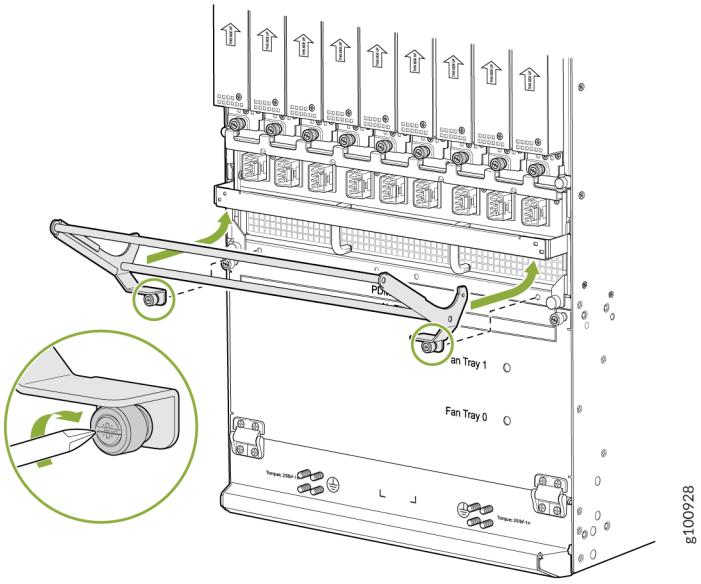
Figure 333: Installing the Standard DC Cable Manager



To install the DC cable manager for the DC PDM (240 V China) or the universal (HVAC/HVDC) PDM (see "Installing the MX2020 DC Cable Manager" on page 785):

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.

Figure 334: Installing the DC Cable Manager on the DC PDM (240 V China) and Universal (HVAC/ HVDC) PDM



4. Push down to secure the DC cable manager in place. Tighten the screws using a screwdriver. See Figure 334 on page 787.

RELATED DOCUMENTATION

- Removing the MX2020 DC Cable Manager | **783**

Replacing the MX2020 Cable Managers

IN THIS SECTION

The MX2020 router consists of an upper, middle card-cage, lower, and DC cable management system used for routing and securing cables away from system components. There are two types of cable management systems: standard and extended. The following instructions represent both.

NOTE: The middle card-cage cable manager is permanently installed on the MX2020 system chassis, and cannot be removed.

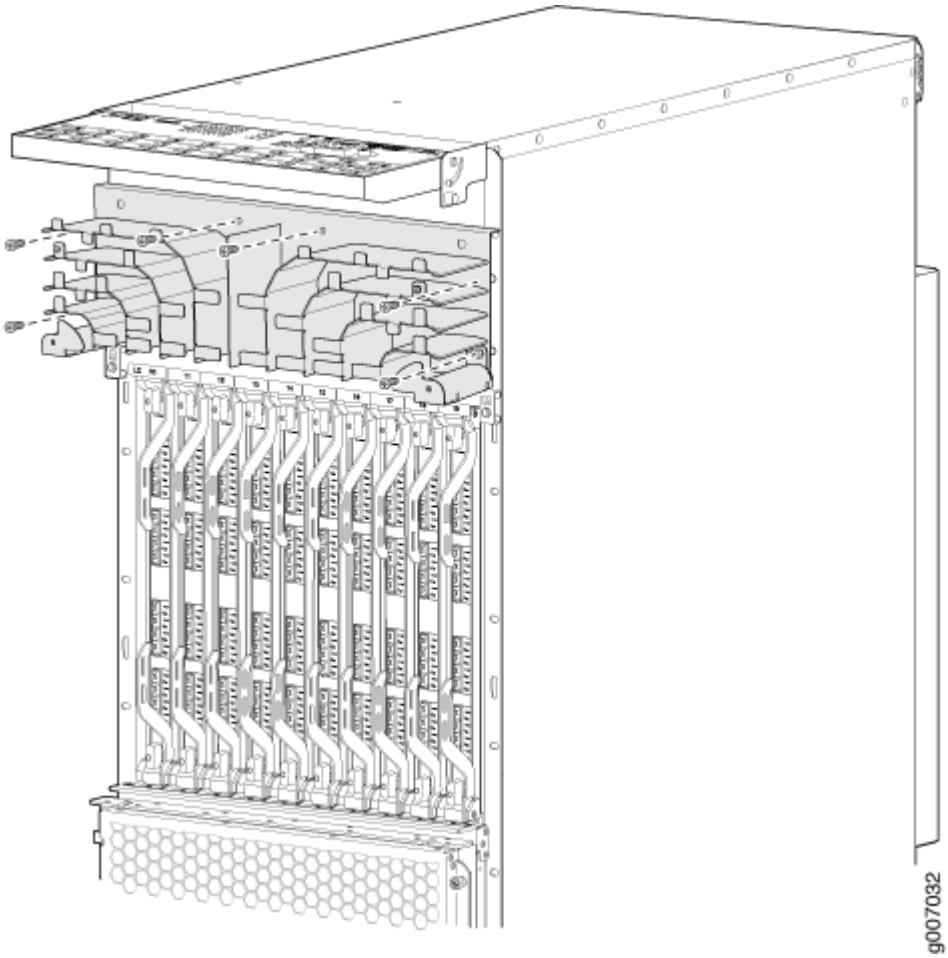
Removing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To remove the upper cable manager (see Figure 335 on page 789):

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 upper cable manager cover, and remove it.
3. Using a Phillips (+) screwdriver (number 1 or 2), loosen the mounting screws on the upper cable manager.
4. Grasp the upper cable manager, and pull it straight out from the studs on the front of the chassis.

Figure 335: Removing the Standard Upper Cable Manager



SEE ALSO

Installing the MX2020 Upper Cable Manager | **807**

Removing the MX2020 Lower Cable Manager

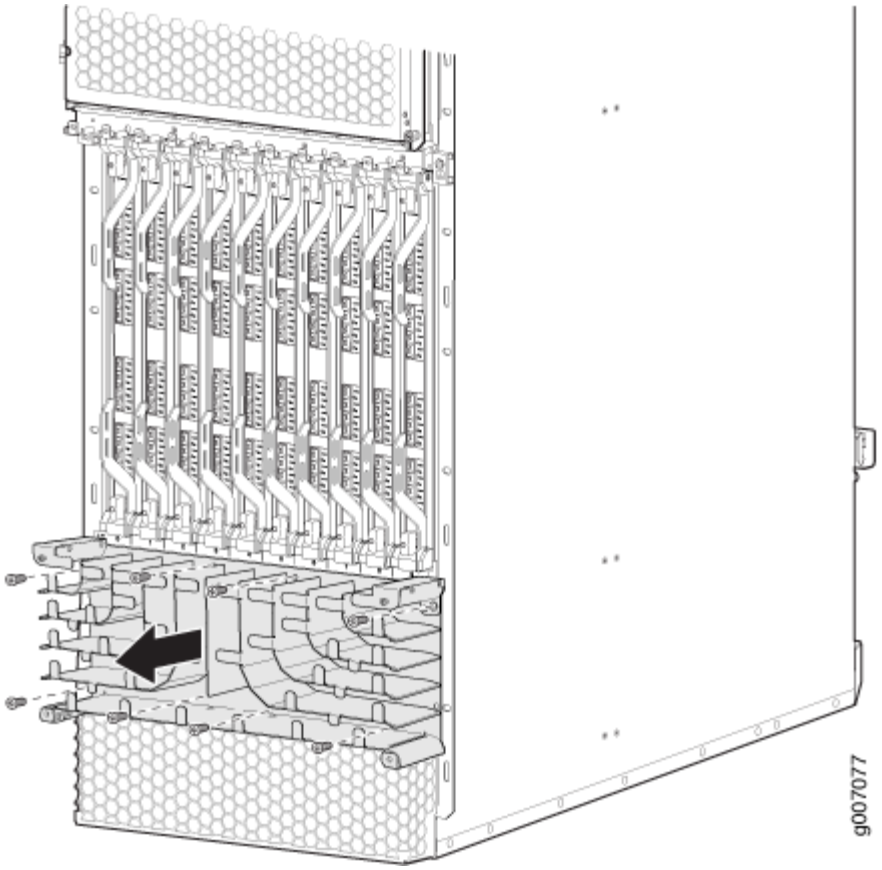
NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To remove the lower cable manager (see Figure 336 on page 790):

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 336: Removing the Standard Lower Cable Manager



SEE ALSO

Installing the MX2020 Lower Cable Manager | 804

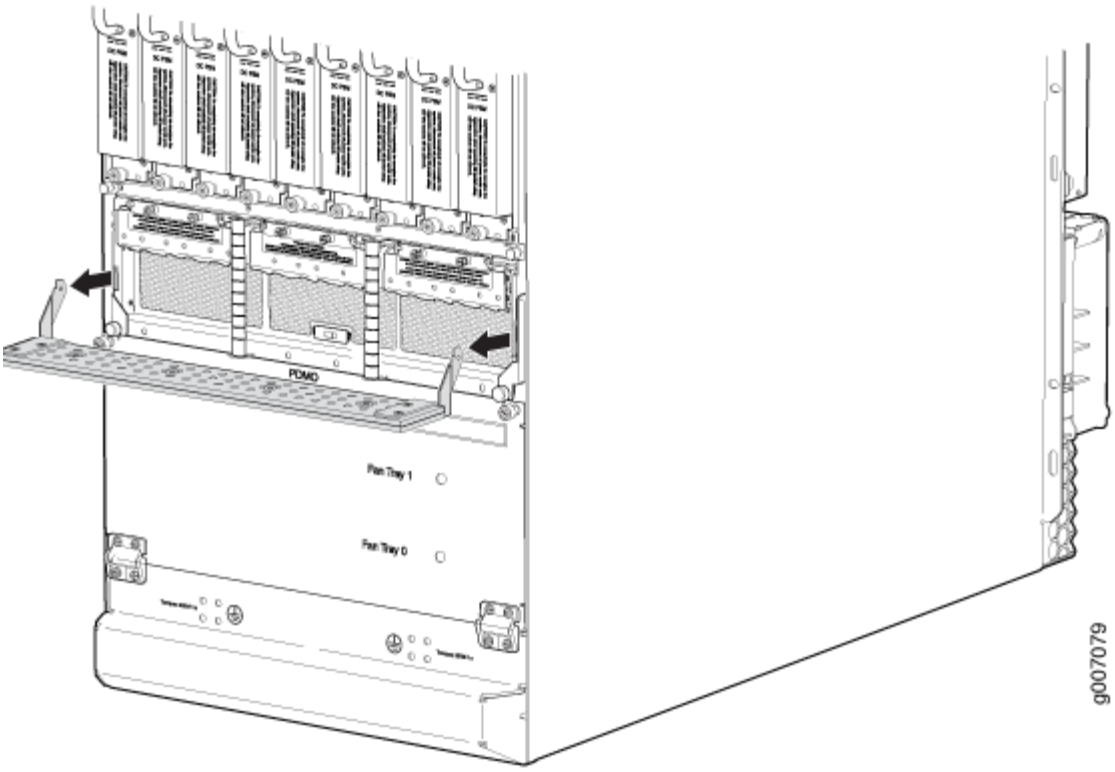
Removing the MX2020 DC Cable Manager

To remove the standard DC cable manager (see Figure 337 on page 791):

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.

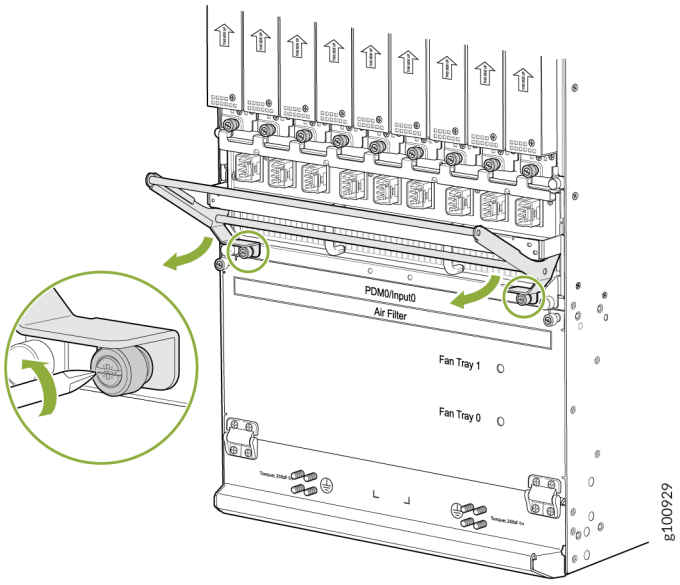
Figure 337: Removing the Standard DC Cable Manager



To remove the cable manager for the DC PDM (240 V China) and the universal (HVAC/HVDC) PDM (see Figure 338 on page 792):

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 338 on page 792

Figure 338: Removing the DC Cable Manager for DC PDM (240 V China) and the Universal (HVAC/HVDC) PDM



3. Grasp the DC cable manager, lift up and pull straight out from the DC PDM on the rear of the chassis.
4. Place the DC cable manager into an electrostatic bag and set it aside.

SEE ALSO

Installing the MX2020 DC Cable Manager | **785**

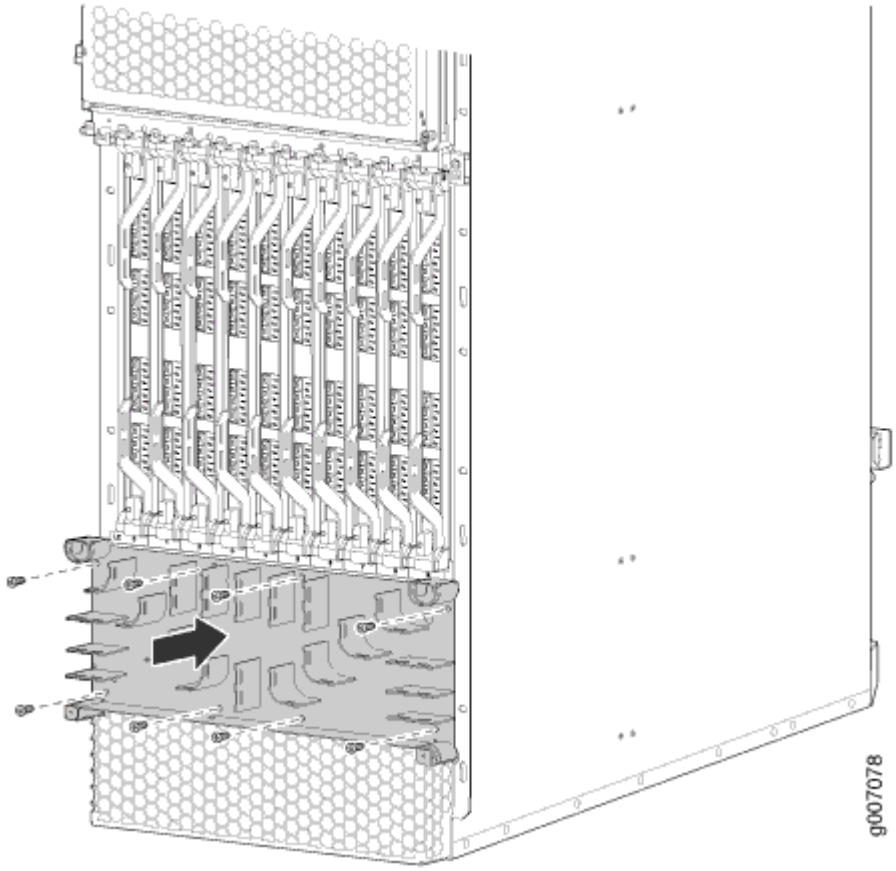
Installing the MX2020 Lower Cable Manager

NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To install the lower cable manager (see Figure 339 on page 793):

1. Position the lower cable manager on the studs on the lower front of the chassis, just below the MPCs.
2. Insert the screws into the corners in the lower cable manager onto the studs on the chassis.
3. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 339: Installing the Standard Lower Cable Manager



SEE ALSO

Removing the MX2020 Lower Cable Manager | 803

Installing the MX2020 Upper Cable Manager

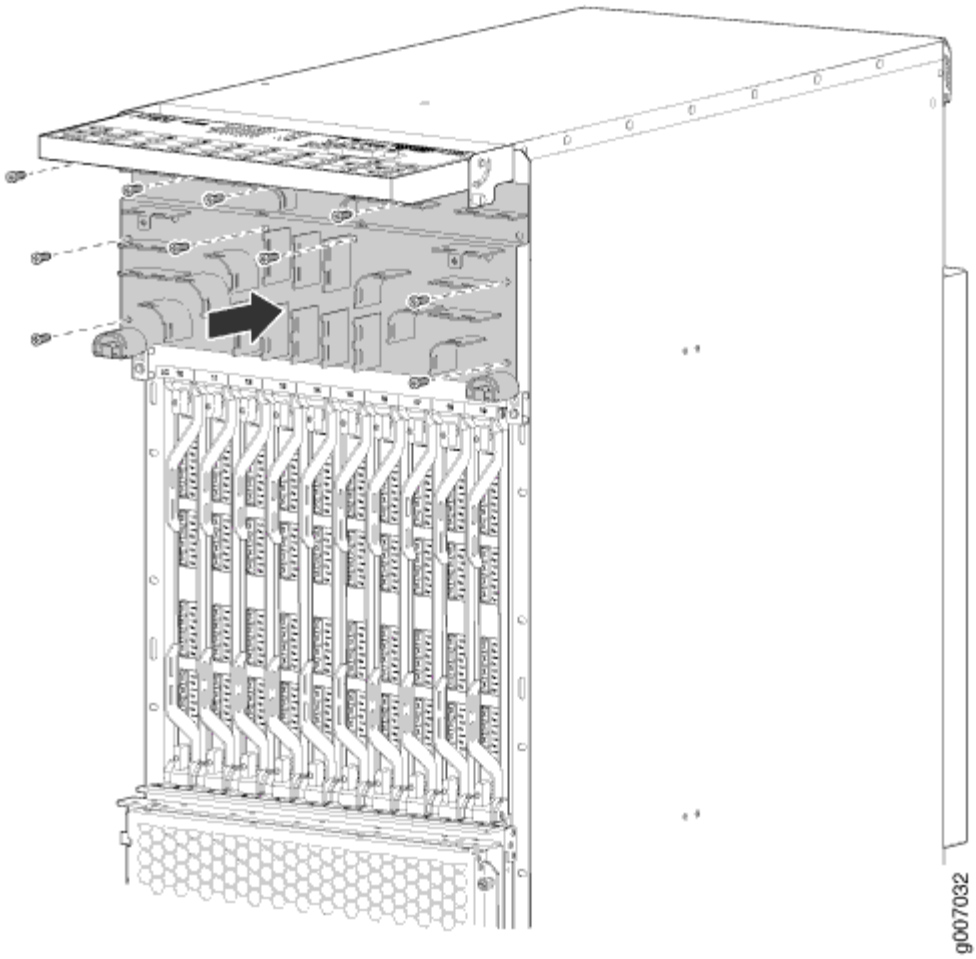
NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To install the upper cable manager (see Figure 340 on page 794):

1. Position the upper cable manager on the studs on the upper front of the chassis, just below the craft interface.
2. Insert the screws into the corners in the upper cable manager onto the studs on the chassis.
3. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.

4. Replace the cable manager cover, and secure the two captive screws.

Figure 340: Installing the Standard Upper Cable Manager



SEE ALSO

Removing the MX2020 Upper Cable Manager | 806

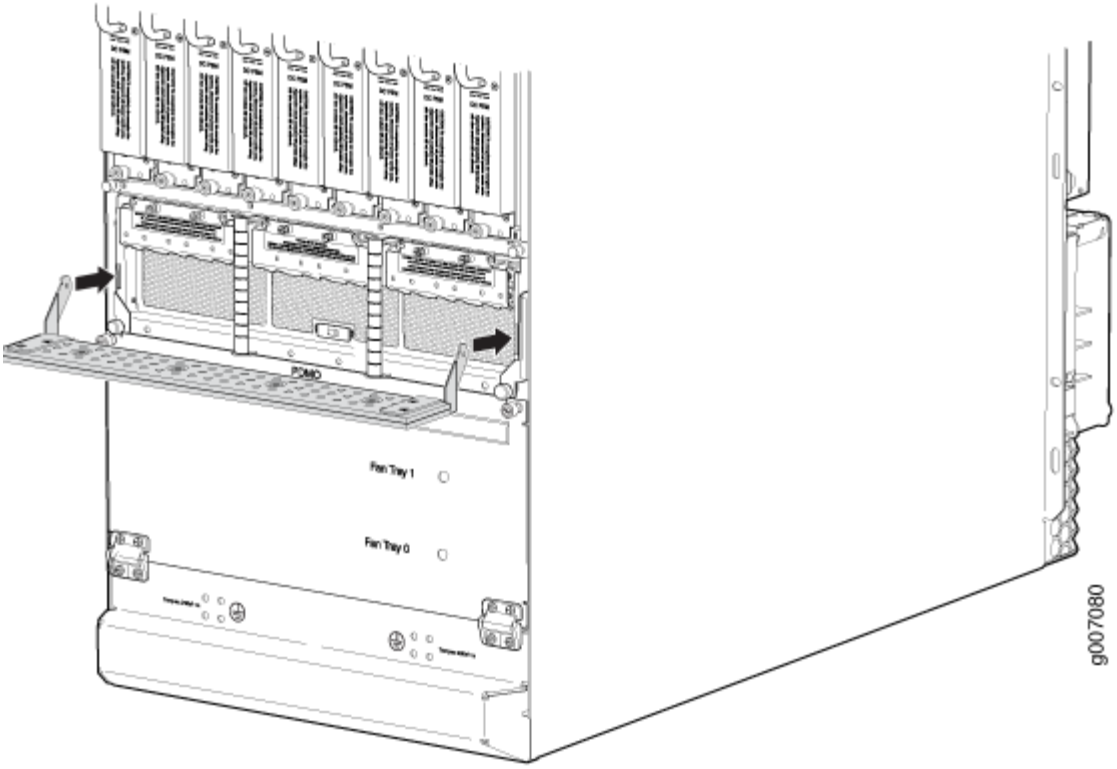
Installing the MX2020 DC Cable Manager

NOTE: To accommodate additional clearance, you may order an extended DC cable manager from Juniper Networks.

To install the DC cable manager (see Figure 341 on page 795):

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.

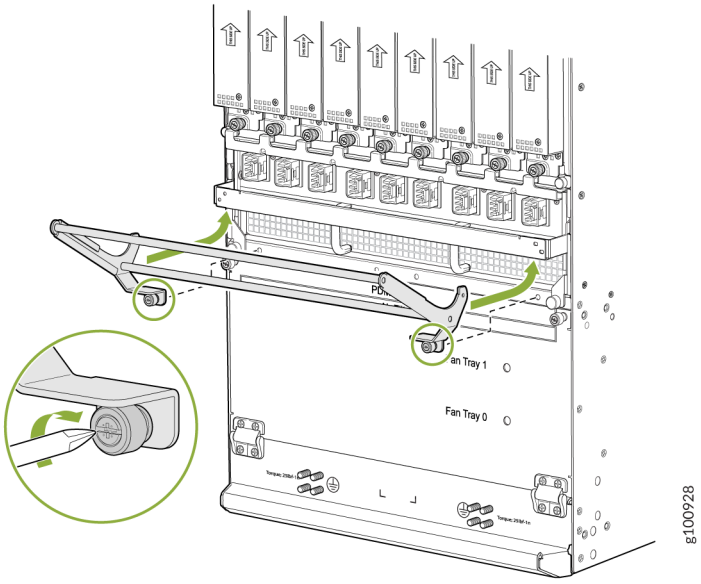
Figure 341: Installing the Standard DC Cable Manager



To install the DC cable manager for the DC PDM (240 V China) or the universal (HVAC/HVDC) PDM (see "Installing the MX2020 DC Cable Manager" on page 794):

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.

Figure 342: Installing the DC Cable Manager on the DC PDM (240 V China) and Universal (HVAC/ HVDC) PDM



4. Push down to secure the DC cable manager in place. Tighten the screws using a screwdriver. See Figure 342 on page 796.

SEE ALSO

Removing the MX2020 DC Cable Manager | **783**

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

MX2020 Cable Management Description | **74**

Replacing the MX2020 Extended Cable Managers | **797**

Replacing the MX2020 Extended Cable Managers

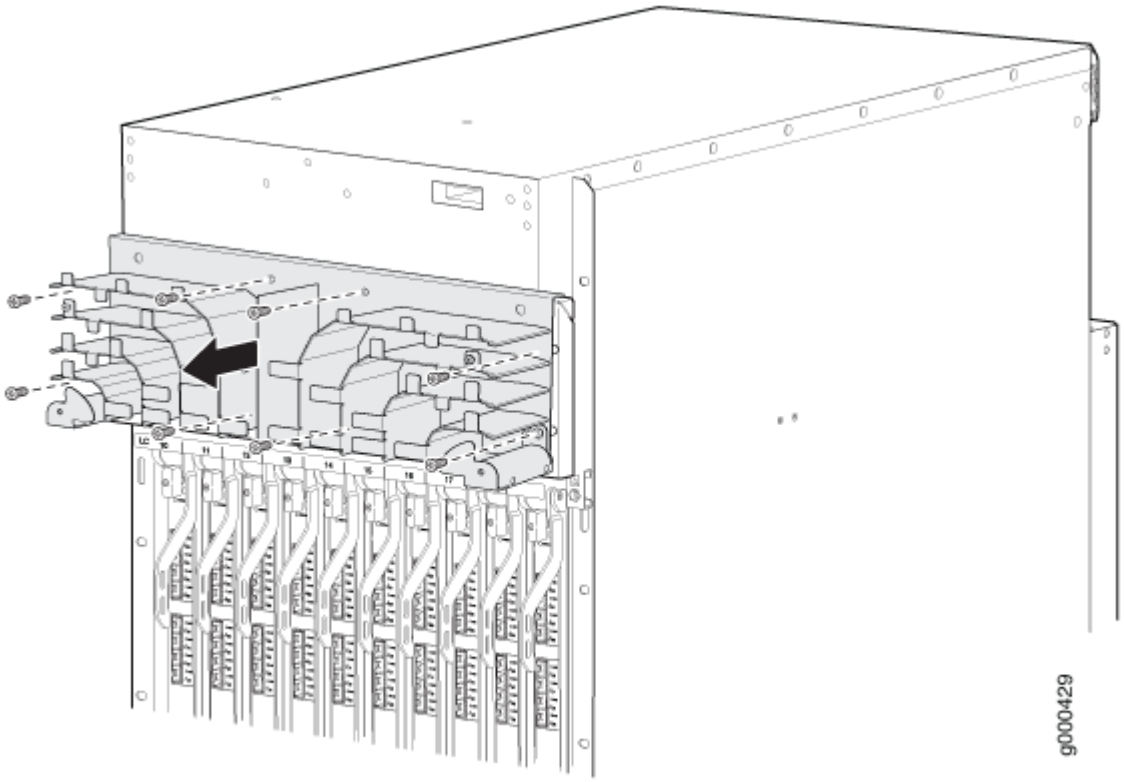
IN THIS SECTION

Removing the MX2020 Upper Extended Cable Manager

To remove the upper MX2020 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. Remove the extended craft interface as described in "Removing the MX2020 Extended Craft Interface" on page 753.
3. To remove the cover, loosen the two captive screws on the extended cable manager cover. Set the extended cable manager cover aside.
4. Remove the eight screws that secure the extended cable manager to the chassis as shown in Figure 343 on page 798.
5. Pull the extended cable manager away from the chassis.

Figure 343: Removing the Extended Upper Cable Manager

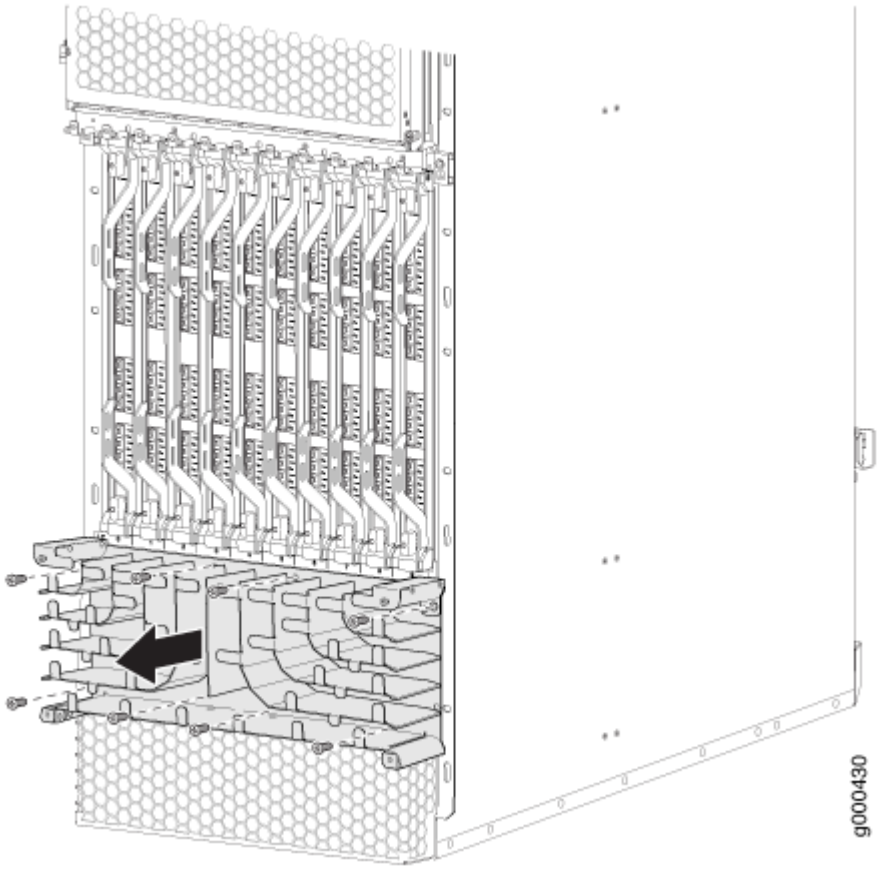


Removing the MX2020 Lower Extended Cable Manager

To remove the lower MX2020 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 344 on page 799.
4. Pull the extended cable manager away from the chassis.

Figure 344: Removing the Extended Lower Cable Manager

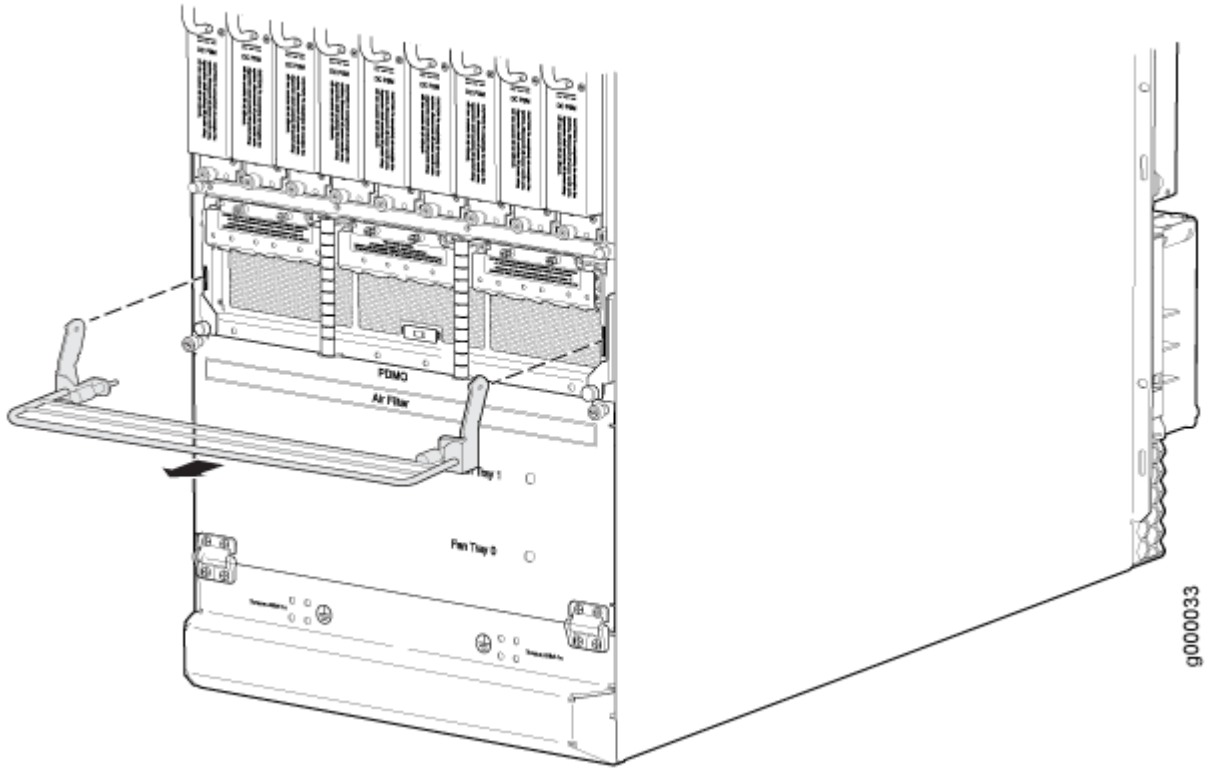


Removing the MX2020 Extended DC Cable Manager

To remove the extended DC cable manager (see Figure 345 on page 800):

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 345: Removing the Extended DC Cable Manager



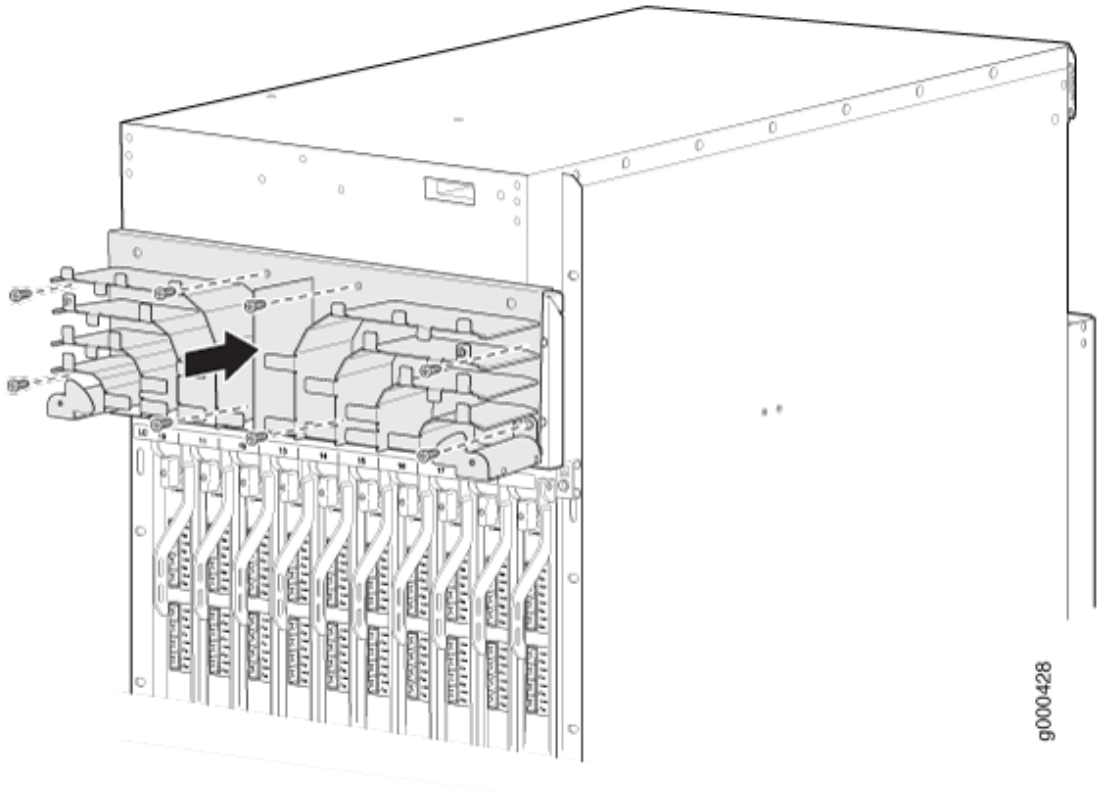
Installing the MX2020 Upper Extended Cable Manager

The upper extended cable manager should be used with the extended craft interface to allow for additional clearance.

To install the upper extended cable manager (see Figure 346 on page 801):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. If necessary, remove the extended craft interface as described in "Removing an MX2020 Extended Craft Interface" on page 753.
3. Position the upper extended cable manager on the studs below the location of the craft interface.
4. Attach the upper extended cable manager using eight screws as shown in Figure 346 on page 801.
5. Replace the cable manager cover, and secure it with the two captive screws.
6. Install the extended craft interface as described in "Installing an MX2020 Extended Craft Interface" on page 754.

Figure 346: Installing the MX2020 Upper Extended Cable Manager

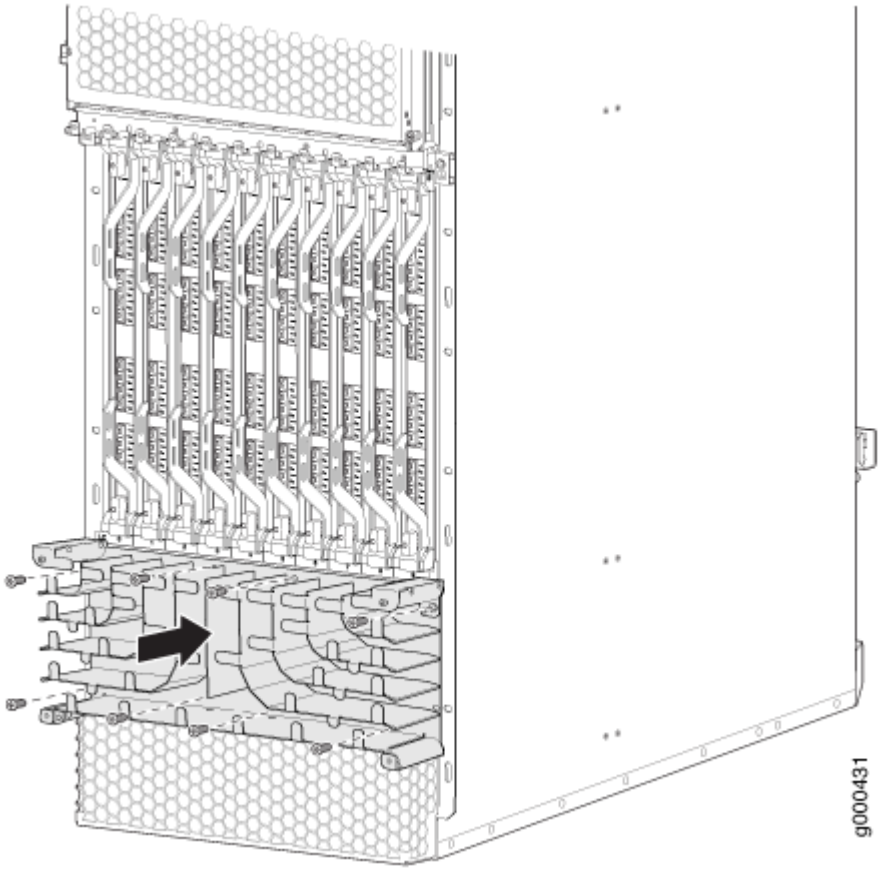


Installing the Lower MX2020 Extended Cable Manager

To install the lower extended cable manager (see Figure 347 on page 802):

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 extended cable manager on the studs below the lower card cage.
3. Attach the lower extended cable manager using eight screws as shown in Figure 347 on page 802.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 347: Installing the Extended Lower Cable Manager

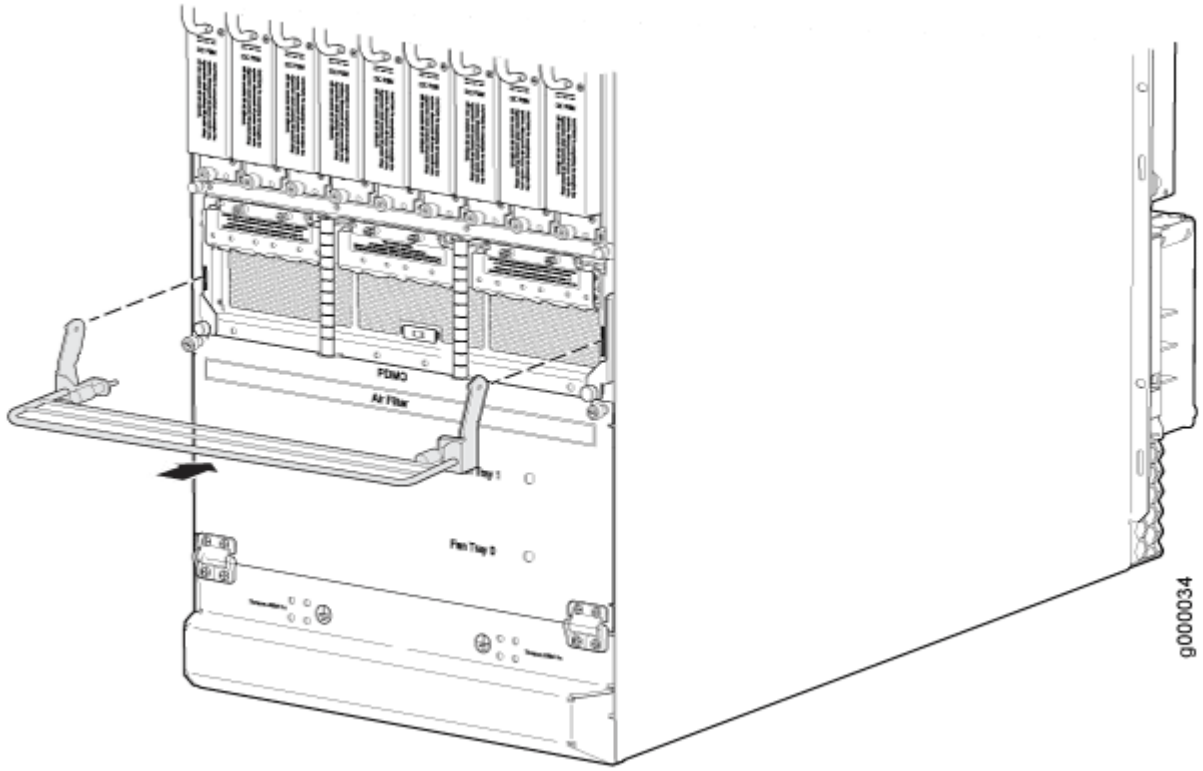


Installing the MX2020 Extended DC Cable Manager

To install the extended DC cable manager (see Figure 348 on page 803):

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 348: Installing the Extended DC Cable Manager



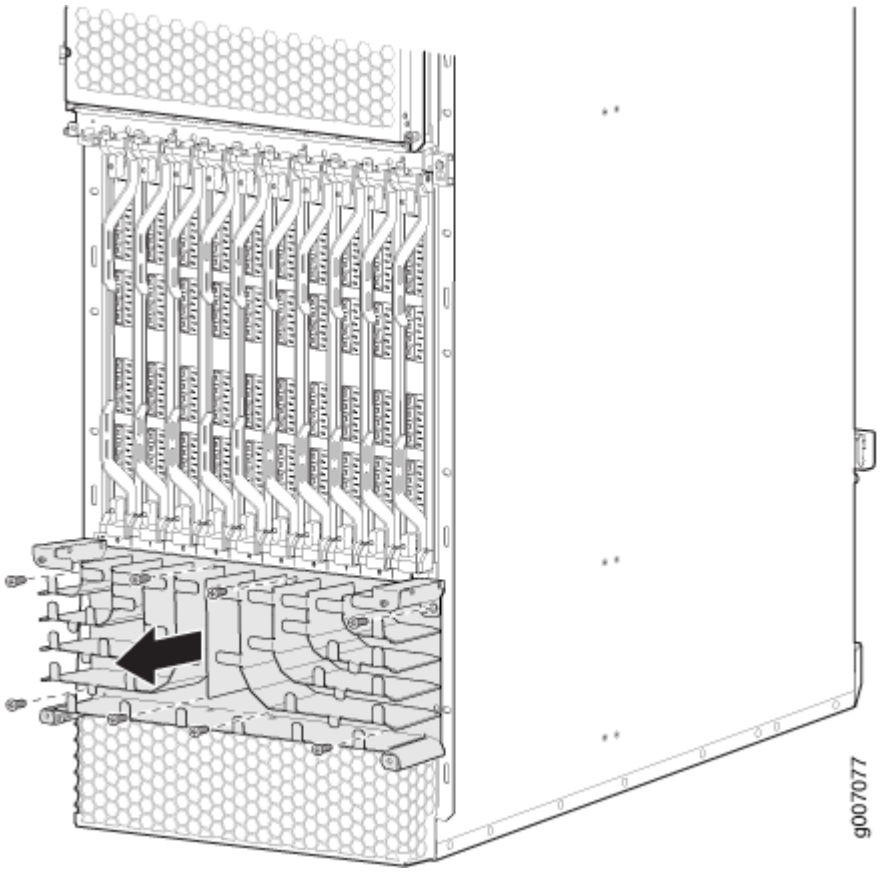
Removing the MX2020 Lower Cable Manager

NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To remove the lower cable manager (see Figure 349 on page 804):

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 349: Removing the Standard Lower Cable Manager



RELATED DOCUMENTATION

Installing the MX2020 Lower Cable Manager | 804

Installing the MX2020 Lower Cable Manager

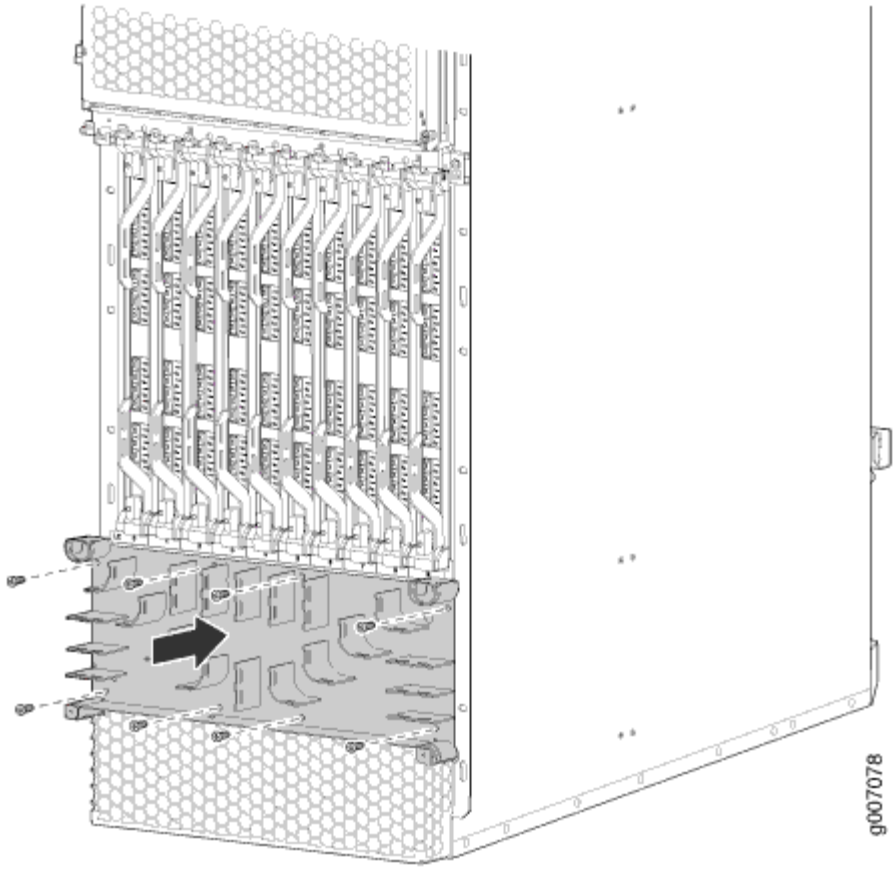
NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To install the lower cable manager (see Figure 350 on page 805):

1. Position the lower cable manager on the studs on the lower front of the chassis, just below the MPCs.

2. Insert the screws into the corners in the lower cable manager onto the studs on the chassis.
3. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 350: Installing the Standard Lower Cable Manager



RELATED DOCUMENTATION

Removing the MX2020 Lower Cable Manager | 803

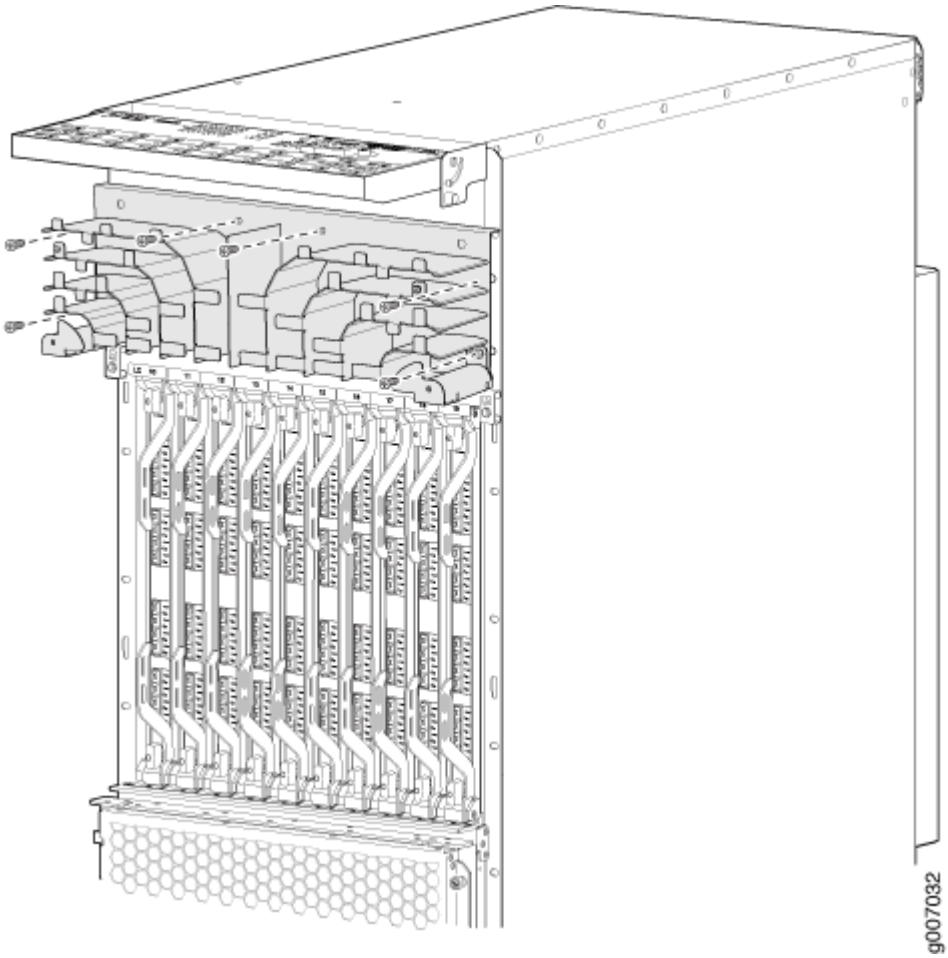
Removing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To remove the upper cable manager (see Figure 351 on page 807):

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 upper cable manager cover, and remove it.
3. Using a Phillips (+) screwdriver (number 1 or 2), loosen the mounting screws on the upper cable manager.
4. Grasp the upper cable manager, and pull it straight out from the studs on the front of the chassis.

Figure 351: Removing the Standard Upper Cable Manager



RELATED DOCUMENTATION

Installing the MX2020 Upper Cable Manager | **807**

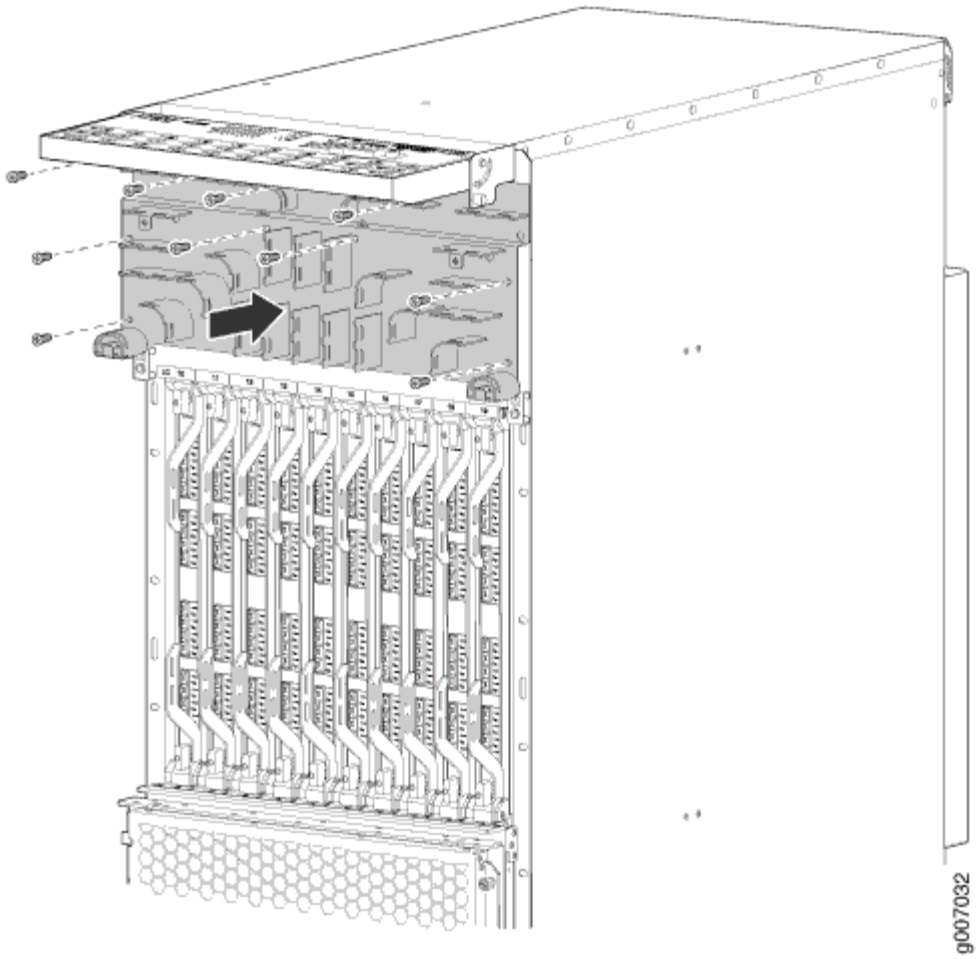
Installing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To install the upper cable manager (see Figure 352 on page 808):

1. Position the upper cable manager on the studs on the upper front of the chassis, just below the craft interface.
2. Insert the screws into the corners in the upper cable manager onto the studs on the chassis.
3. Using a Phillips (+) screwdriver (number 1 or 2), tighten the mounting screws securely.
4. Replace the cable manager cover, and secure the two captive screws.

Figure 352: Installing the Standard Upper Cable Manager



RELATED DOCUMENTATION

Removing the MX2020 Upper Cable Manager | 806

Replacing an MX2020 Three-Phase Delta AC Power Cord

IN THIS SECTION

The MX2020 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 MX2020 Three-Phase Delta AC Power Cord

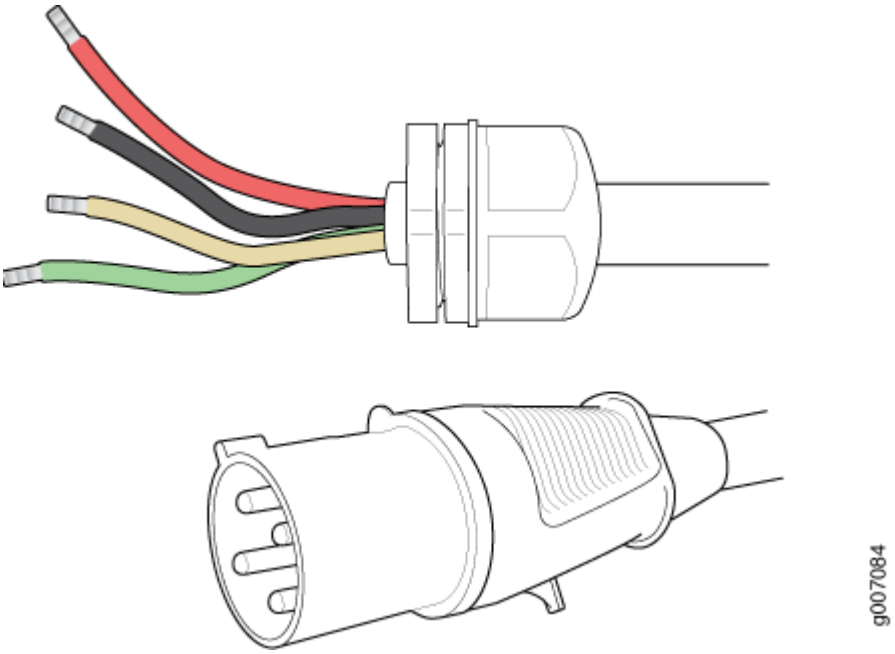
To remove a three-phase delta AC power cord:

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 353 on page 810) from the power source.

Figure 353: 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 354 on page 811). 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:

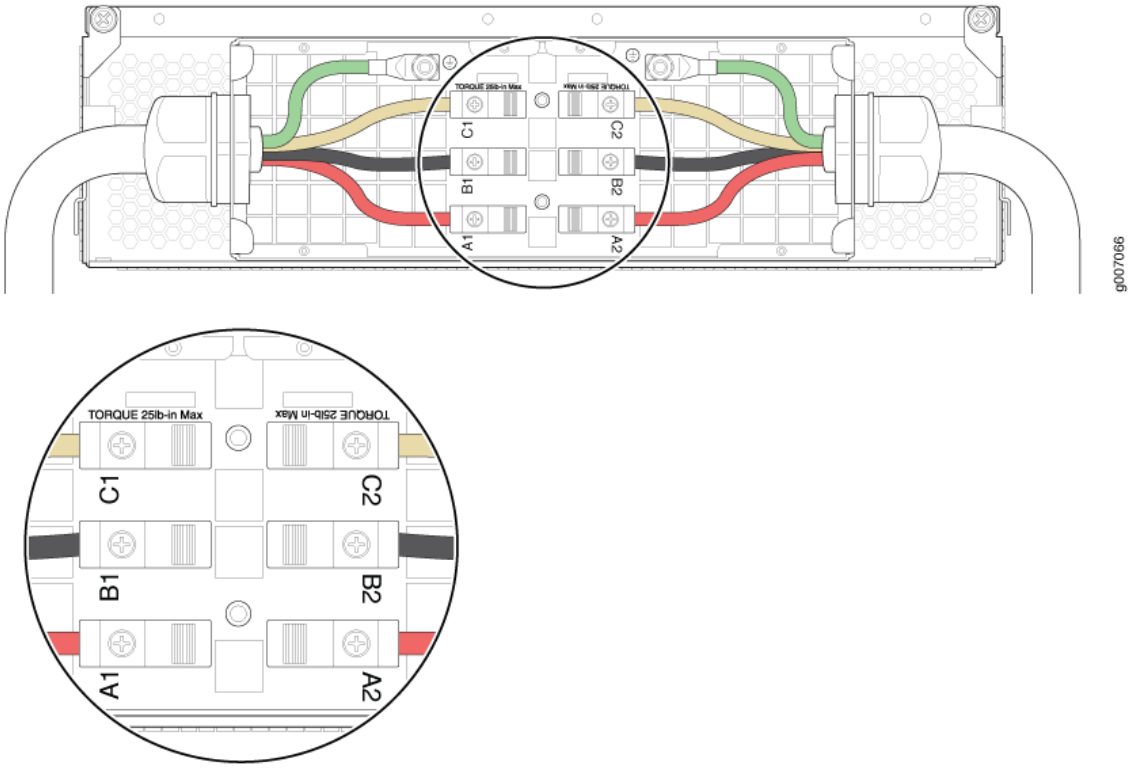
a. Remove the wire labeled **L3** from the input terminal labeled **C1**.

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 354: 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 MX2020 Three-Phase Delta AC Power Cord | 812

Installing an MX2020 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. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
9. Put 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 355 on page 813). 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 122 on page 814 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

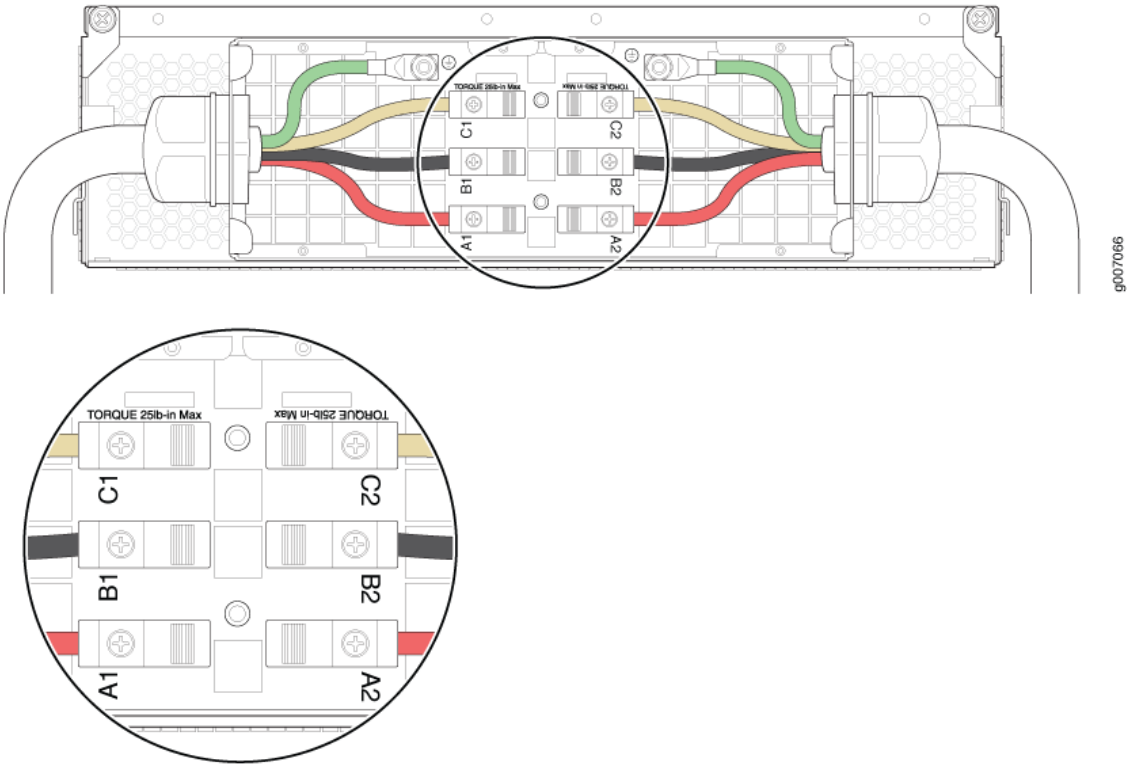
    a. Insert the grounding wire into the grounding point labeled **GND**.

    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 355: 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 MX2020 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**.

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 may be caused by miswired 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 264VAC when measured with a 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 122: 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 is not touching or blocking 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

RELATED DOCUMENTATION

Prevention of Electrostatic Discharge Damage

MX2000 Three-Phase Delta AC Power Distribution Module Description

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

Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules

Troubleshooting the MX2000 Router Power System

MX2000 AC Power Cord Specifications

MX2000 Three-Phase Delta AC Power Distribution Module Electrical Specifications

Replacing an MX2020 Three-Phase Wye AC Power Cord

IN THIS SECTION

The MX2020 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 MX2020 Three-Phase Wye AC Power Cord

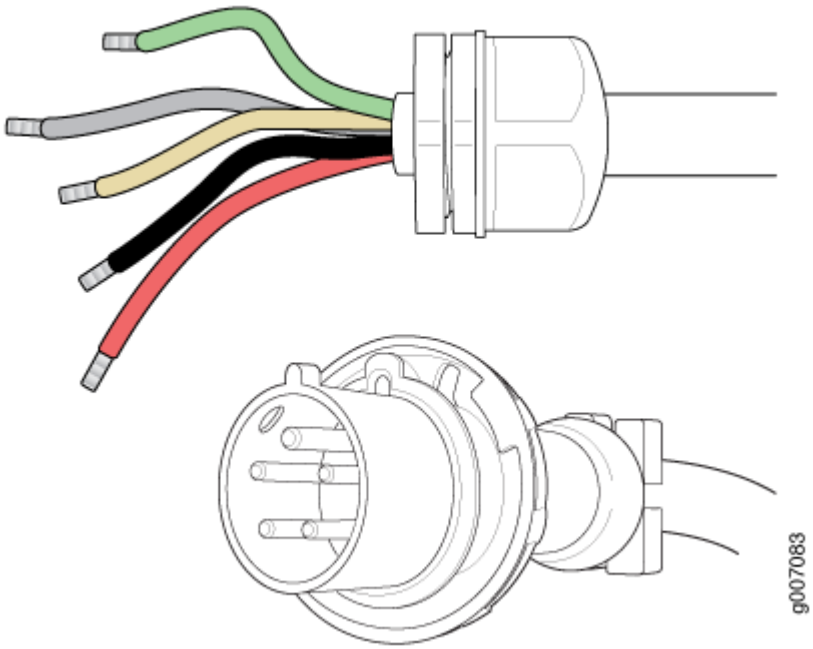
To remove a three-phase wye AC power cord:

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 356 on page 817) from the power source.

Figure 356: 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 357 on page 818). 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**.

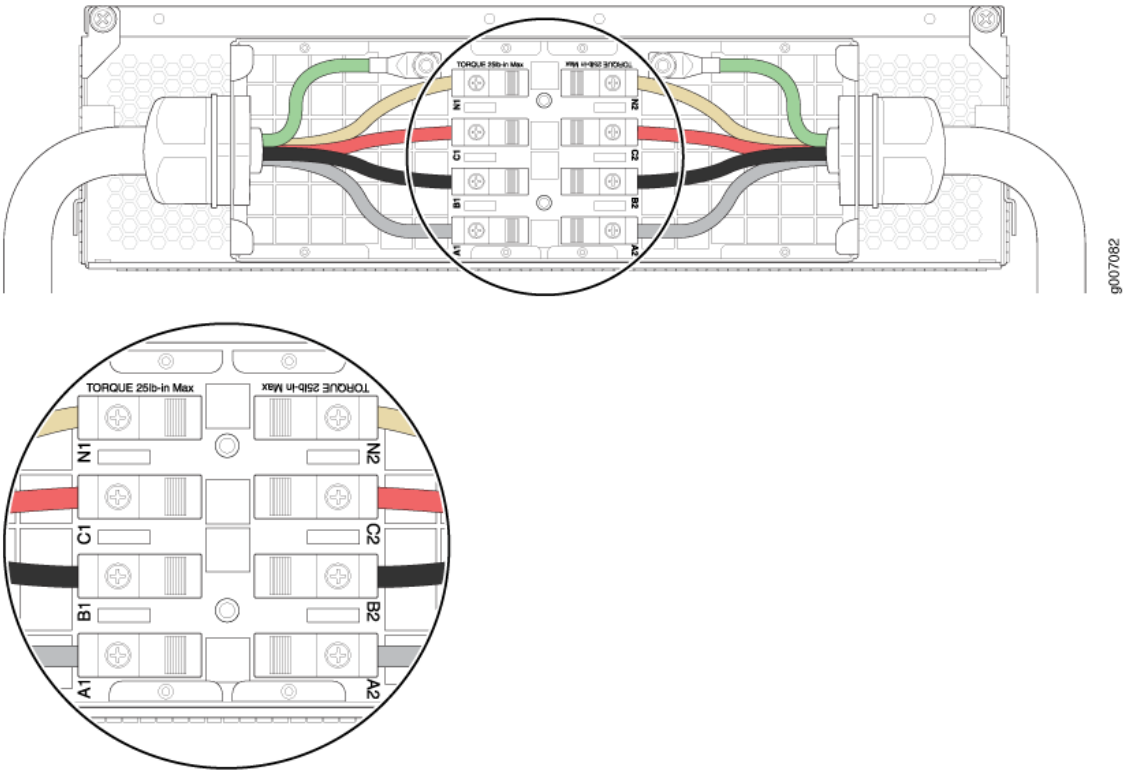
b. Remove the wire labeled **L3** from the input terminal labeled **C1**.

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 357: 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 PDM slot.

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 MX2000 Three-Phase Wye AC Power Cord | 819

Installing an MX2000 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. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
9. Put 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 358 on page 820). 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 123 on page 821 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**.

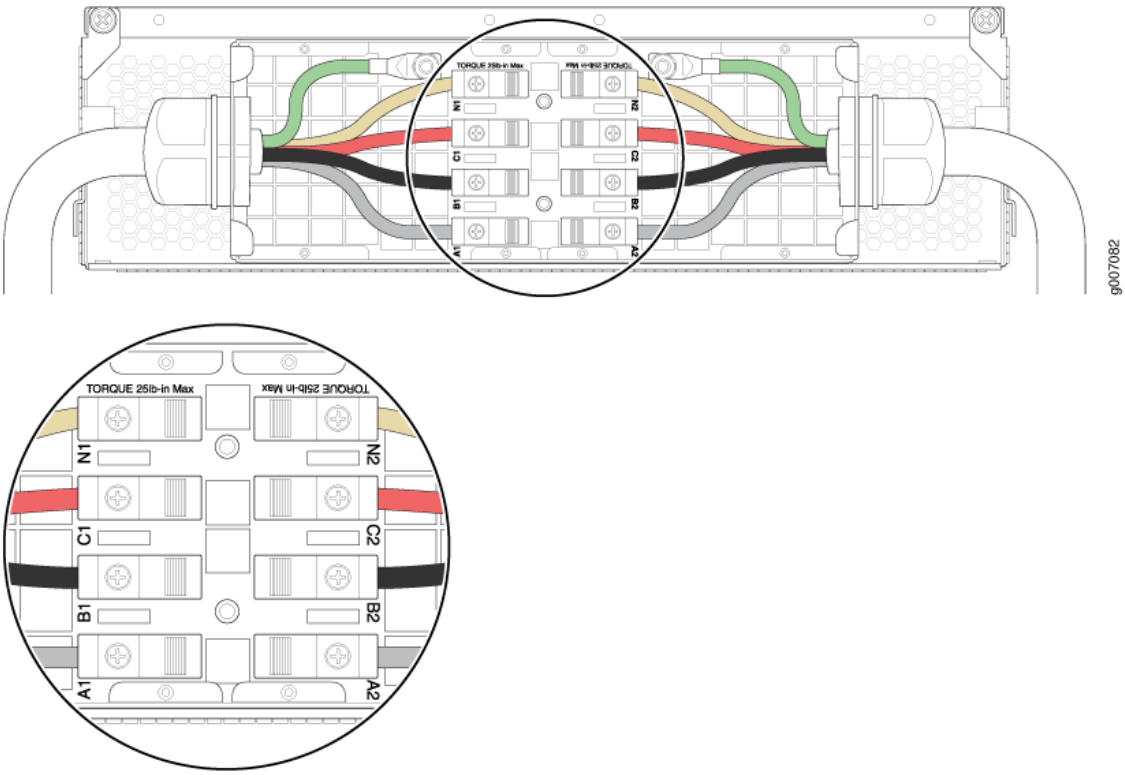
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    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 358: 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**.

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 may 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 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 123: 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. Screw the retaining nut onto the AC power cord to secure it to the metal wiring compartment.
13. Reinstall the metal PDM wiring cover, and using a number 2 Phillips (+) screwdriver, tighten the four captive screws on the metal AC wiring compartment.
14. 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.
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 MX2020 Three-Phase Wye AC Power Cord | **816**

RELATED DOCUMENTATION

Preventing Electrostatic Discharge Damage to an MX2020 Router

MX2020 Three-Phase Wye AC Power Distribution Module Description

MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs

MX2020 AC Power Cord Specifications

Troubleshooting the MX2000 Router Power System

Replacing an MX2020 DC Power Distribution Module Cable

IN THIS SECTION

Disconnecting an MX2020 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.

SEE ALSO

MX2020 DC Power Requirements | 278

MX2020 DC Power Electrical Safety Guidelines and Warnings

MX2020 DC Power Distribution Module (-48 V) Description | 176

Removing an MX2000 Router DC Power Distribution Module (-48 V) | 522

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*.

To connect a power cable for a DC PDM:

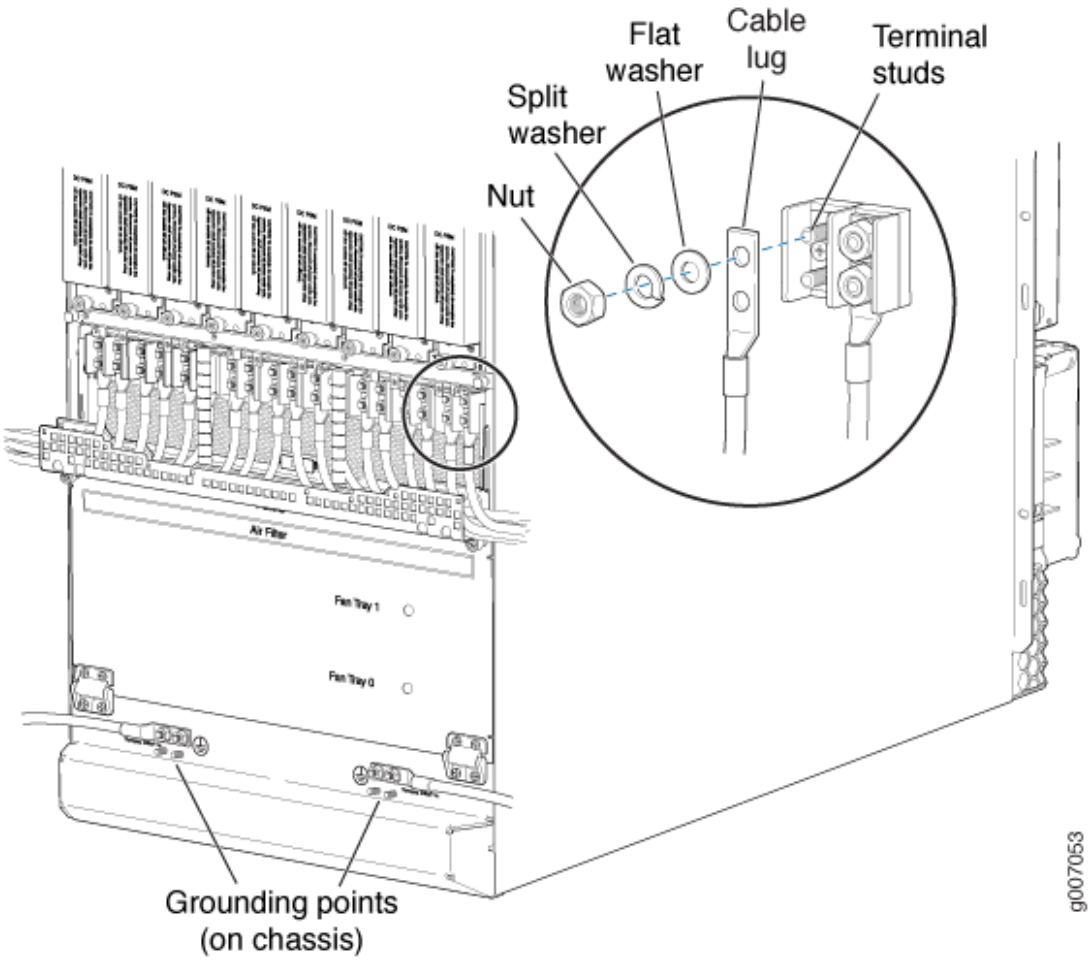
1. Locate a replacement power cable that meets the specifications defined in "MX2000 Router DC (-48 V) Power Subsystem Electrical Specifications" on page 292.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the **–48V** LED is off.
4. Secure 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 359 on page 825). 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 359: 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" on page 292.

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.

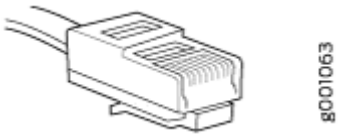
RELATED DOCUMENTATION

- Preventing Electrostatic Discharge Damage to an MX2020 Router
- MX2020 DC Power Distribution Module (-48 V) Description | **176**
- DC Power Cable Specifications for the MX2020 Router | **305**
- MX2020 DC Power Electrical Safety Guidelines

Connect a Device to a Management Console Using an RJ-45 Connector

Ensure that you have an Ethernet cable that has an RJ-45 connector at either end and an RJ-45-to-DB-9 serial port adapter.

Figure 360: RJ-45 Connector on an Ethernet Cable



> **NOTE**: We no longer include the RJ-45 console cable with the DB-9 adapter as part of the device package. If the console cable and adapter are not included in your device package, or if you need a different type of adapter, you can order the following separately:
>
> - RJ-45 to DB-9 adapter (JNP-CBL-RJ45-DB9)

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

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

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

You can configure and manage your network devices using a dedicated management channel. Each device has a console port that you can connect to using an Ethernet cable with an RJ-45 connector. Use the console port to connect the device to the console server or management console. The console port accepts a cable that has an RJ-45 connector.

To connect the device to a management console:

1. Connect one end of the Ethernet cable to the console port (labeled **CON**, **CONSOLE**, or **CON1**) on the device.
2. Connect the other end of the Ethernet cable to the console server (see Figure 361 on page 828) or management console (see Figure 362 on page 829).

Figure 361: Connect a Device to a Management Console Through a Console Server

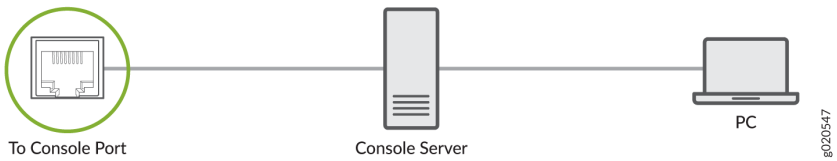


Figure 362: Connect a Device Directly to a Management Console

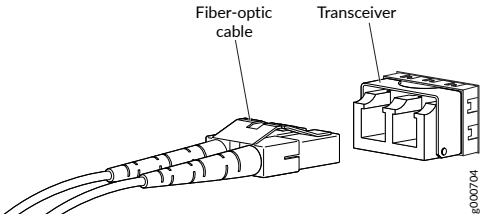
Connect a Fiber-Optic Cable

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

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

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

1. If the fiber-optic cable connector is covered with a rubber safety cap, remove the cap. Save the cap.
2. Remove the rubber safety cap from the optical transceiver. Save the cap.
3. Insert the cable connector into the optical transceiver.



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

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

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

Disconnect a Fiber-Optic Cable

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

Ensure that you have the following parts and tools available:

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

Juniper Networks devices have optical transceivers to which you can connect fiber-optic cables.

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

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

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

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

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

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

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

How to Handle Fiber-Optic Cables

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

Follow these guidelines when handling fiber-optic cables:

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

CHAPTER 31

Powering Off the Router

IN THIS CHAPTER

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*
- *Powering On the DC-Powered MX2010 Router*
- Powering On the DC-Powered (-48 V) MX2020 Router | **452**
- Powering On the DC-Powered (240 V China) MX2000 Router | **454**

CHAPTER 32

Maintaining the Chassis and Components

IN THIS CHAPTER

Routine Maintenance Procedures for the MX2020 Router

IN THIS SECTION

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 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 MX2020 Hardware Components | 330

Maintaining the MX2020 Air Filter | 621

Maintaining the MX2020 Fan Trays | 593

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

Maintaining the MX2010 Host Subsystem

Maintaining the MX2020 Host Subsystem | 645

Maintaining the MX2020 Chassis FRU Power On Sequence

IN THIS SECTION

Purpose

For optimum router performance, verify the condition of the FRU power on sequence.

Action

On a regular basis:

- Check the status of the MX2020 chassis FRU power on sequence issuing the `show chassis power sequence` command.

  The 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 10 11 12 13 14 15 16 17 18 19
```

NOTE: Because the MPCs are combined with the ADCs, the MPCs may not boot up in a specific power up sequence.

RELATED DOCUMENTATION

MX2020 Power Subsystem Description | 156

Maintaining the MX2020 Power Usage | 574

Prevention of Electrostatic Discharge Damage

Troubleshooting the MX2000 Router Power System

Maintaining and Verifying the Status of the MX2020 Router Components

Maintaining the MX2020 Ethernet Switch

IN THIS SECTION

Purpose

For optimum router performance, verify the status of the Gigabit Ethernet ports connected to MPC devices.

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 down on GE port 0 connected to device: FPC0

Link is down on GE port 1 connected to device: FPC1

Link is down on GE port 2 connected to device: FPC3

Link is down on GE port 3 connected to device: FPC2

Link is down on GE port 4 connected to device: FPC5

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 down on GE port 6 connected to device: FPC6

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 down on GE port 9 connected to device: FPC9

Link is down on GE port 10 connected to device: FPC10

Link is good on GE port 11 connected to device: FPC11
  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 12 connected to device: FPC13

Link is down on GE port 13 connected to device: FPC12

Link is down on GE port 14 connected to device: FPC14

Link is down on GE port 15 connected to device: FPC15

Link is down on GE port 16 connected to device: FPC17

Link is good on GE port 17 connected to device: FPC16
  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 18 connected to device: FPC18
  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 19 connected to device: FPC19

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 output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description

Maintaining and Verifying the MX2020 Router Version

IN THIS SECTION

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: mx2020host
Model: mx2020
JUNOS Base OS boot [12.3I20121202_1803_lwwang]
JUNOS Base OS Software Suite [12.3I20121202_1803_lwwang]
JUNOS 64-bit Kernel Software Suite [12.3I20121202_1803_lwwang]
JUNOS Crypto Software Suite [12.3I20121202_1803_lwwang]
JUNOS Packet Forwarding Engine Support (M/T Common) [12.3I20121202_1803_lwwang]
JUNOS Packet Forwarding Engine Support (X2000) [12.3I20121202_1803_lwwang]
JUNOS Online Documentation [12.3I20121202_1803_lwwang]
JUNOS Services AACL Container package [12.3I20121202_1803_lwwang]
JUNOS Services Application Level Gateways [12.3I20121202_1803_lwwang]
JUNOS AppId Services [12.3I20121202_1803_lwwang]
JUNOS Border Gateway Function package [12.3I20121202_1803_lwwang]
JUNOS Services Captive Portal and Content Delivery Container package
[12.3I20121202_1803_lwwang]
JUNOS Services HTTP Content Management package [12.3I20121202_1803_lwwang]
JUNOS IDP Services [12.3I20121202_1803_lwwang]
JUNOS Services LL-PDF Container package [12.3I20121202_1803_lwwang]
JUNOS Services NAT [12.3I20121202_1803_lwwang]
```

```
JUNOS Services PTSP Container package [12.3I20121202_1803_lwwang]
JUNOS Services RPM [12.3I20121202_1803_lwwang]
JUNOS Services Stateful Firewall [12.3I20121202_1803_lwwang]
JUNOS Voice Services Container package [12.3I20121202_1803_lwwang]
JUNOS Services Example Container package [12.3I20121202_1803_lwwang]
JUNOS Services SSL [12.3I20121202_1803_lwwang]
JUNOS Services Crypto [12.3I20121202_1803_lwwang]
JUNOS Services IPSec [12.3I20121202_1803_lwwang]
JUNOS Runtime Software Suite [12.3I20121202_1803_lwwang]
JUNOS Routing Software Suite [12.3I20121202_1803_lwwang]
```

RELATED DOCUMENTATION

Tools and Parts Required to Maintain the MX2020 Hardware Components | 330

5

PART

Troubleshooting Hardware

CHAPTER 33

Troubleshooting Components

IN THIS CHAPTER

MX2020 Troubleshooting Resources

IN THIS SECTION

Command-Line Interface

To troubleshoot an MX2020 router, you use the Junos OS command-line interface (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 the Junos OS, see the appropriate Junos OS configuration guide.

- JTAC—If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. If you encounter software problems, or problems with hardware components not discussed here, contact JTAC.

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:

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.

```
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 supplies.
- 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 allows you to troubleshoot the MX2020 router. The craft interface is located on the upper front of the router. It contains LEDs, buttons for the router.

LEDs on the craft interface include the following:

- 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 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 located on the upper right of the craft interface and labeled **RE0** and **RE1**.

- Power supply module LEDs—A set of eighteen 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 in the top of the craft interface, and are labeled **0** through **8** for the bottom PSMs, and **9** through **17** for the top PSMs.

- Line card LEDs—Twenty bicolor LEDs, **LC0** through **LC9**, for the bottom ten line cards (MPCs), and **LC10** through **LC19**, for the top ten line cards, indicate the status. Green indicates the line card is online, green blinking indicates that the line card is booting, and the red indicates that a failure. The line card LEDs 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 SFB is online, green blinking indicates the SFB 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**, indicates that 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 one bicolor LED, 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 incoming power.
- AC or DC PSM LEDs—Four LEDs, labeled **PWR OK**, **FAULT**, **INP0**, and **INP1**, on each power supply module faceplate indicates the status of that power supply module.

RELATED DOCUMENTATION

MX2020 Craft Interface Description | 68

Troubleshooting the MX2020 Cooling System | 851

Troubleshooting a Modular Port Concentrator (MPC) | 856

Troubleshooting the MX2020 MICs | 854

Troubleshooting the MX2000 Router Power System

Troubleshooting the MX2020 Cooling System

IN THIS SECTION

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 monitor 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 124 on page 852.

Table 124: MX2020 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 124: MX2020 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

MX2020 Craft Interface Description | 68
Replacing an MX2020 Fan Tray | 588
Maintaining the MX2020 Air Filter | 621
Maintaining the MX2020 Fan Trays | 593

Troubleshooting the MX2020 Host Subsystems

IN THIS SECTION

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.
   - Standalone MX2020 router—Issue the `show chassis alarms` command to view the alarms.

RELATED DOCUMENTATION

MX2000 Host Subsystem CB-RE Description

MX2020 Craft Interface Description | 68

Troubleshooting the MX2020 MICs

IN THIS SECTION

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. For more information, 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 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 7   Online       MPCE Type 3 3D
  PIC 0  Online       1X100GE CFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 8   Online       MPC Type 2 3D
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       10x 1GE(LAN) SFP
  PIC 3  Online       10x 1GE(LAN) SFP
Slot 9   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 10  Present      MPC 3D 16x 10GE
Slot 11  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 15  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 18  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+
```

For further description of the output from the command, see the *Junos OS System Basics and Services Command Reference*.

RELATED DOCUMENTATION

- MX2000 Modular Interface Card (MIC) Description | **123**
- Maintaining MX2020 MICs | **732**
- Maintaining Cables That Connect to MX2020 MPCs or MICs | **781**
- Replacing an MX2020 MIC | **720**

Troubleshooting a Modular Port Concentrator (MPC)

IN THIS SECTION

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 MPC software to it 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 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 **OK** and **FAIL** line card LEDs, **LC0** through **LC9**, and **LC10** through **LC19** 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 using the following CLI command: `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           42     10          0       2048       18         13
  1  Online           40     10          0       2048       18         13
  2  Online           40      9          0       2048       18         13
  3  Online           41      9          0       2048       18         13
  4  Online           41      9          0       2048       18         13
  5  Online           42     10          0       2048       18         13
  6  Online           42     10          0       2048       18         13
  7  Online           42     10          0       2048       18         13
```

```
  8  Online           42     10          0       2048       18         13
  9  Online           43      8          0       2048       18         13
 10  Online           43     10          0       2048       18         13
 11  Online           38     10          0       2048       18         13
 12  Online           38      8          0       2048       18         13
 13  Online           39     10          0       2048       18         13
 14  Online           39     10          0       2048       18         13
 15  Online           41     10          0       2048       18         13
 16  Online           42     10          0       2048       18         13
 17  Online           43     10          0       2048       18         13
 18  Online           44     10          0       2048       18         13
 19  Online           48      9          0       2048       18         13
```

Use the following option to display more detailed information: **detail** option. The following example does not specify a slot number, which is optional:

For further description of the output from the commands, see the *Junos OS System Basics Configuration Guide*.

```
user@host> show chassis fpc detail
Slot 4 information:
  State                               Online
  Temperature                      28
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                 11264 MB
  Start time:                         2012-11-26 16:20:07 PST
  Uptime:                             18 hours, 16 minutes, 7 seconds
  Max Power Consumption           610 Watts
Slot 7 information:
  State                               Online
  Temperature                      30
  Total CPU DRAM                 2048 MB
  Total RLDRAM                   1036 MB
  Total DDR DRAM                 6656 MB
  Start time:                         2012-11-26 16:20:12 PST
  Uptime:                             18 hours, 16 minutes, 2 seconds
  Max Power Consumption           520 Watts
Slot 8 information:
  State                               Online
  Temperature                      29
  Total CPU DRAM                 2048 MB
```

```
  Total RLDRAM                      662 MB
  Total DDR DRAM                   2560 MB
  Start time:                           2012-11-26 16:20:18 PST
  Uptime:                               18 hours, 15 minutes, 56 seconds
  Max Power Consumption             348 Watts
Slot 9 information:
  State                                 Online
  Temperature                        31
  Total CPU DRAM                   2048 MB
  Total RLDRAM                     1036 MB
  Total DDR DRAM                  11264 MB
  Start time:                           2012-11-26 17:34:36 PST
  Uptime:                               17 hours, 1 minute, 38 seconds
  Max Power Consumption             610 Watts
Slot 10 information:
  State                                 Present
  Temperature                        28
  Total CPU DRAM                      0 MB
  Total RLDRAM                        0 MB
  Total DDR DRAM                      0 MB
  Max Power Consumption             440 Watts
Slot 11 information:
  State                                 Online
  Temperature                        38
  Total CPU DRAM                   2048 MB
  Total RLDRAM                     1036 MB
  Total DDR DRAM                  11264 MB
  Start time:                           2012-11-26 16:20:33 PST
 Uptime:                               18 hours, 15 minutes, 41 seconds
  Max Power Consumption             610 Watts
Slot 15 information:
  State                                 Online
  Temperature                        36
  Total CPU DRAM                   2048 MB
  Total RLDRAM                     1036 MB
  Total DDR DRAM                  11264 MB
  Start time:                           2012-11-26 16:20:40 PST
  Uptime:                               18 hours, 15 minutes, 34 seconds
  Max Power Consumption             610 Watts
Slot 18 information:
  State                                 Online
  Temperature                        31
  Total CPU DRAM                   2048 MB
```

```
Total RLDRAM                    1324 MB
Total DDR DRAM                  5120 MB
Start time:                          2012-11-26 16:20:46 PST
Uptime:                              18 hours, 15 minutes, 28 seconds
Max Power Consumption            440 Watts
```

RELATED DOCUMENTATION

- MX2020 Craft Interface Description | **68**
- MX2020 Modular Port Concentrator (MPC) Description | **138**
- Maintaining MX2020 MPCs | **714**
- Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

Troubleshooting the MX2000 Router Power System

IN THIS SECTION

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" on page 193 and *MX2010 High-Voltage Universal (HVAC/HVDC) Power Supply Module LEDs*.

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 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.

PART 6

Contacting Customer Support and Returning the Chassis or Components

CHAPTER 34

Contacting Customer Support

IN THIS CHAPTER

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 35

Locating Component Serial Numbers

IN THIS CHAPTER

Displaying MX2020 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 DC power chassis hardware:

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                JN11E336EAFJ      MX2020
Midplane         REV 29   750-040240   ABAB9382          Lower Power Midplane
Midplane 1       REV 04   711-032386   ABAB9385          Upper Backplane
PMP 1            REV 05   711-032428   ACAJ1526          Upper Power Midplane
PMP 0            REV 04   711-032426   ACAJ1585          Lower Power Midplane
FPM Board        REV 06   760-040242   ABBT8836          Front Panel Display
PSM 4            REV 03   740-045050   1EDB23500AF       DC 52V Power Supply Module
```

```
PSM 5            REV 01   740-045050   1E02224005Z       DC 52V Power Supply Module
PSM 6            REV 01   740-045050   1E022240058       DC 52V Power Supply Module
PSM 7            REV 01   740-045050   1E02224005B       DC 52V Power Supply Module
PSM 8            REV 01   740-045050   1E02224005A       DC 52V Power Supply Module
PSM 13           REV 01   740-045050   1E02224005W       DC 52V Power Supply Module
PSM 14           REV 01   740-045050   1E02224006W       DC 52V Power Supply Module
PSM 15           REV 01   740-045050   1E02224004L       DC 52V Power Supply Module
PSM 16           REV 01   740-045050   1E022240051       DC 52V Power Supply Module
PSM 17           REV 01   740-045050   1E022240052       DC 52V Power Supply Module
PDM 0            REV 0B   740-038109   VJ00014           DC Power Dist Module
PDM 1            REV 0B   740-038109   VJ00018           DC Power Dist Module
PDM 2            REV 01   740-045234   1EFA2350022       DC Power Dist Module
PDM 3            REV 01   740-045234   1EFA2350008       DC Power Dist Module
Routing Engine 0 REV 02   740-041821   9009099715        RE-S-1800x4
Routing Engine 1 REV 02   740-041821   9009099711        RE-S-1800x4
CB 0             REV 12   750-040257   CAAD9502          Control Board
CB 1             REV 12   750-040257   CAAD9499          Control Board
SPMB 0           REV 02   711-041855   ABBS1475          PMB Board
SPMB 1           REV 02   711-041855   ABBS1481          PMB Board
SFB 0            REV 03   711-044466   ABBV6799          Switch Fabric Board
SFB 1            REV 03   711-044466   ABBV6800          Switch Fabric Board
SFB 2            REV 03   711-044466   ABBV6806          Switch Fabric Board
SFB 3            REV 03   711-044466   ABBV6822          Switch Fabric Board
SFB 4            REV 03   711-044466   ABBV6791          Switch Fabric Board
SFB 5            REV 03   711-044466   ABBV6817          Switch Fabric Board
SFB 6            REV 05   711-044466   ABBX5679          Switch Fabric Board
SFB 7            REV 05   711-044466   ABBX5696          Switch Fabric Board
FPC 4            REV 09   750-037355   CAAF0937          MPC4E 3D 2CGE+8XGE
  CPU            REV 08   711-035209   CAAD8004          HMPC PMB 2G
  PIC 0                   BUILTIN      BUILTIN           4x10GE SFPP
    Xcvr 0       REV 01   740-021308   19T511100949      SFP+-10G-SR
    Xcvr 1       REV 01   740-021308   19T511101380      SFP+-10G-SR
    Xcvr 2       REV 01   740-021308   T09D06449         SFP+-10G-SR
    Xcvr 3       REV 01   740-021308   19T511101780      SFP+-10G-SR
  PIC 1                   BUILTIN      BUILTIN           1X100GE CFP
    Xcvr 0       REV 01   740-035329   X12J00034         CFP-100G-SR10
  PIC 2                   BUILTIN      BUILTIN           4x10GE SFPP
    Xcvr 1       REV 01   740-031980   AJ102XE           SFP+-10G-SR
  PIC 3                   BUILTIN      BUILTIN           1X100GE CFP
FPC 7            REV 07   750-045372   CAAL9977          MPCE Type 3 3D
  CPU            REV 08   711-035209   CAAL9140          HMPC PMB 2G
 MIC 0          REV 18   750-033199   CAAE0300          1X100GE CFP
    PIC 0                BUILTIN      BUILTIN           1X100GE CFP
```

```
    Xcvr 0              NON-JNPR     X12J00262          CFP-100G-SR10
  MIC 1          REV 18   750-028380   YG1179             3D 2x 10GE XFP
    PIC 2                BUILTIN      BUILTIN            1x 10GE XFP
      Xcvr 0             NON-JNPR     T09L20458          XFP-10G-SR
    PIC 3                BUILTIN      BUILTIN            1x 10GE XFP
FPC 8            REV 22   750-031089   ZT4919             MPC Type 2 3D
  CPU            REV 06   711-030884   ZV2480             MPC PMB 2G
  MIC 0          REV 18   750-028380   YN8610             3D 2x 10GE XFP
    PIC 0                BUILTIN      BUILTIN            1x 10GE XFP
      Xcvr 0             NON-JNPR     T09G88978          XFP-10G-SR
    PIC 1                BUILTIN      BUILTIN            1x 10GE XFP
  MIC 1          REV 26   750-028392   ZT8724             3D 20x 1GE(LAN) SFP
    PIC 2                BUILTIN      BUILTIN            10x 1GE(LAN) SFP
      Xcvr 0     REV 01   740-011782   P8Q2318            SFP-SX
      Xcvr 4     REV 01   740-011782   PCH2P6F            SFP-SX
    PIC 3                BUILTIN      BUILTIN            10x 1GE(LAN) SFP
      Xcvr 0     REV 01   740-011613   PE70XRB            SFP-SX
      Xcvr 1     REV 01   740-021309   91D104A00011       UNSUPPORTED
FPC 9            REV 11   750-037358   CAAE2204           MPC4E 3D 32XGE
  CPU            REV 08   711-035209   CAAD9042           HMPC PMB 2G
  PIC 0                BUILTIN      BUILTIN            8X10GE SFPP
  PIC 1                BUILTIN      BUILTIN            8X10GE SFPP
  PIC 2                BUILTIN      BUILTIN            8X10GE SFPP
  PIC 3                BUILTIN      BUILTIN            8X10GE SFPP
FPC 10           REV 30   750-028467   ZM4986             MPC 3D 16x 10GE
  CPU
FPC 11           REV 11   750-037358   CAAE2184           MPC4E 3D 32XGE
  CPU            REV 08   711-035209   CAAE2685           HMPC PMB 2G
  PIC 0                BUILTIN      BUILTIN            8X10GE SFPP
    Xcvr 0       REV 01   740-021308   AMH0285            SFP+-10G-SR
    Xcvr 1       REV 01   740-031980   AM91AAV            SFP+-10G-SR
    Xcvr 2       REV 01   740-021308   ANA08EA            SFP+-10G-SR
    Xcvr 3       REV 01   740-021308   19T511101863       SFP+-10G-SR
    Xcvr 4       REV 01   740-031980   183363A02523       SFP+-10G-SR
    Xcvr 5       REV 01   740-031980   B11F00240          SFP+-10G-SR
    Xcvr 6       REV 01   740-021308   19T511101870       SFP+-10G-SR
    Xcvr 7       REV 01   740-031980   B11G00148          SFP+-10G-SR
  PIC 1                BUILTIN      BUILTIN            8X10GE SFPP
    Xcvr 0       REV 01   740-031980   AJ10J9J            SFP+-10G-SR
    Xcvr 1       REV 01   740-021308   19T511100460       SFP+-10G-SR
    Xcvr 2       REV 01   740-031980   AJ30GDY            SFP+-10G-SR
    Xcvr 3       REV 01   740-021308   19T511101645       SFP+-10G-SR
    Xcvr 4       REV 01   740-031980   B11F00307          SFP+-10G-SR
```

```
    Xcvr 5       REV 01   740-021308   AN10KV1          SFP+-10G-SR
    Xcvr 6       REV 01   740-031980   153363A00048     SFP+-10G-SR
    Xcvr 7       REV 01   740-031980   B11F00185        SFP+-10G-SR
  PIC 2                   BUILTIN      BUILTIN          8X10GE SFPP
  PIC 3                   BUILTIN      BUILTIN          8X10GE SFPP
FPC 15         REV 06   750-037355   CAAB1158         MPC4E 3D 2CGE+8XGE
  CPU          REV 08   711-035209   CAAB1187         HMPC PMB 2G
  PIC 0                   BUILTIN      BUILTIN          4x10GE SFPP
  PIC 1                   BUILTIN      BUILTIN          1X100GE CFP
  PIC 2                   BUILTIN      BUILTIN          4x10GE SFPP
  PIC 3                   BUILTIN      BUILTIN          1X100GE CFP
    Xcvr 0               NON-JNPR     X12J00358        CFP-100G-SR10
FPC 18         REV 32   750-028467   ZR2043           MPC 3D 16x 10GE
  CPU          REV 10   711-029089   ZT6927           AMPC PMB
  PIC 0                   BUILTIN      BUILTIN          4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   B11F00361        SFP+-10G-SR
    Xcvr 1       REV 01   740-031980   B11F00268        SFP+-10G-SR
    Xcvr 2       REV 01   740-031980   AJ71BQ8          SFP+-10G-SR
    Xcvr 3       REV 01   740-031980   AHP04XX          SFP+-10G-SR
  PIC 1                   BUILTIN      BUILTIN          4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-021308   ANA0Q20          SFP+-10G-SR
    Xcvr 1       REV 01   740-021308   T09H14420        SFP+-10G-SR
    Xcvr 2       REV 01   740-031980   B11F00220        SFP+-10G-SR
    Xcvr 3       REV 01   740-031980   B11F00254        SFP+-10G-SR
  PIC 2                   BUILTIN      BUILTIN          4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-031980   B10G01429        SFP+-10G-SR
    Xcvr 1       REV 01   740-031980   B11G00206        SFP+-10G-SR
    Xcvr 2       REV 01   740-031980   B11E02181        SFP+-10G-SR
    Xcvr 3       REV 01   740-021308   AH803TP          SFP+-10G-SR
  PIC 3                   BUILTIN      BUILTIN          4x 10GE(LAN) SFP+
    Xcvr 0       REV 01   740-021308   19T511101819     SFP+-10G-SR
    Xcvr 1       REV 01   740-021308   19T511100646     SFP+-10G-SR
    Xcvr 2       REV 01   740-021308   T09D06573        SFP+-10G-SR
    Xcvr 3       REV 01   740-021308   T09D06516        SFP+-10G-SR
ADC 4          REV 05   750-043596   CAAC2078         Adapter Card
ADC 7          REV 13   750-043596   ABBX5547         Adapter Card
ADC 8          REV 01   750-043596   ZV4088           Adapter Card
ADC 9          REV 01   750-043596   ZV4168           Adapter Card
ADC 10
ADC 11         REV 05   750-043596   CAAC2057         Adapter Card
ADC 15         REV 13   750-043596   ABBX5573         Adapter Card
ADC 18         REV 05   750-043596   CAAC2077         Adapter Card
Fan Tray 0     REV 2A   760-046960   ACAY0019         172mm FanTray - 6 Fans
```

```
Fan Tray 1       REV 2A   760-046960   ACAY0021          172mm FanTray - 6 Fans
Fan Tray 2       REV 2A   760-046960   ACAY0001          172mm FanTray - 6 Fans
Fan Tray 3       REV 03   760-046960   ACAY0123          172mm FanTray - 6 Fans
```

The sample output below shows the universal (HVAC/HVDC) power chassis hardware:

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                JN1248551AFJ      MX2020
Midplane         REV 51   750-040240   ABAD0719          Lower Backplane
Midplane 1       REV 06   711-032386   ABAD1385          Upper Backplane
PMP 1            REV 05   711-032428   ACAJ3828          Upper Power Midplane
PMP 0            REV 04   711-032426   ACAJ3642          Lower Power Midplane
FPM Board        REV 13   760-040242   ABCX9082          Front Panel Display
PSM 0            Rev 01   740-075342   1EGK929000K       MX2K-UNIVERSAL-HV-PSM
PSM 1            Rev 01   740-075342   1EGK9290004       MX2K-UNIVERSAL-HV-PSM
PSM 2            Rev 01   740-075342   1EGK929000A       MX2K-UNIVERSAL-HV-PSM
PSM 3            Rev 01   740-075342   1EGK929000G       MX2K-UNIVERSAL-HV-PSM
PSM 5            Rev 01   740-075342   1EGK929000T       MX2K-UNIVERSAL-HV-PSM
PSM 6            Rev 01   740-075342   1EGK9290008       MX2K-UNIVERSAL-HV-PSM
PSM 7            Rev 01   740-075342   1EGK9290005       MX2K-UNIVERSAL-HV-PSM
PSM 8            Rev 01   740-075342   1EGK929000W       MX2K-UNIVERSAL-HV-PSM
PSM 10           Rev 01   740-075342   1EGK9520007       MX2K-UNIVERSAL-HV-PSM
PSM 11           Rev 01   740-075342   1EGK927001T       MX2K-UNIVERSAL-HV-PSM
PSM 12           Rev 01   740-075342   1EGK927001F       MX2K-UNIVERSAL-HV-PSM
PSM 13           Rev 01   740-075342   1EGK927001L       MX2K-UNIVERSAL-HV-PSM
PSM 14           Rev 01   740-075342   1EGK929000S       MX2K-UNIVERSAL-HV-PSM
PSM 15           Rev 01   740-075342   1EGK927001H       MX2K-UNIVERSAL-HV-PSM
PSM 16           Rev 01   740-075342   1EGK924001V       MX2K-UNIVERSAL-HV-PSM
PSM 17           Rev 01   740-075342   1EGK9290001       MX2K-UNIVERSAL-HV-PSM
PDM 0            REV 01   740-087218   1EGJ8440005       MX2K-UNIVERSAL-HV-PDM
PDM 1            REV 01   740-087218   1EGJ8360016       MX2K-UNIVERSAL-HV-PDM
PDM 2            REV 01   740-087218   1EGJ8360018       MX2K-UNIVERSAL-HV-PDM
PDM 3            REV 01   740-087218   1EGJ8360017       MX2K-UNIVERSAL-HV-PDM
```

Most components also have a small rectangular serial number ID label attached to the component body (see Figure 363 on page 877).

Figure 363: Serial Number ID Label

RELATED DOCUMENTATION

Contact Customer Support

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

MX2020 Chassis Serial Number Label

MX2020 Craft Interface Serial Number Label | **879**

MX2020 MPC Serial Number Label | **882**

MX2020 MIC Serial Number Label | **880**

MX2020 CB-RE Serial Number Label | **877**

MX2020 SFB Serial Number Label | **889**

MX2020 Power Distribution Module Serial Number Label | **883**

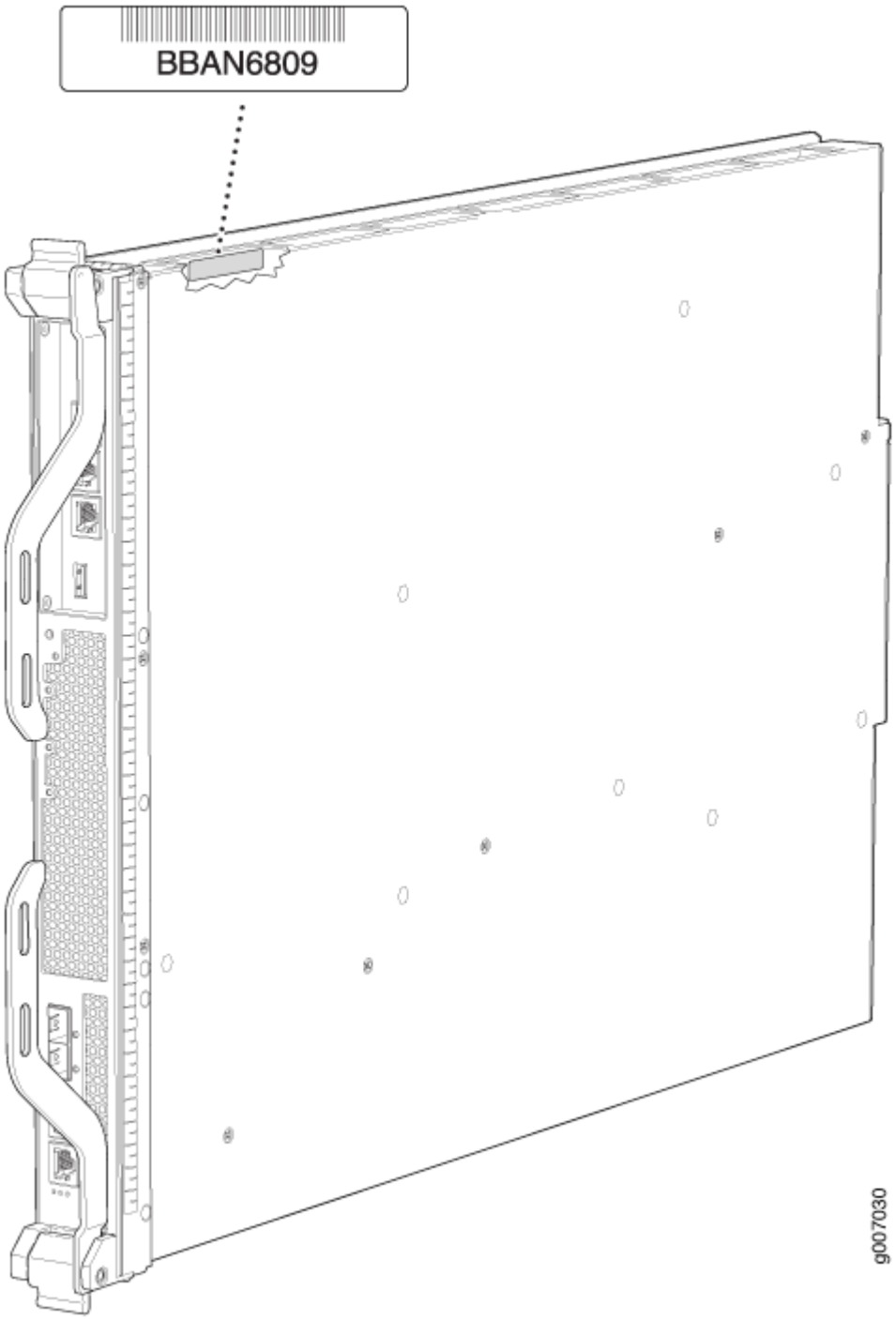
MX2020 Power Supply Module Serial Number Label | **885**

MX2020 Fan Tray Serial Number Label | **880**

MX2020 CB-RE Serial Number Label

The serial number label is located on the left side of the top of the CB-RE (see Figure 364 on page 878).

Figure 364: CB-RE Serial Number Label



RELATED DOCUMENTATION

Removing a CB-RE from an MX2000 Router

Displaying MX2020 Router Components and Serial Numbers | 872

Contact Customer Support

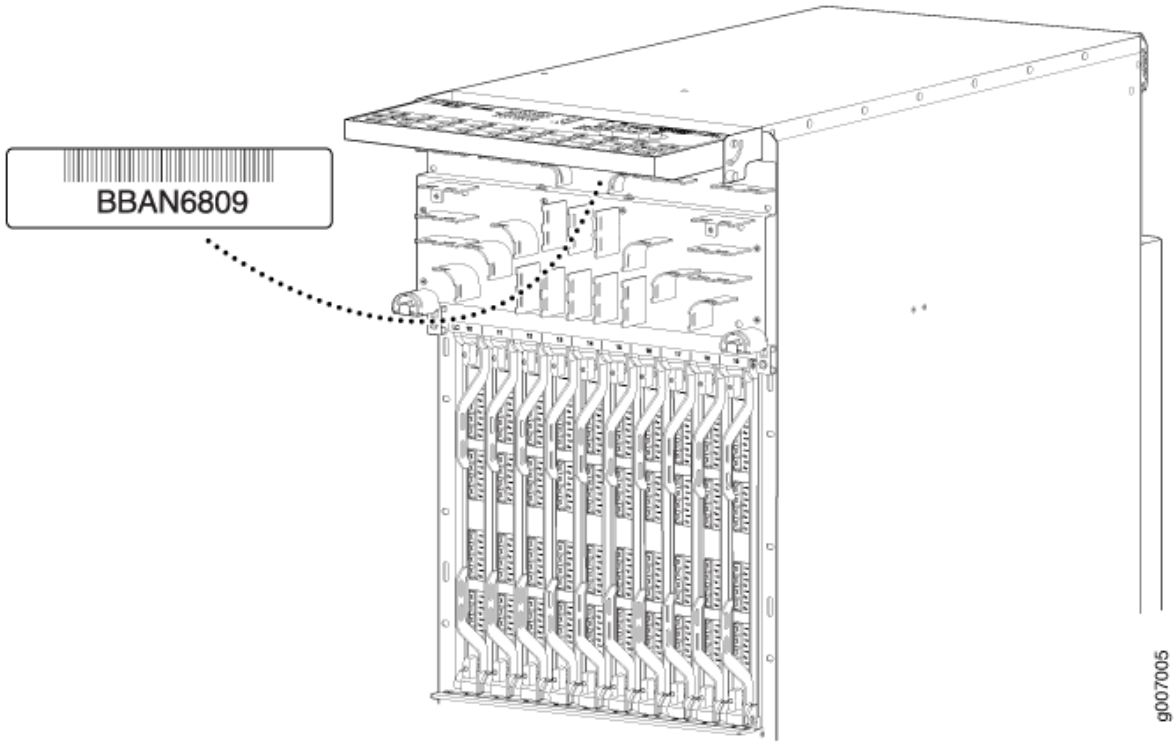
How to Return a Hardware Component to Juniper Networks, Inc.

Guidelines for Packing Hardware Components for Shipment

MX2020 Craft Interface Serial Number Label

The serial number is located on the back of the craft interface panel (see Figure 365 on page 879).

Figure 365: Craft Interface Serial Number Label



RELATED DOCUMENTATION

Replacing the MX2020 Craft Interface

Displaying MX2020 Router Components and Serial Numbers | 872

Contact Customer Support

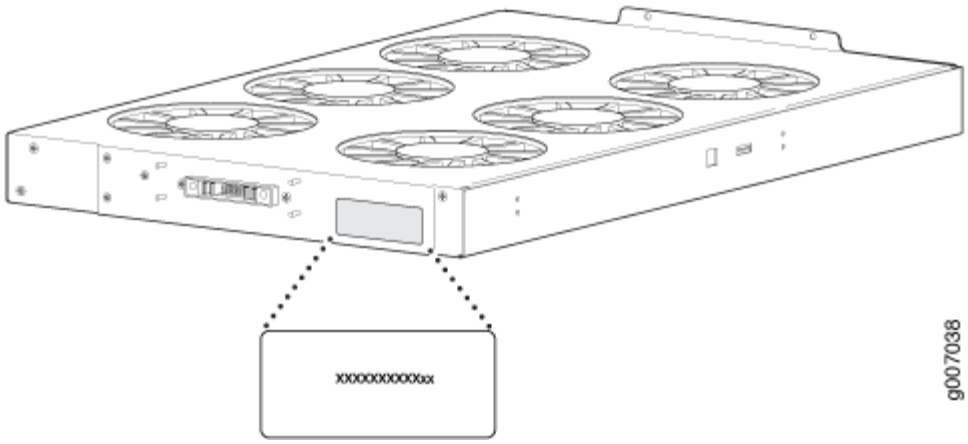
How to Return a Hardware Component to Juniper Networks, Inc.

Guidelines for Packing Hardware Components for Shipment

MX2020 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 366 on page 880).

Figure 366: MX2020 Fan Tray Serial Number Label



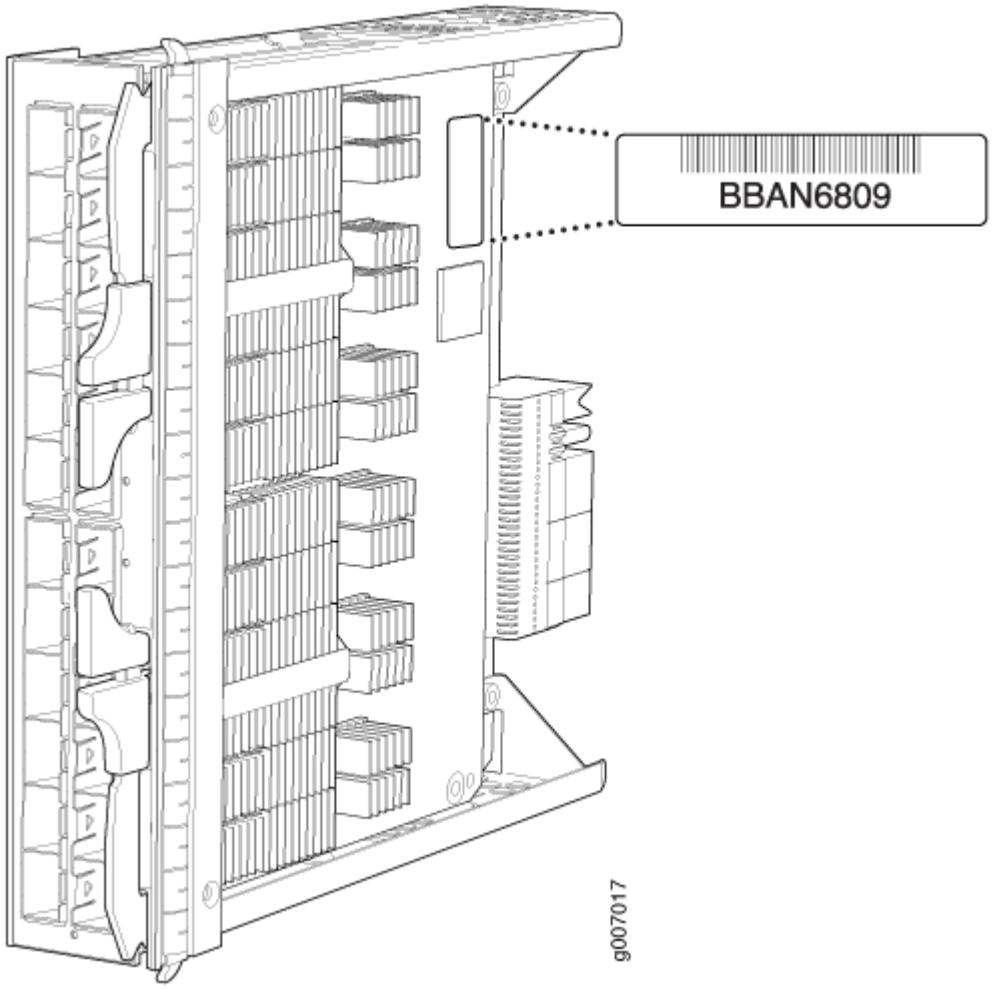
RELATED DOCUMENTATION

- Displaying MX2020 Router Components and Serial Numbers | 872
- *Contact Customer Support*
- *How to Return a Hardware Component to Juniper Networks, Inc.*
- *Guidelines for Packing Hardware Components for Shipment*

MX2020 MIC Serial Number Label

The serial number label location varies according to the number of ports on a MIC (see Figure 367 on page 881). The exact location may be slightly different on different MICs, depending on the placement of components on the MIC board.

Figure 367: MIC Serial Number Label



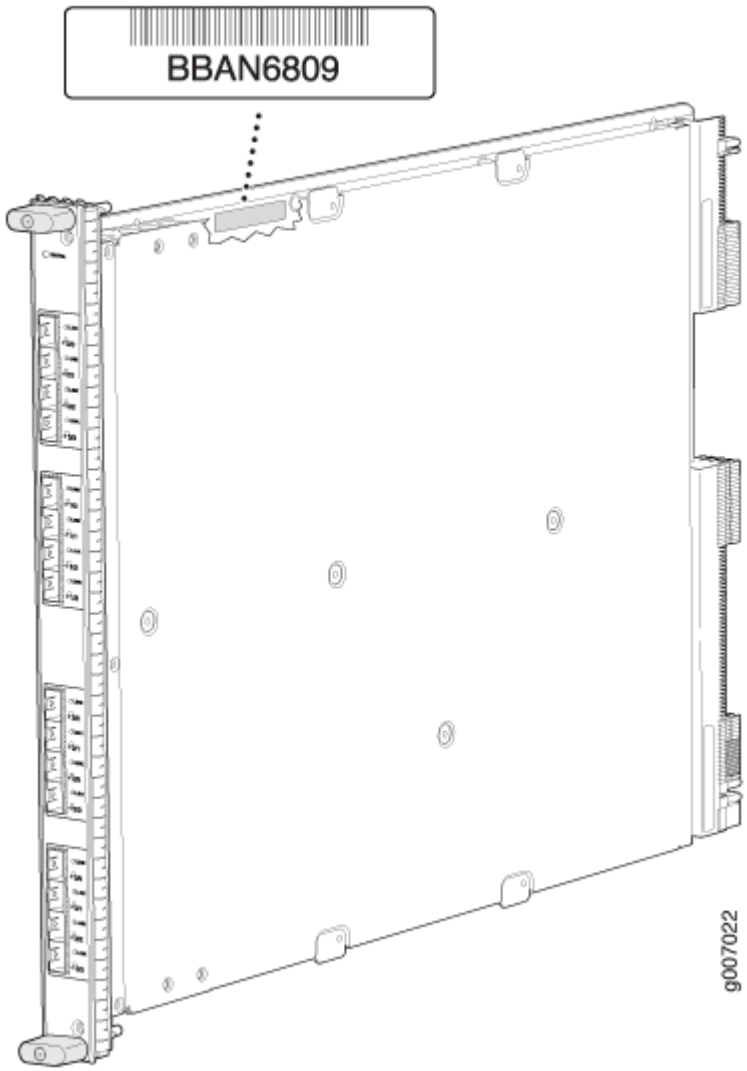
RELATED DOCUMENTATION

- Replacing an MX2020 MIC | **720**
- Displaying MX2020 Router Components and Serial Numbers | **872**
- *Contact Customer Support*
- *How to Return a Hardware Component to Juniper Networks, Inc.*
- *Guidelines for Packing Hardware Components for Shipment*

MX2020 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 368 on page 882).

Figure 368: MPC Serial Number Label



RELATED DOCUMENTATION

Replacing an MX2020 MPC and Adapter Card (ADC) | **701**

MX2020 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 369 on page 883).

For the 60/80 A DC PDM the serial number label is located on the rear (see Figure 370 on page 884).

Figure 369: AC Power Distribution Module Three-Phase Delta and Wye Serial Number Label

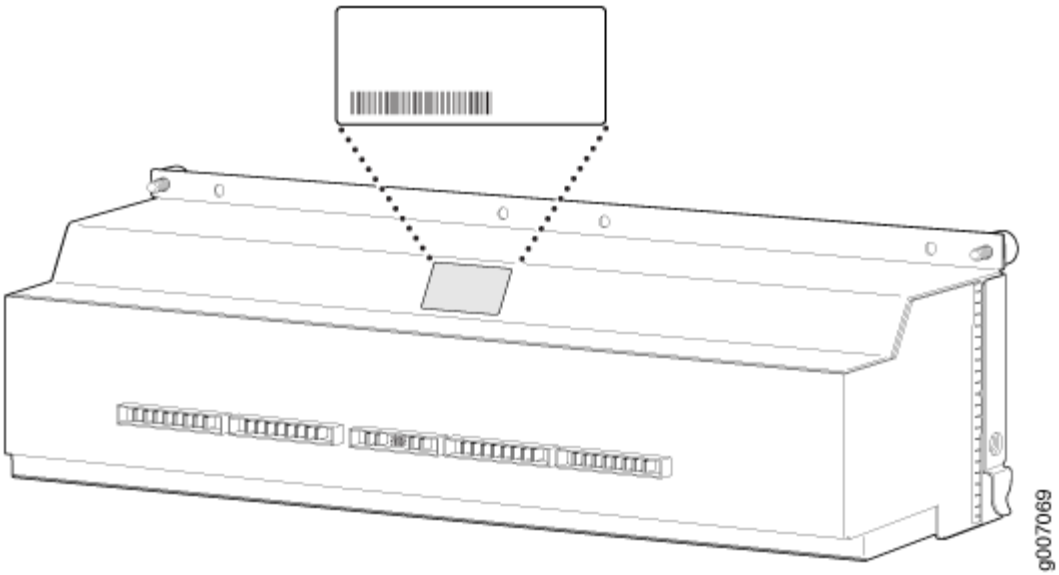


Figure 370: DC Power Distribution Module (-48 V) Serial Number Label

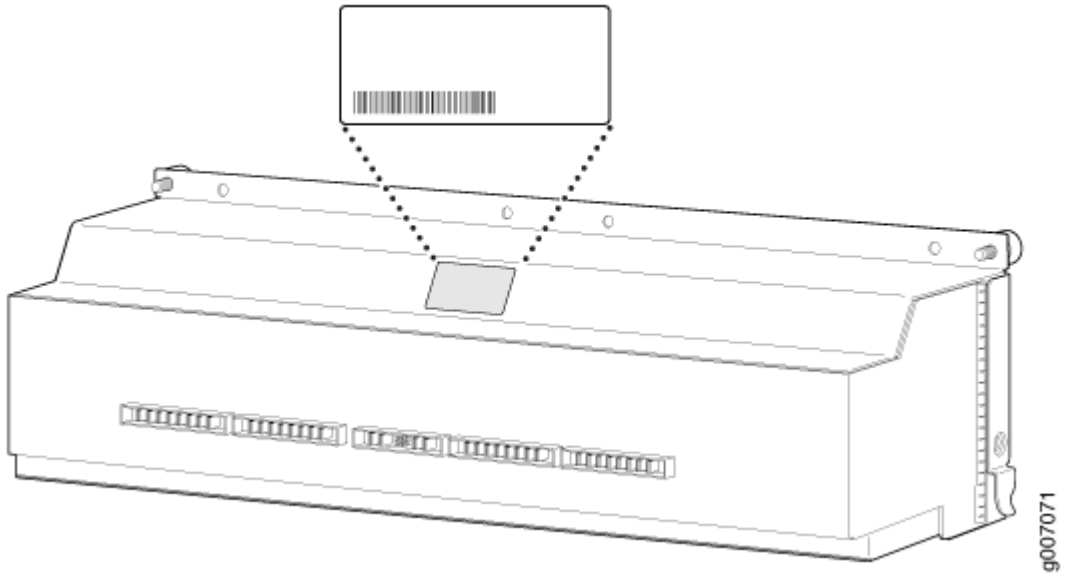
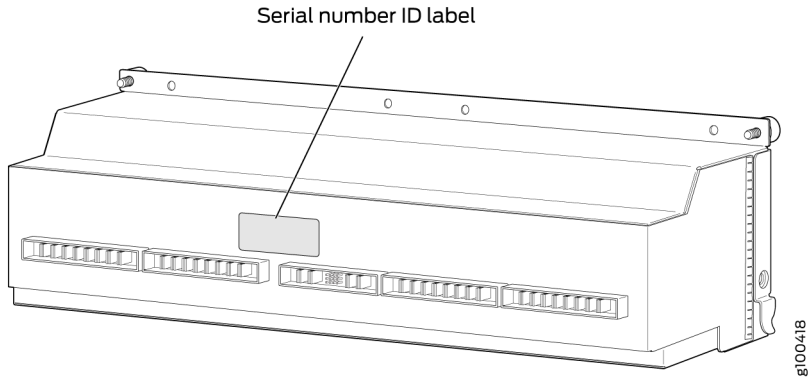


Figure 371: DC (240 V China) and Second-Generation Universal Power (HVAC/HVDC) Distribution Module Serial Number Label



RELATED DOCUMENTATION

- *Replacing an MX2000 Three-Phase Delta AC Power Distribution Module*
- *Replacing an MX2020 Three-Phase Wye AC Power Distribution Module*
- *Replacing an MX2000 DC Power Distribution Module (-48 V)*

Replacing an MX2000 DC Power Distribution Module (240 V China)

Displaying MX2020 Router Components and Serial Numbers | **872**

Contact Customer Support

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

Guidelines for Packing Hardware Components for Shipment

MX2020 Power Supply Module Serial Number Label

The serial number label is located on the side of the PSM (see Figure 372 on page 886, Figure 373 on page 887) and Figure 374 on page 888.

Figure 372: AC Power Supply Module Serial Number Label

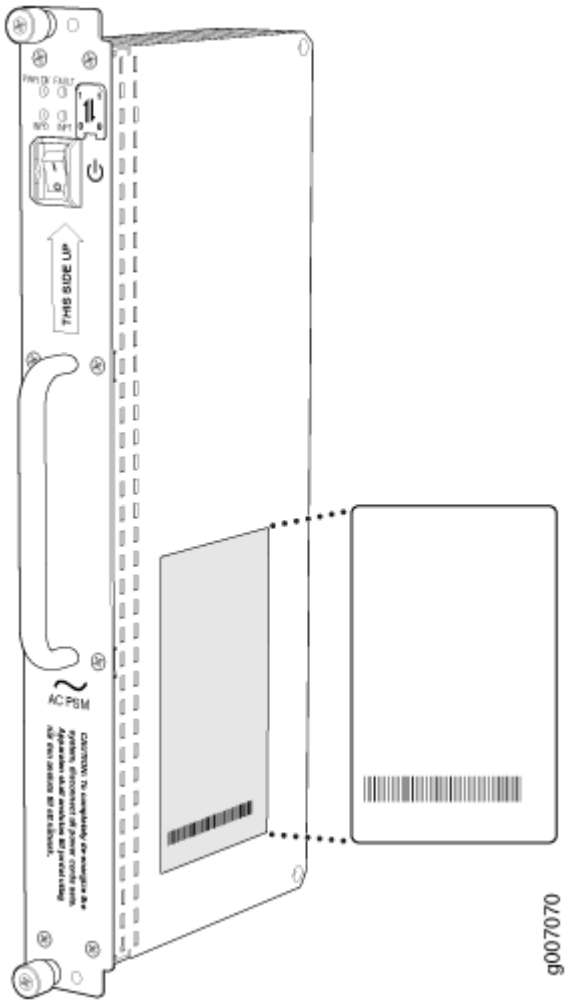


Figure 373: DC Power Supply Module Serial (-48 V) Number Label

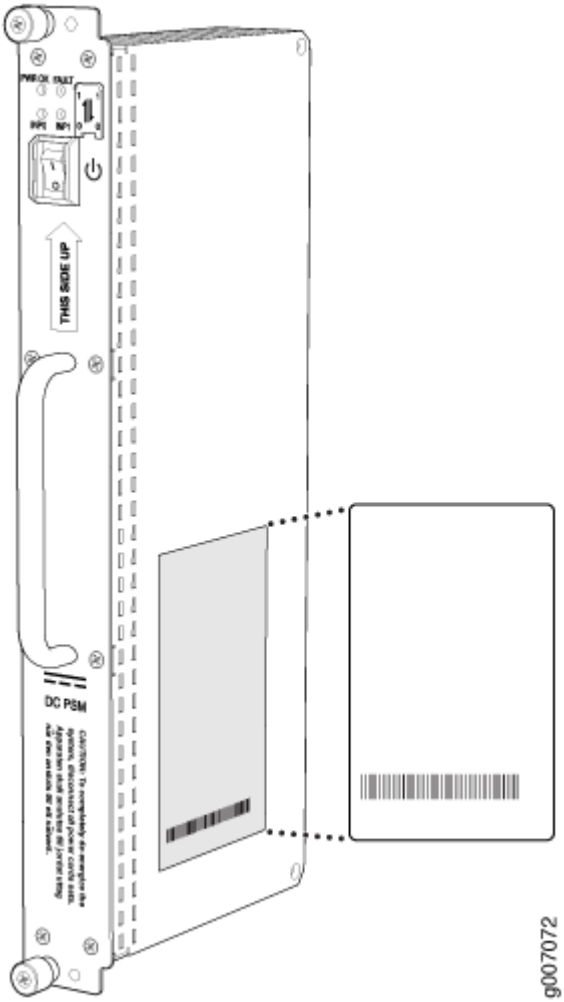
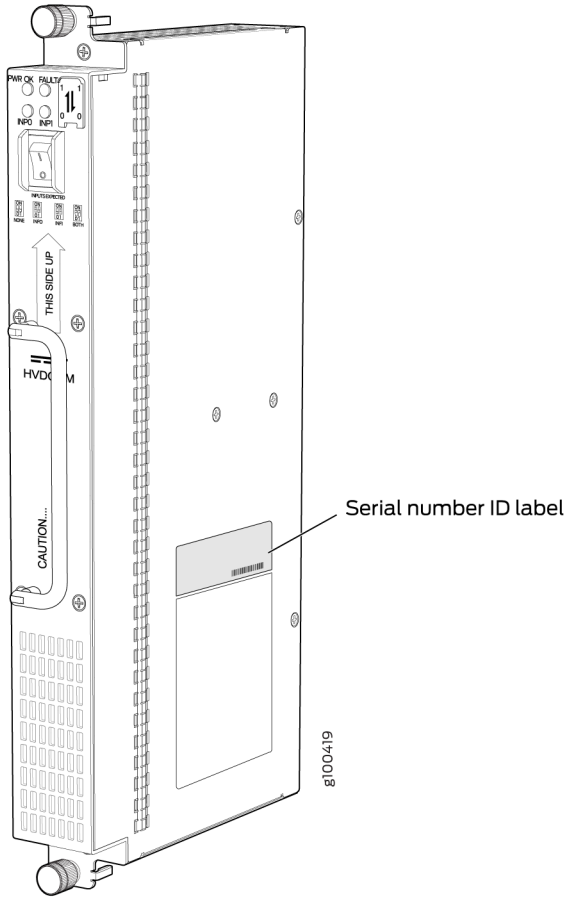


Figure 374: DC (240 V China) and Second-Generation Universal Power (HVAC/HVDC) Power Supply Module Serial Number Label



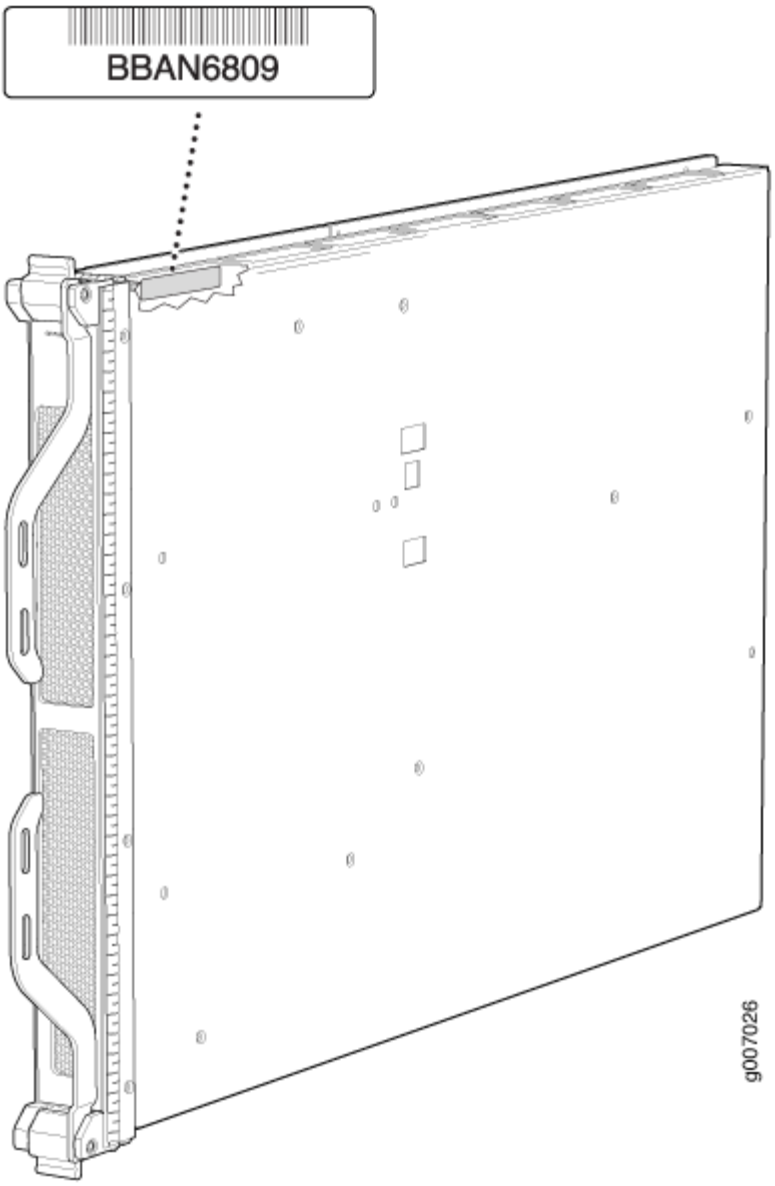
RELATED DOCUMENTATION

- *Replacing an MX2000 AC Power Supply Module*
- Replacing an MX2020 DC Power Supply Module (-48 V) | **544**
- *Replacing an MX2000 DC Power Supply Module (240 V China)*
- Displaying MX2020 Router Components and Serial Numbers | **872**
- *Contact Customer Support*
- *How to Return a Hardware Component to Juniper Networks, Inc.*
- *Guidelines for Packing Hardware Components for Shipment*

MX2020 SFB Serial Number Label

The serial number is located on the right side of the top of the SFB (see Figure 375 on page 889).

Figure 375: SFB Serial Number Label



RELATED DOCUMENTATION

Displaying MX2020 Router Components and Serial Numbers | 872

CHAPTER 36

Packing and Returning Components

IN THIS CHAPTER

Contact Customer Support to Obtain a Return Material Authorization

If you need to return a device or hardware component to Juniper Networks for repair or replacement, obtain an RMA number from JTAC. You must obtain an RMA number before you attempt to return the component.

After locating the serial number of the device or hardware component you want to return, open a service request with the JTAC on the Web or by telephone.

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

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

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

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

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

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

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

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 | **809**

Replacing an MX2020 Three-Phase Wye AC Power Cord | **816**

Disconnecting an MX2020 DC Power Distribution Module Cable | **823**

Installing the Router Transport Kit on the MX2020 Router | **376**

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.

PART 7

Safety and Compliance Information

CHAPTER 37

General Safety Guidelines and Warnings

IN THIS CHAPTER

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

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 38

Installation and Maintenance Safety Guidelines and Warnings

IN THIS CHAPTER

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 39

Radiation and Laser Warnings

IN THIS CHAPTER

Laser and LED Safety Guidelines and Warnings

IN THIS SECTION

Juniper Networks devices are equipped with laser transmitters, which are considered a Class 1 Laser Product by the U.S. Food and Drug Administration and are evaluated as a Class 1 Laser Product per IEC/EN 60825-1 requirements.

Observe the following guidelines and warnings:

General Laser Safety Guidelines

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

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

- Avoid direct exposure to the beam.

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

Avertissement Les connecteurs à fibre optique sans terminaison peuvent émettre un rayonnement laser invisible. Le cristallin de l'œil humain faisant converger toute la puissance du laser sur la rétine, toute focalisation directe de l'œil sur une source laser, —même de faible puissance—, peut entraîner des lésions oculaires irréversibles.

Class 1 Laser Product Warning

LASER WARNING: Class 1 laser product.
Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Avertissement Produit laser de classe I.

Warnung Laserprodukt der Klasse 1.

Avvertenza Prodotto laser di Classe 1.

Advarsel Laserprodukt av klasse 1.

Aviso Produto laser de classe 1.

¡Atención! Producto láser Clase I.

Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

LASER WARNING: Class 1 LED product.
Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Avertissement Alarme de produit LED Class I.

Warnung Class 1 LED-Produktwarnung.

Avvertenza Avvertenza prodotto LED di Classe 1.

Advarsel LED-produkt i klasse 1.

Aviso Produto de classe 1 com LED.

¡Atención! Aviso sobre producto LED de Clase 1.

Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

LASER WARNING: Do not stare into the laser beam or view it directly with optical instruments.
Waarschuwing Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

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

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

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

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

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

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

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

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

Radiation from Open Port Apertures Warning

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

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

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

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

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

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

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

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

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

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

CHAPTER 40

Maintenance and Operational Safety Guidelines and Warnings

IN THIS CHAPTER

Maintenance and Operational Safety Guidelines and Warnings

IN THIS SECTION

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

Battery Handling Warning

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

Waarschuwing Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant

aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.

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

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

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

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

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

Aviso Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.

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

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

Jewelry Removal Warning

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

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

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

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

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Varning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

Lightning Activity Warning

WARNING: Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.

Avertissement Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.

Warnung Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.

Avvertenza Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.

Advarsel Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.

Aviso Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).

¡Atención! No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.

Varning! Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.

Operating Temperature Warning

WARNING: To prevent the device from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature. To prevent airflow restriction, allow at least 6 in. (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke switch van de Juniper Networks router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40° C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

Varoitus Ettei Juniper Networks switch-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40° C. Ettei ilmanvaihto estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

Avertissement Pour éviter toute surchauffe des routeurs de la gamme Juniper Networks switch, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40° C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

Warnung Um einen Router der switch vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40° C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsöffnungen herum frei bleibt.

Avvertenza Per evitare il surriscaldamento dei switch, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i Juniper Networks switch Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador Juniper Networks switch, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie Juniper Networks switch se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en Juniper Networks switch överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C

överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this device must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Avertissement La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L'eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.

Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales

Varning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

CHAPTER 41

Electrical Safety Guidelines and Warnings

IN THIS CHAPTER

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 376 on page 925) 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.

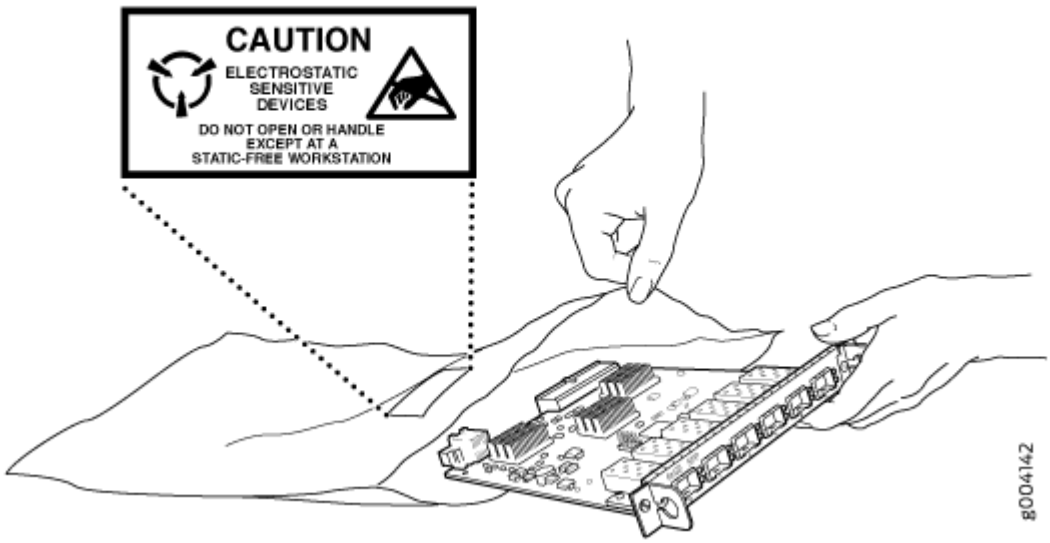
  Avertissement Par mesure de sécurité, vérifiez régulièrement la résistance du bracelet antistatique. Cette valeur doit être comprise entre 1 et 10 mégohms (Mohms).

- 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 376 on page 925). If you are returning a component, place it in an antistatic bag before packing it.

Figure 376: 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 42

Agency Approvals and Compliance Statements

IN THIS CHAPTER

Agency Approvals and Compliance Statements for the MX2020 Router

IN THIS SECTION

Agency Approvals for MX2020 Routers

IN THIS SECTION

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 MX2020 Router

Compliance Statements for EMC Requirements for the MX2020 Router | 937

Compliance Statements for Environmental Requirements | 941

Compliance Statements for NEBS for the MX2020 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.

SEE ALSO

Agency Approvals for MX2020 Routers | 935

Compliance Statements for EMC Requirements for the MX2020 Router | 937

Compliance Statements for Environmental Requirements | 941

Compliance Statements for EMC Requirements for the MX2020 Router

IN THIS SECTION

United States | 939

Canada

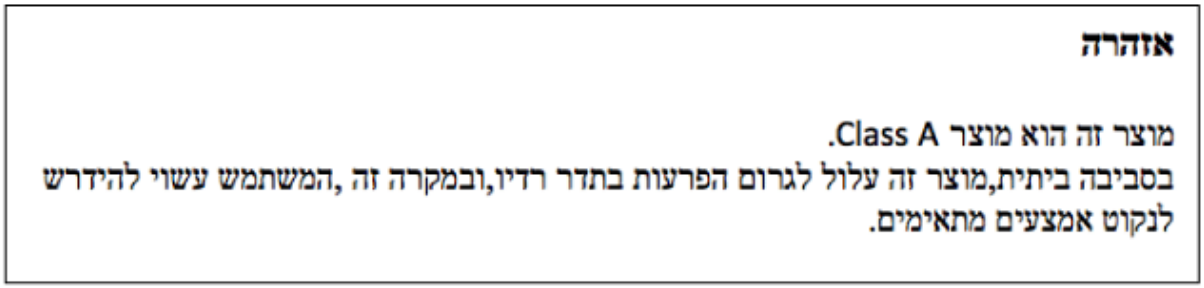
This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Community

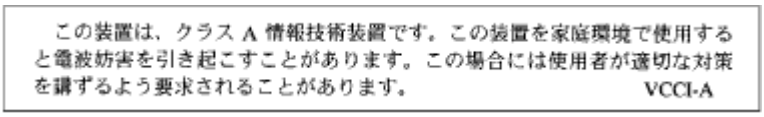
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Israel



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

Japan



Translation from Japanese—This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. VCCI-A

United States

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

SEE ALSO

- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States)
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan)
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada)

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

IN THIS SECTION

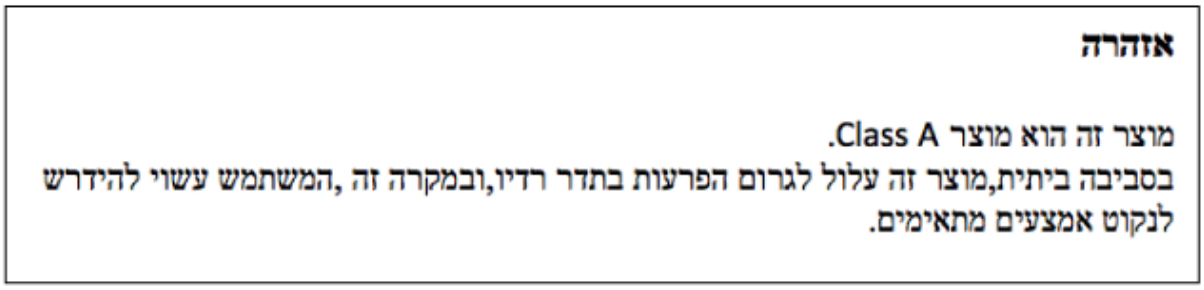
Canada

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

European Community

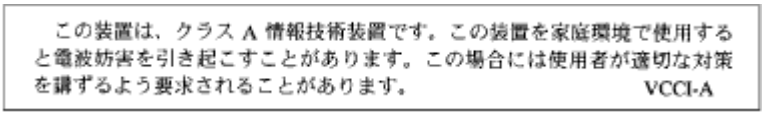
This is a Class A product. In a domestic environment, this product might cause radio interference in which case the user might be required to take adequate measures.

Israel



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

Japan



The preceding translates as follows:

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

United States

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in

accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Compliance Statements for Environmental Requirements

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

Compliance Statements for Data Center

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.