MX2020 3D Universal Edge Router Hardware Guide

Modified: 2015-11-18

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

MX2020 3D Universal Edge Router Hardware Guide

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

YEAR 2000 NOTICE

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

END USER LICENSE AGREEMENT

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

Table of Contents

Part 3 Initial Installation and Configuration

List of Figures

List of Tables

About the Documentation

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at http://www.juniper.net/techpubs/.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at http://www.juniper.net/books.

Supported Platforms

For the features described in this document, the following platforms are supported:

- MX2020

Documentation Conventions

Table 1 on page xxviii defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xxviii defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		    route default {
		      nexthop *address*;
		      retain;
		    }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page at the Juniper Networks Technical Documentation site at http://www.juniper.net/techpubs/index.html, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at http://www.juniper.net/techpubs/feedback/.

- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: http://www.juniper.net/customers/support/
- Search for known bugs: http://www2.juniper.net/kb/
- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/
- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: http://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

PART 1

Overview

CHAPTER 1

MX2020 Router Overview

MX2020 Router Overview

The MX2020 3D Universal Edge Router is an Ethernet-optimized edge router that provides both switching and carrier-class Ethernet routing. The MX2020 router enables a wide range of business and residential applications 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 which means a maximum of 20 Modular Port Concentrators (MPCs) including adapter cards (ADCs), and Modular Interface Cards (MICs), a host subsystem consisting of 2 Control Board with Routing Engines (CB-REs), and 8 Switch Fabric Boards (SFBs).

Up to 2 MICs can be installed in each MPC. Fully populated, the MX2020 router supports up to 40 MICs.

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

Related Documentation

- MX2020 Component Redundancy on page 12
- MX2020 Physical Specifications on page 108
- MX2020 Chassis Description on page 5
- MX2020 Host Subsystem Description on page 57
- MX2020 Craft Interface Description on page 37
- MX2020 Power Subsystem Description on page 83
- MX2020 Cooling System Description on page 53

CHAPTER 2

System Overview and Architecture

MX2020 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components, (see Figure 1 on page 6, Figure 2 on page 8, and Figure 3 on page 9). 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 36.20 in. (91.95 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 38.67 in. (98.2 cm) deep.

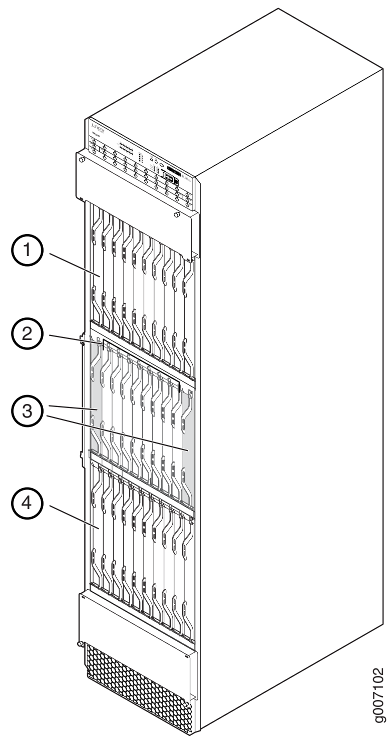
CAUTION: Before removing or installing components, attach an ESD strap to an ESD point, and place the other end of the strap around your bare wrist. Failure to use an ESD strap could result in damage to the hardware components.

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 1: 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 3 on page 6 for information on MX2020 router components.

Table 3: Front Components in a Fully Configured MX2020 Router

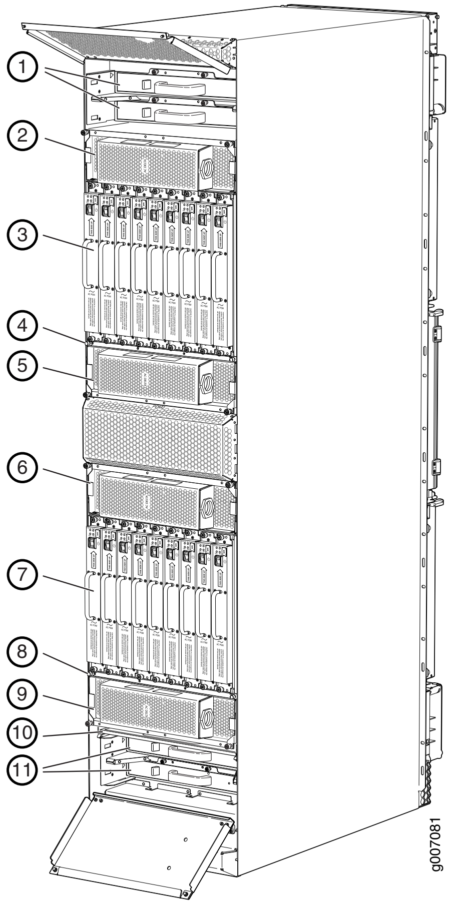
Component No.	Component Description	Slots	Number of FRUs
1	Upper cable manager– (standard or extended)	–	1
2	MPCs with ADCs and MICs (top)	10 through 19 (top)	10

Table 3: Front Components in a Fully Configured MX2020 Router *(continued)*

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

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

Figure 2: 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 4 on page 8 for information on MX2020 router components.

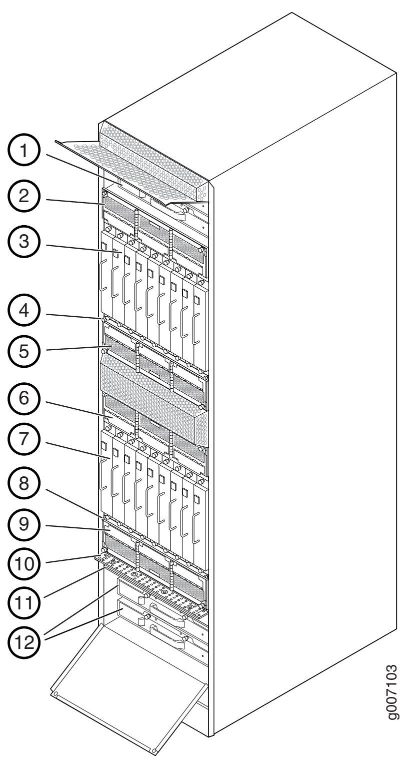
Table 4: Rear Components in a Fully Configured AC-Powered MX2020 Router

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	PDM3/Input1	1
3	AC PSM	9 through 17	9
4	PSM air filter	–	1

Table 4: Rear Components in a Fully Configured AC-Powered MX2020 Router *(continued)*

Component No.	Component Description	Slots	Number of FRUs
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

Figure 3: Rear View of a Fully Configured DC-Powered MX2020 Router Chassis



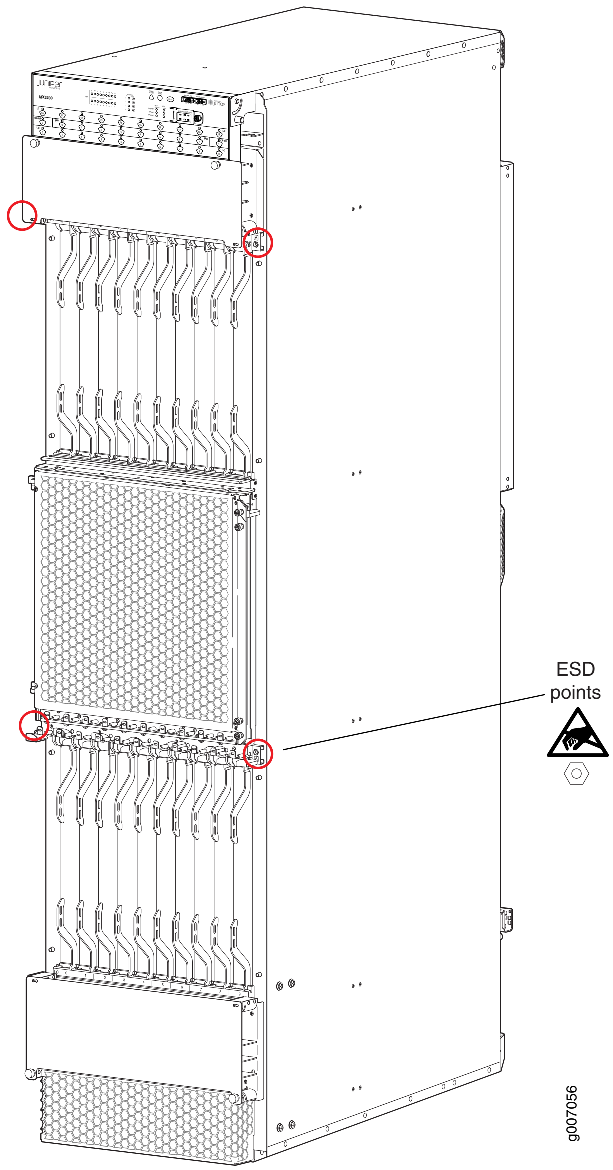
Remove field replacement units (FRUs) from the rear of the MX2020 router before you install the router. See Table 5 on page 10 for information on MX2020 router components.

Table 5: 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
2	DC PDM	PDM3/Input1	1
3	DC PSM	9 through 17	9
4	PSM air filter	–	1
5	DC PDM	PDM2/Input0	1
6	DC PDM	PDM1/Input1	1
7	DC PSM	0 through 8	9
8	PSM air filter	–	1
9	DC PDM	PDM0/Input0	1
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 4 on page 11).

Figure 4: MX2020 Router ESD Points



Related Documentation

- MX2020 Physical Specifications on page 108
- Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet on page 205
- MX2020 Router Grounding Specifications on page 117
- MX2020 Chassis Moving Guidelines on page 107

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 Router Overview on page 3
- MX2020 Chassis Description on page 5
- MX2020 Modular Port Concentrator Description on page 68
- MX2020 Switch Fabric Board Description on page 64
- MX2020 Host Subsystem Description on page 57
- MX2020 Modular Interface Card Description on page 73
- MX2020 Power Subsystem Description on page 83
- MX2020 Power Midplane Description on page 85

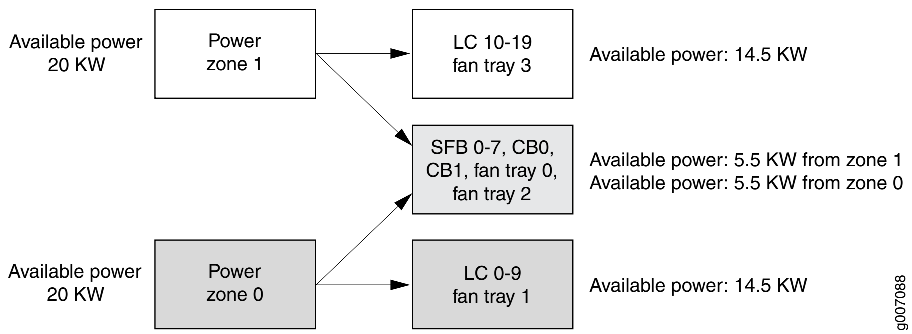
MX2020 Component Redundancy

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 combined Control Board and Routing Engine (CB-RE) functioning together. The router can have one or two host subsystems. If two host subsystems are installed, one functions as the master and the other functions as the backup. If the master host subsystem (or either of its components) fails, the backup can take over as the master.
- DC power subsystem—The MX2020 DC power system is made up of two subsystems. Each subsystem provides power to ten line card slots, one local fan tray and critical FRUs. These critical FRUs consist of two CB-REs, eight SFBs located in the center of

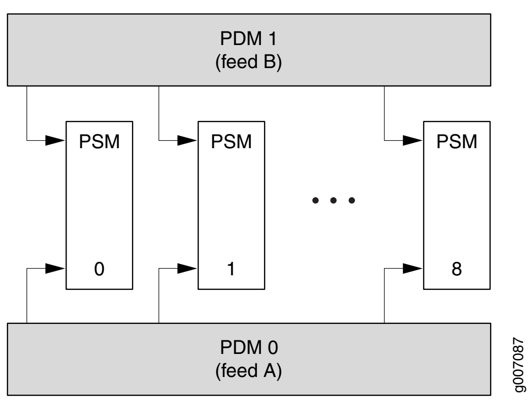
the chassis, and two fan trays (one for each zone). Specifically, each power subsystem has enough power delivery capacity to power ten line card slots, three fan trays, two CB-REs, and eight SFBs. There are nine DC power supply modules (PSMs), and two DC power distribution modules (PDMs) in each subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning, but the router will continue functioning, (see Figure 5 on page 13).

Figure 5: Power Distribution from Each Power Subsystem to the FRUs



- DC power feed redundancy—The MX2020 router subsystem is feed redundant. Each PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. There are two PDMs per power subsystem that carry nine feeds each. Users should connect feeds from one power source to one PDM and feeds from the other power source to the second PDM of the power subsystem, (see Figure 6 on page 13).

Figure 6: DC Power Subsystem Feed Redundancy



Each PSM has a set of two DIP switches located on the faceplate. These DIP switches are used to indicate whether a user wants to connect one feed to the power subsystem, two feeds, or none. These DIP switches provide critical information to the power management subsystem to help generate alarms in case of a feed failure or a wrong connection. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly. See “MX2020 DC Power Supply Module Description” on page 96.

- AC power subsystem—The MX2020 supports connection of a three-phase AC power system. There are two types of three-phase power systems: the three-phase delta and three-phase wye. The AC power going to the PSMs is split into three individual phases—each PSM works on a single phase. This means the power system works independent of the kind of AC feed is connected. The user can connect one or two feeds, depending on the power system configuration (number of PSMs, redundancy, etc.). Each phase from each of the two feeds is distributed among one or two PSMs (one feed has each phase going to two PSMs, and the other feed has each phase going to a single PSM). See Figure 7 on page 14 and Figure 8 on page 14.

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

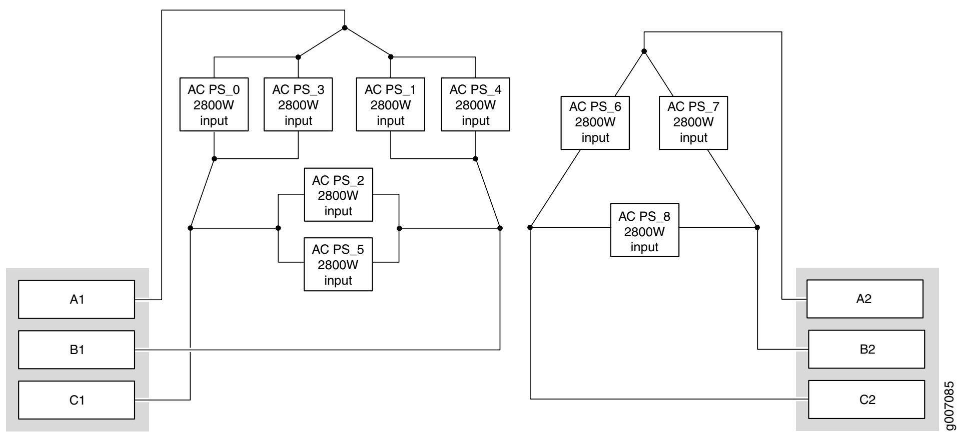
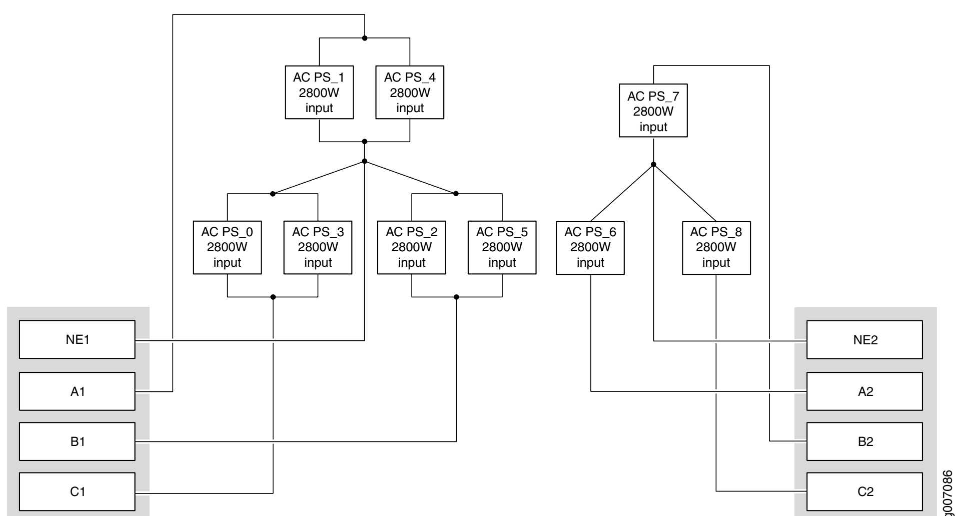


Figure 8: Power Distribution from Three-Phase Feed Wye PDM to the AC PSMs



The AC power 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, (see “MX2020 Three-Phase Delta AC Power Distribution Module Description” on page 86, “MX2020 Three-Phase Wye AC Power Distribution Module Description” on page 88, and “MX2020 AC Power Supply Module Description” on page 158).

- AC power requirements—Table 6 on page 15 shows the MX2020 current requirements for the three–phase delta and wye power feeds.

Table 6: AC PDM Delta and Wye Current Requirements

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

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

- PDMs—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 kicks in to provide full power. A total of four PDMs can be installed into a router. Each DC PDM operates with up to nine separate feeds of either 60 A or 80 A current limit. The capacity of these feeds is relayed to system software through a switch located on the DC PDM. The MX2020 router supports two types of three-phase power system PDMs. The three-phase delta and three-phase wye. Individual phases are taken from three-phase feeds to individual PSMs. One AC feed provides power to six PSMs, while the second input feed provides power to the remaining three PSMs (supporting a total of nine PSMs).
- PSMs—All AC or DC PSMs in a subsystem share the load (the 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. In the AC or DC configuration, 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.
- Cooling system—The cooling system has a total of four fan trays— two per zone—which are controlled by the host subsystem. Each zone is made up of a set of ten MPCs, four

SFBs, and one CB-RE, (see “MX2020 Cooling System Description” on page 53). If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient, cooling for the router. The fan trays are powered by two power subsystems that are divided into zones (upper zone 1 and lower zone 0).

Related Documentation

- MX2020 Router Overview on page 3
- *Displaying MX2020 Router Components and Serial Numbers*
- Guidelines for Packing Router Components for Shipment on page 409
- Returning a Hardware Component to Juniper Networks, Inc. on page 412

MX2020 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site (see Table 7 on page 17). 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.**

Table 7 on page 17 lists the FRUs for the MX2020 router.

Table 7: 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) • Master 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) • AC power distribution modules (if redundant) • DC power supply modules (if redundant) • DC power distribution modules (if redundant) • Fan trays	• Control Board and Routing Engine (CB-RE) (nonredundant) • Switch Fabric Board (SFB) (nonredundant)

Related Documentation

- Taking an MX2020 Host Subsystem Offline on page 401
- Tools and Parts Required for Replacing MX2020 Hardware Components on page 416
- Replacing the MX2020 Cable Managers on page 437
- Replacing the MX2020 Craft Interface on page 450
- Replacing an MX2020 Fan Tray on page 471
- Replacing the MX2020 Air Filters on page 431

MX2020 Router Hardware Components and CLI Terminology

The MX2020 router supports the components in Table 8 on page 17.

Table 8: MX2020 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	CHAS-BP-MX2020	**MX2020**	"MX2020 Physical Specifications" on page 108 "MX2020 Chassis Description" on page 5

Table 8: MX2020 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
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 37
Extended craft interface panel	MX2K-FPD-KIT-S		"MX2020 Craft Interface Description" on page 37
Cooling system, including air baffle, fan trays, and air filters			"MX2020 Cooling System Description" on page 53
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 83
PDM blank cover	MX2000-PDM-BLANK	N/A	"MX2020 DC Power Distribution Module Description" on page 94
Power distribution module (PDM)	MX2000-PDM-DC	**DC 52V Power Dist Module**	
	MX2000-PDM-AC-DELTA	**AC Delta Power Dist Module**	"MX2020 Three-Phase Delta AC Power Distribution Module Description" on page 86
	MX2000-PDM-AC-WYE	**AC Y Power Dist Module**	"MX2020 Three-Phase Wye AC Power Distribution Module Description" on page 88
	MX2K-PDM-AC-1PH	**Single-phase AC PDM**	
	MX2K-PDM-OP-AC	**Single-phase AC PDM (6+1)**	
	MX2K-PDM-OP-DC	**Optimized Power DC PDM (6+1)**	

Table 8: MX2020 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
PSM blank cover	MX2000-PSM-BLANK	N/A	"MX2020 Power Subsystem Description" on page 83
Power supply module (PSM)	MX2000-PSM-AC	**AC 52V Power Supply Module**	
	MX2000-PSM-DC	**DC 52V Power Supply Module**	
MIC	See *MX Series Interface Module Reference*		"MX2020 Modular Interface Card Description" on page 73
MPC blank cover	MX2000-LC-BLANK	N/A	"MX2020 Modular Port Concentrator Description" on page 68
MPC	See *MX Series Interface Module Reference*		
ADC	MX2000-LC-ADAPTER	**Adapter Card**	"MX2020 Adapter Card (ADC) Description" on page 67
SFB blank cover	MX2000-RE-SFB-BLANK	N/A	"MX2020 Switch Fabric Board Description" on page 64
SFB	MX2000-SFB	**Switch Fabric Board**	
CB-RE blank cover	MX2000-RE-SFB-BLANK	N/A	"MX2020 CB-RE Description" on page 59
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**Control Board**	
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**RE-S-1800x4**	"RE-MX2000-1800x4 CB-RE Description" on page 61
Transceiver	See *MX Series Interface Module Reference*	**Xcvr**	"Installing an SFP or XFP Transceiver into an MX2020 MPC or MIC" on page 333

Related Documentation

- MX2020 Router Overview on page 3
- *MX Series Router Interface Names*
- MX2020 Port and Interface Numbering on page 79

CHAPTER 3

Chassis Components and Descriptions

MX2020 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components, (see Figure 1 on page 6, Figure 2 on page 8, and Figure 3 on page 9). 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 36.20 in. (91.95 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 38.67 in. (98.2 cm) deep.

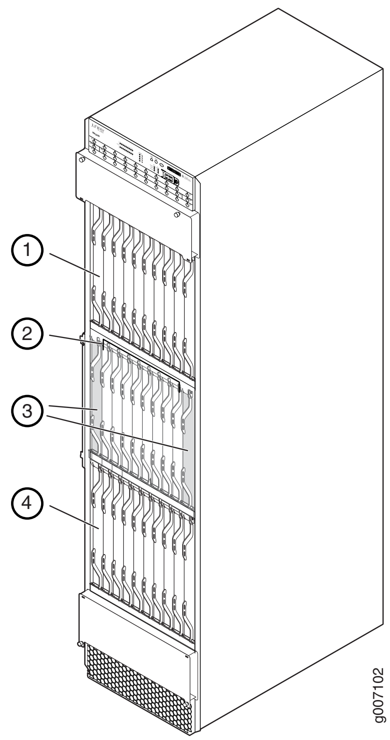
CAUTION: Before removing or installing components, attach an ESD strap to an ESD point, and place the other end of the strap around your bare wrist. Failure to use an ESD strap could result in damage to the hardware components.

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 9: 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 3 on page 6 for information on MX2020 router components.

Table 9: Front Components in a Fully Configured MX2020 Router

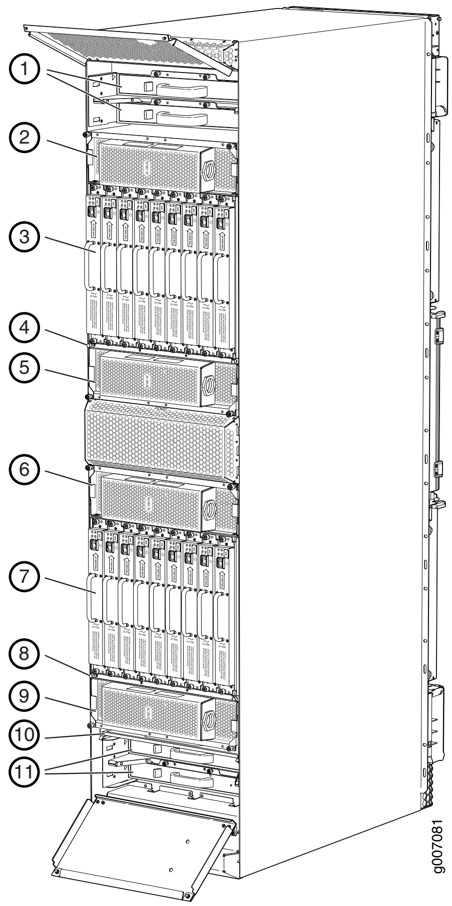
Component No.	Component Description	Slots	Number of FRUs
1	Upper cable manager– (standard or extended)	–	1
2	MPCs with ADCs and MICs (top)	10 through 19 (top)	10

Table 9: Front Components in a Fully Configured MX2020 Router *(continued)*

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

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

Figure 10: 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 4 on page 8 for information on MX2020 router components.

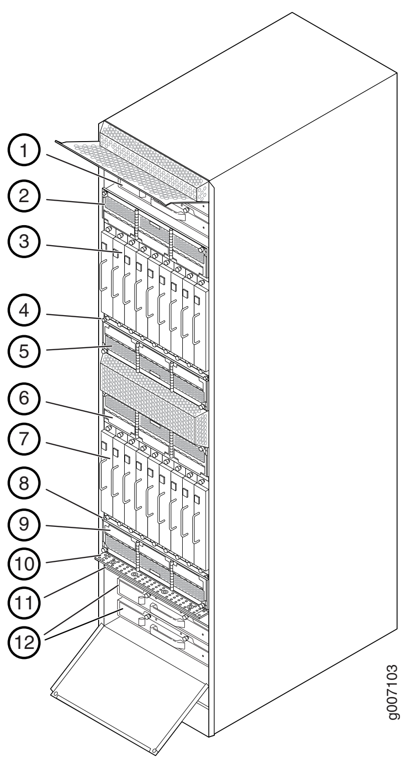
Table 10: Rear Components in a Fully Configured AC-Powered MX2020 Router

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	PDM3/Input1	1
3	AC PSM	9 through 17	9
4	PSM air filter	–	1

Table 10: Rear Components in a Fully Configured AC-Powered MX2020 Router *(continued)*

Component No.	Component Description	Slots	Number of FRUs
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

Figure 11: Rear View of a Fully Configured DC-Powered MX2020 Router Chassis



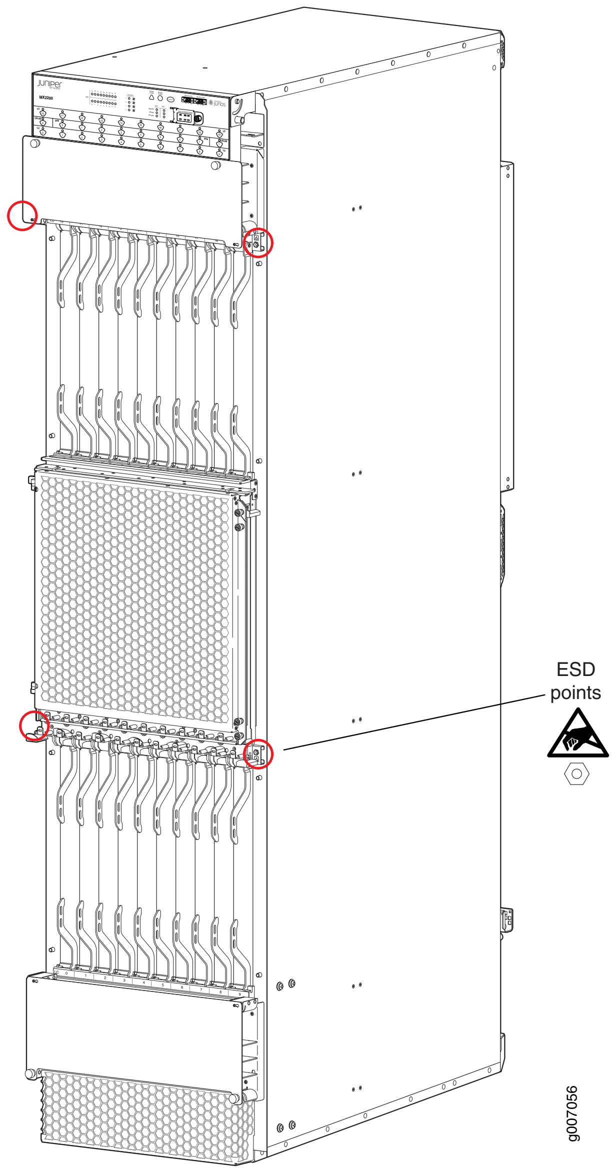
Remove field replacement units (FRUs) from the rear of the MX2020 router before you install the router. See Table 5 on page 10 for information on MX2020 router components.

Table 11: 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
2	DC PDM	PDM3/Input1	1
3	DC PSM	9 through 17	9
4	PSM air filter	–	1
5	DC PDM	PDM2/Input0	1
6	DC PDM	PDM1/Input1	1
7	DC PSM	0 through 8	9
8	PSM air filter	–	1
9	DC PDM	PDM0/Input0	1
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 4 on page 11).

Figure 12: MX2020 Router ESD Points



Related Documentation

- MX2020 Physical Specifications on page 108
- Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet on page 205
- MX2020 Router Grounding Specifications on page 117
- MX2020 Chassis Moving Guidelines on page 107

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 Router Overview on page 3
- MX2020 Chassis Description on page 5
- MX2020 Modular Port Concentrator Description on page 68
- MX2020 Switch Fabric Board Description on page 64
- MX2020 Host Subsystem Description on page 57
- MX2020 Modular Interface Card Description on page 73
- MX2020 Power Subsystem Description on page 83
- MX2020 Power Midplane Description on page 85

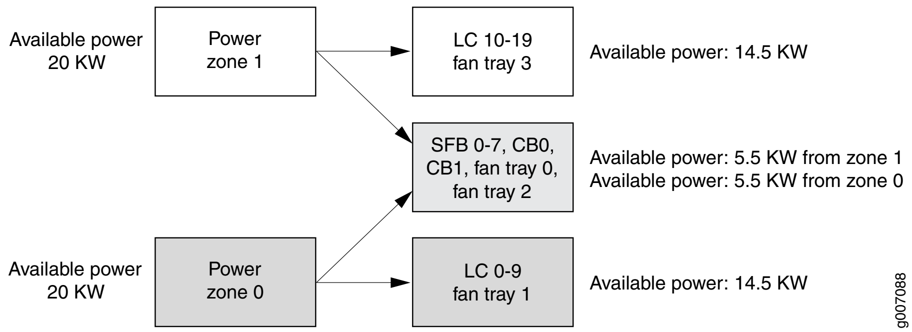
MX2020 Component Redundancy

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 combined Control Board and Routing Engine (CB-RE) functioning together. The router can have one or two host subsystems. If two host subsystems are installed, one functions as the master and the other functions as the backup. If the master host subsystem (or either of its components) fails, the backup can take over as the master.
- DC power subsystem—The MX2020 DC power system is made up of two subsystems. Each subsystem provides power to ten line card slots, one local fan tray and critical FRUs. These critical FRUs consist of two CB-REs, eight SFBs located in the center of

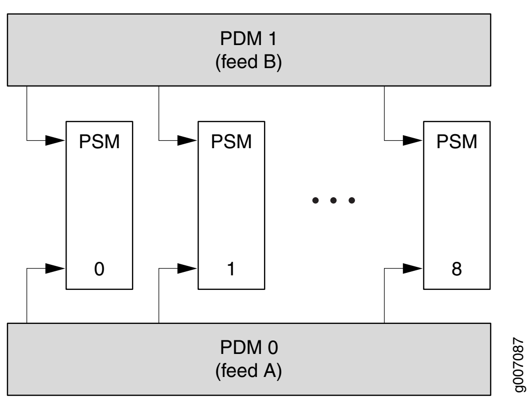
the chassis, and two fan trays (one for each zone). Specifically, each power subsystem has enough power delivery capacity to power ten line card slots, three fan trays, two CB-REs, and eight SFBs. There are nine DC power supply modules (PSMs), and two DC power distribution modules (PDMs) in each subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning, but the router will continue functioning, (see Figure 5 on page 13).

Figure 13: Power Distribution from Each Power Subsystem to the FRUs



- DC power feed redundancy—The MX2020 router subsystem is feed redundant. Each PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. There are two PDMs per power subsystem that carry nine feeds each. Users should connect feeds from one power source to one PDM and feeds from the other power source to the second PDM of the power subsystem, (see Figure 6 on page 13).

Figure 14: DC Power Subsystem Feed Redundancy



Each PSM has a set of two DIP switches located on the faceplate. These DIP switches are used to indicate whether a user wants to connect one feed to the power subsystem, two feeds, or none. These DIP switches provide critical information to the power management subsystem to help generate alarms in case of a feed failure or a wrong connection. Each PDM has an LED per feed indicating whether the feed is active or not, or whether the feed is connected properly. See "MX2020 DC Power Supply Module Description" on page 96.

- AC power subsystem—The MX2020 supports connection of a three-phase AC power system. There are two types of three-phase power systems: the three-phase delta and three-phase wye. The AC power going to the PSMs is split into three individual phases—each PSM works on a single phase. This means the power system works independent of the kind of AC feed is connected. The user can connect one or two feeds, depending on the power system configuration (number of PSMs, redundancy, etc.). Each phase from each of the two feeds is distributed among one or two PSMs (one feed has each phase going to two PSMs, and the other feed has each phase going to a single PSM). See Figure 7 on page 14 and Figure 8 on page 14.

Figure 15: Power Distribution from Three-Phase Feed Delta PDM to the AC PSMs

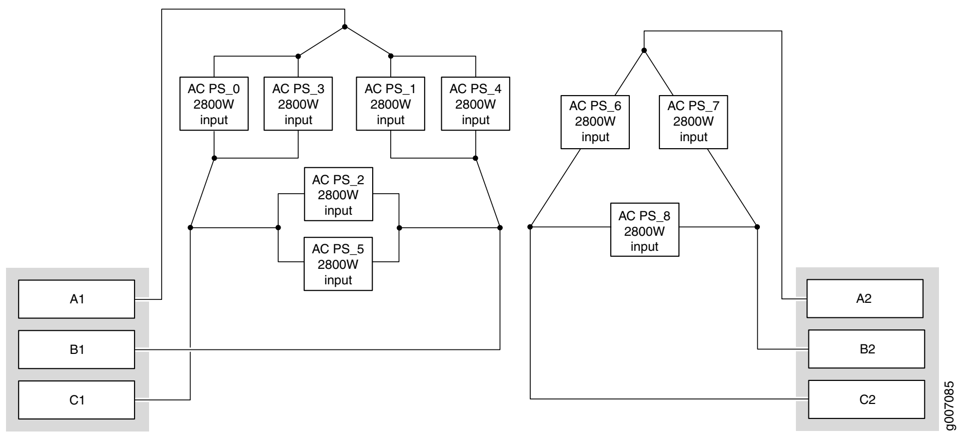
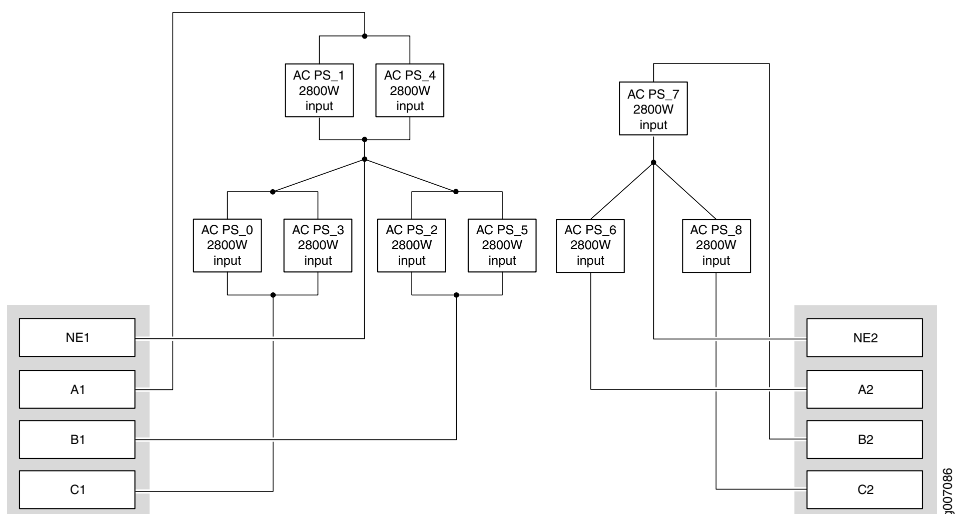


Figure 16: Power Distribution from Three-Phase Feed Wye PDM to the AC PSMs



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, (see "MX2020 Three-Phase Delta AC Power Distribution Module Description" on page 86, "MX2020 Three-Phase Wye AC Power Distribution Module Description" on page 88, and "MX2020 AC Power Supply Module Description" on page 158).

- AC power requirements—Table 6 on page 15 shows the MX2020 current requirements for the three–phase delta and wye power feeds.

Table 12: AC PDM Delta and Wye Current Requirements

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

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

- PDMs—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 kicks in to provide full power. A total of four PDMs can be installed into a router. Each DC PDM operates with up to nine separate feeds of either 60 A or 80 A current limit. The capacity of these feeds is relayed to system software through a switch located on the DC PDM. The MX2020 router supports two types of three-phase power system PDMs. The three-phase delta and three-phase wye. Individual phases are taken from three-phase feeds to individual PSMs. One AC feed provides power to six PSMs, while the second input feed provides power to the remaining three PSMs (supporting a total of nine PSMs).
- PSMs—All AC or DC PSMs in a subsystem share the load (the 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. In the AC or DC configuration, 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.
- Cooling system—The cooling system has a total of four fan trays— two per zone—which are controlled by the host subsystem. Each zone is made up of a set of ten MPCs, four

SFBs, and one CB-RE, (see "MX2020 Cooling System Description" on page 53). If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient, cooling for the router. The fan trays are powered by two power subsystems that are divided into zones (upper zone 1 and lower zone 0).

Related Documentation

- MX2020 Router Overview on page 3
- *Displaying MX2020 Router Components and Serial Numbers*
- Guidelines for Packing Router Components for Shipment on page 409
- Returning a Hardware Component to Juniper Networks, Inc. on page 412

MX2020 Field-Replaceable Units

Field-replaceable units (FRUs) are router components that can be replaced at the customer site (see Table 7 on page 17). 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.**

Table 7 on page 17 lists the FRUs for the MX2020 router.

Table 13: 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) • Master 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) • AC power distribution modules (if redundant) • DC power supply modules (if redundant) • DC power distribution modules (if redundant) • Fan trays	• Control Board and Routing Engine (CB-RE) (nonredundant) • Switch Fabric Board (SFB) (nonredundant)

Related Documentation

- Taking an MX2020 Host Subsystem Offline on page 401
- Tools and Parts Required for Replacing MX2020 Hardware Components on page 416
- Replacing the MX2020 Cable Managers on page 437
- Replacing the MX2020 Craft Interface on page 450
- Replacing an MX2020 Fan Tray on page 471
- Replacing the MX2020 Air Filters on page 431

MX2020 Router Hardware Components and CLI Terminology

The MX2020 router supports the components in Table 8 on page 17.

Table 14: MX2020 Router Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	CHAS-BP-MX2020	**MX2020**	"MX2020 Physical Specifications" on page 108 "MX2020 Chassis Description" on page 5

Table 14: MX2020 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
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 37
Extended craft interface panel	MX2K-FPD-KIT-S		“MX2020 Craft Interface Description” on page 37
Cooling system, including air baffle, fan trays, and air filters			“MX2020 Cooling System Description” on page 53
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 83
PDM blank cover	MX2000-PDM-BLANK	N/A	“MX2020 DC Power Distribution Module Description” on page 94
Power distribution module (PDM)	MX2000-PDM-DC	**DC 52V Power Dist Module**	
	MX2000-PDM-AC-DELTA	**AC Delta Power Dist Module**	“MX2020 Three-Phase Delta AC Power Distribution Module Description” on page 86
	MX2000-PDM-AC-WYE	**AC Y Power Dist Module**	“MX2020 Three-Phase Wye AC Power Distribution Module Description” on page 88
	MX2K-PDM-AC-1PH	**Single-phase AC PDM**	
	MX2K-PDM-OP-AC	**Single-phase AC PDM (6+1)**	
	MX2K-PDM-OP-DC	**Optimized Power DC PDM (6+1)**	

Table 14: MX2020 Router Hardware Components and CLI Terminology *(continued)*

Component	Hardware Model Number	CLI Name	Description
PSM blank cover	MX2000-PSM-BLANK	N/A	"MX2020 Power Subsystem Description" on page 83
Power supply module (PSM)	MX2000-PSM-AC	**AC 52V Power Supply Module**	
	MX2000-PSM-DC	**DC 52V Power Supply Module**	
MIC	See *MX Series Interface Module Reference*		"MX2020 Modular Interface Card Description" on page 73
MPC blank cover	MX2000-LC-BLANK	N/A	"MX2020 Modular Port Concentrator Description" on page 68
MPC	See *MX Series Interface Module Reference*		
ADC	MX2000-LC-ADAPTER	**Adapter Card**	"MX2020 Adapter Card (ADC) Description" on page 67
SFB blank cover	MX2000-RE-SFB-BLANK	N/A	"MX2020 Switch Fabric Board Description" on page 64
SFB	MX2000-SFB	**Switch Fabric Board**	
CB-RE blank cover	MX2000-RE-SFB-BLANK	N/A	"MX2020 CB-RE Description" on page 59
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**Control Board**	
Control Board and Routing Engine (CB-RE)	RE-MX2000-1800X4	**RE-S-1800x4**	"RE-MX2000-1800x4 CB-RE Description" on page 61
Transceiver	See *MX Series Interface Module Reference*	**Xcvr**	"Installing an SFP or XFP Transceiver into an MX2020 MPC or MIC" on page 333

Related Documentation

- MX2020 Router Overview on page 3
- *MX Series Router Interface Names*
- MX2020 Port and Interface Numbering on page 79

CHAPTER 4

Alarm and Display Components

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. Table 15 on page 38 describes the LEDs, buttons, and connectors.

Figure 17: Front Panel of the Craft Interface

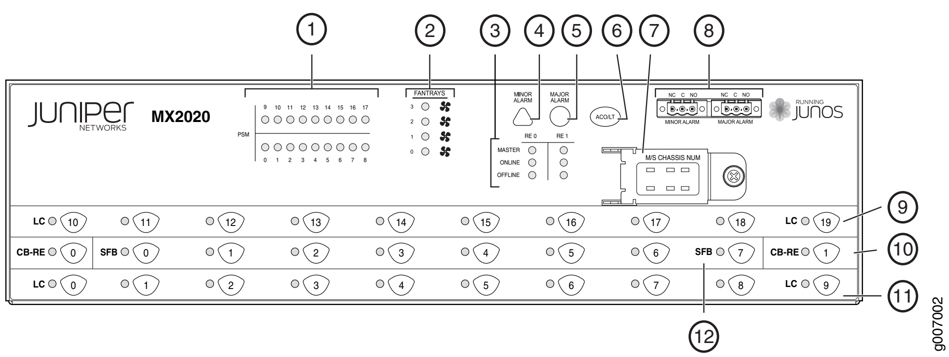


Figure 18: Extended Craft Interface

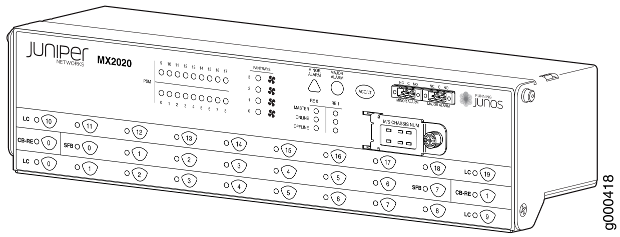


Table 15: Craft Interface LEDs, Buttons, and Connectors

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.
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.

Table 15: Craft Interface LEDs, Buttons, and Connectors *(continued)*

Function No.	Label	Description
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.
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 on page 450
- *MX2020 Craft Interface Serial Number Label*

MX2020 Component LEDs on the Craft Interface

MX2020 Host Subsystem LEDs and Buttons on the Craft Interface

Each host subsystem has three LEDs, located in the upper middle of the craft interface, that indicate its status. The LEDs labeled **RE0** show the status of the Routing Engine on the CB-RE in slot **0**. The LEDs labeled **RE1** show the status of the Routing Engine on the CB-RE in slot **1**. Table 16 on page 39 describes the functions of the host subsystem LEDs.

Table 16: Host Subsystem LEDs on the Craft Interface

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

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

MX2020 Power Supply Module LEDs on the Craft Interface

Each power supply module (PSM) has one bicolor LED on the craft interface that indicates its status. The LEDs, labeled **0** through **8** (bottom) and **9** through **17** (top), are located on the upper left of the craft interface next to the **PSM** label. Table 17 on page 40 describes the functions of the PSM LEDs on the craft interface.

Table 17: Power Supply Module LEDs on the Craft Interface

Label	Color	State	Description
PSM	Green	On steadily	PSM is functioning normally.
	Red	On steadily	PSM module has failed or power input has failed.

MX2020 Line Card LEDs and Buttons on the Craft Interface

Each line card (MPC) has one bicolor LED on the craft interface that indicates its status. The LEDs, labeled **0** through **9** (bottom) and **10** through **19** (top), are located along the bottom of the craft interface. Table 18 on page 40 describes the functions of the LEDs.

Table 18: Line Card LEDs on the Craft Interface

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

There are twenty push buttons located next to each of the line cards on the craft interface. These buttons are used to place the line cards online or offline. When a line card is inserted into an ADC, and installed into the MX2020 router the online/offline buttons can turn both cards on or off.

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

MX2020 SFB LED and Buttons on the Craft Interface

Each SFB has one tricolor LED on the craft interface that indicates its status. The SFB LED, labeled **0** through **7**, are located along the bottom of the craft interface. Table 19 on page 41 describes the functions of the SFB LED.

Table 19: SFB LED on the Craft Interface

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

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

MX2020 Fan Tray LEDs on the Craft Interface

The fan tray LEDs, labeled **0** through **3**, are located on the top middle of the craft interface. Table 20 on page 41 describes the functions of the fan tray LEDs.

Table 20: Fan Tray LEDs on the Craft Interface

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

Related Documentation

- MX2020 Craft Interface Description on page 37
- MX2020 Alarm Relay Contacts on the Craft Interface on page 41

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 19 on page 42) 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 21 on page 42).

Figure 19: Alarm Relay Contacts

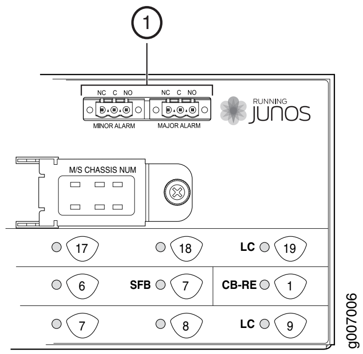


Table 21: Alarm Relay Contacts

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 on page 283
- Connecting the Alarm Relay Wires to the MX2020 Craft Interface on page 282

MX2020 Alarm LEDs and Alarm Cutoff/Lamp Test Button

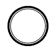
Two large alarm LEDs are located at the upper right of the craft interface. When lit, the circular red LED indicates a critical condition that can result in a system shutdown. A lit triangular yellow LED indicates a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously.

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 22 on page 43 describes the alarm LEDs and alarm cutoff button in more detail.

Table 22: 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 on page 37
- MX2020 Alarm Relay Contacts on the Craft Interface on page 41
- MX2020 Router Overview on page 3

CHAPTER 5

Cable and Rack Management

MX2020 Cable Manager Description

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

The upper cable manager, (see Figure 20 on page 46) 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 20 on page 46) 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 21 on page 47).

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 20 on page 46).

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 20: MX2020 Standard Cable Managers

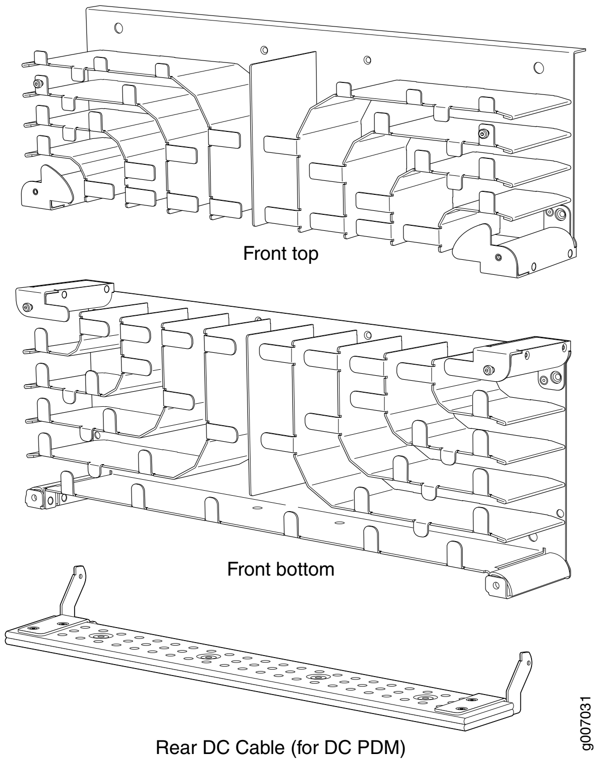
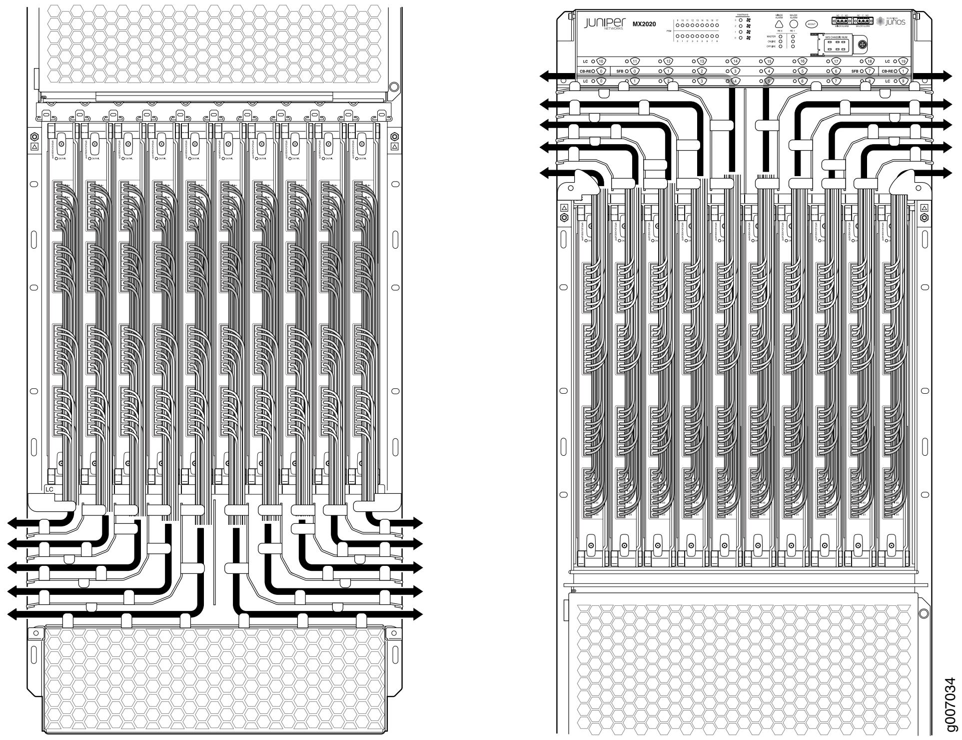


Figure 21: Upper and Lower Cable Management



The middle card-cage cable manager, (see Figure 22 on page 48 and Figure 23 on page 48) 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 22: Middle Card-Cage Cable Manager

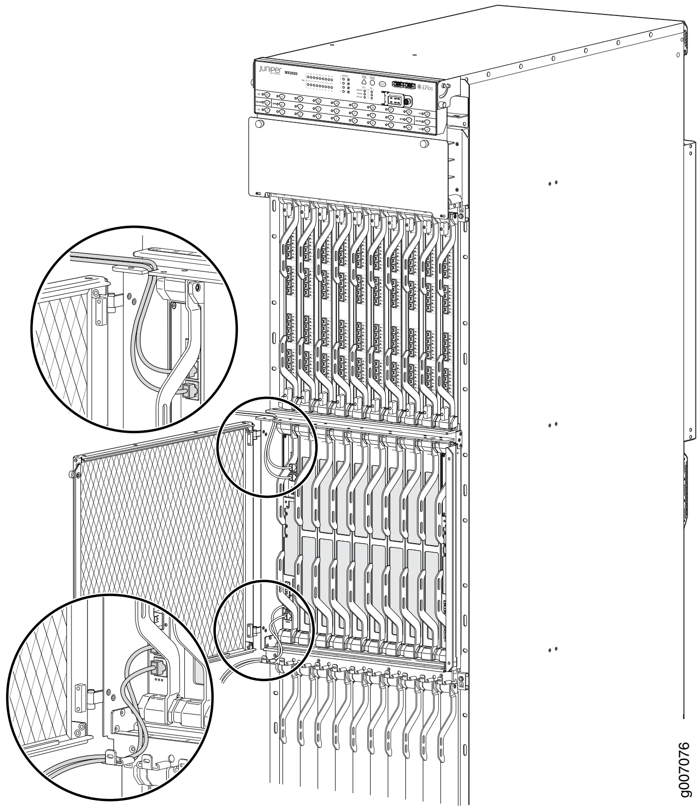
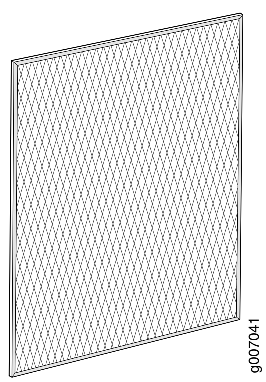


Figure 23: Middle Card-Cage Air Filter



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 24 on page 49).

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 24 on page 49).

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 24: MX2020 Extended Cable Managers

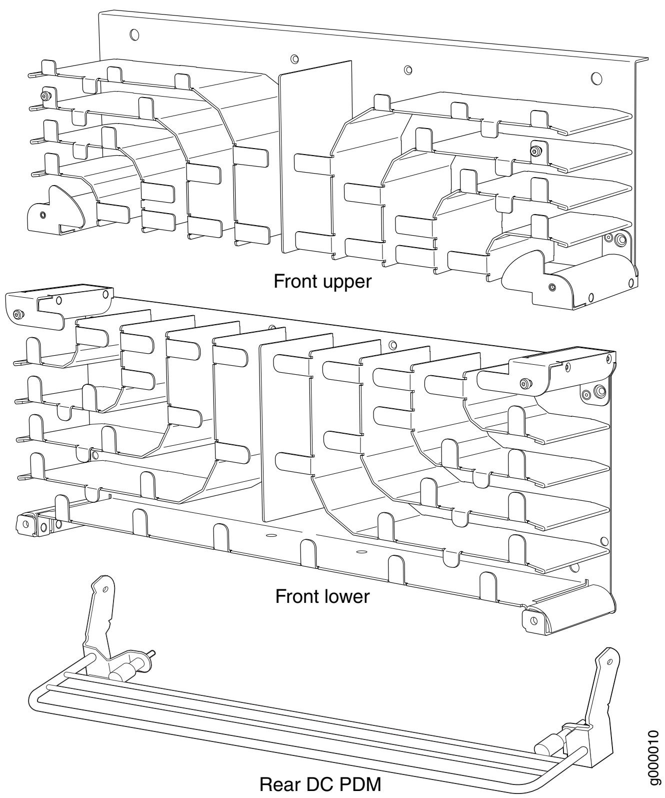
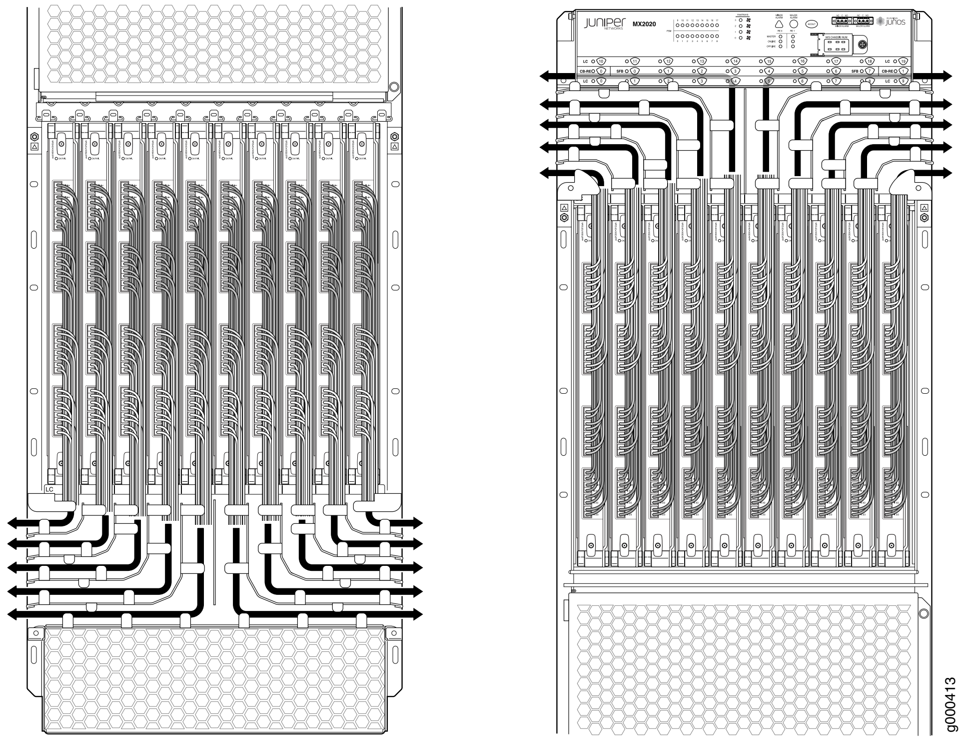


Figure 25: Upper and Lower Extended Cable Management



Related Documentation

- Installing the MX2020 Upper Cable Manager on page 332
- Installing the MX2020 Lower Cable Manager on page 314
- Installing the MX2020 DC Cable Manager on page 303
- Replacing the MX2020 Cable Managers on page 437

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 on page 5
- MX2020 Backplane Description on page 11

- Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet on page 205

CHAPTER 6

Cooling System

MX2020 Cooling System Description

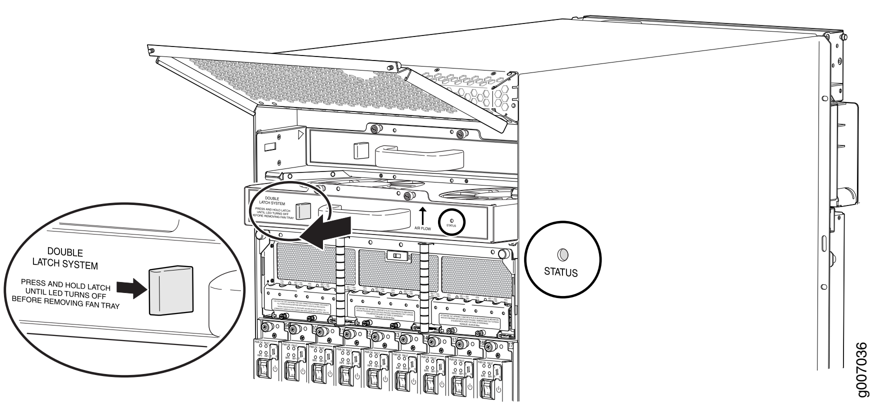
The cooling system consists of the following components:

- Fan tray—MX2000-FANTRAY
- 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. These are labeled **1** through **6** 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 26 on page 53).

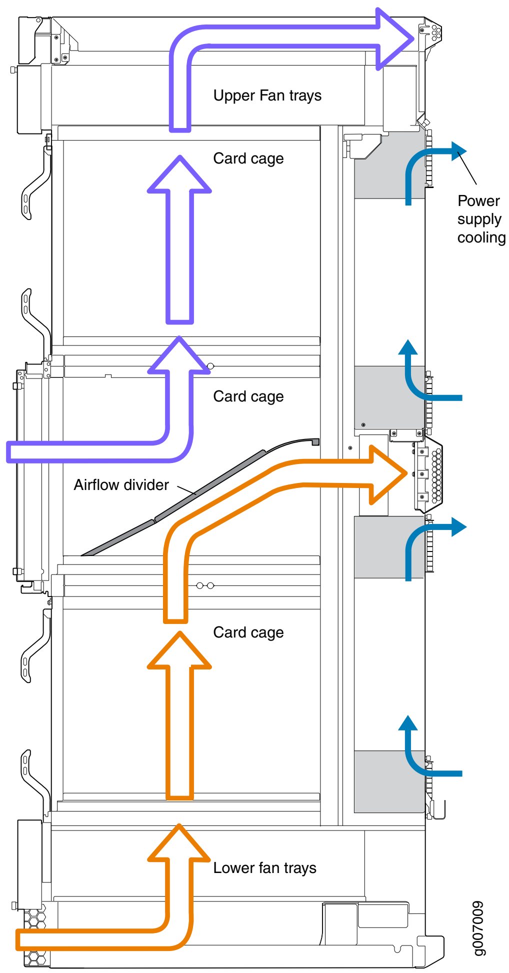
Figure 26: Removing Fan Tray



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 27 on page 54).

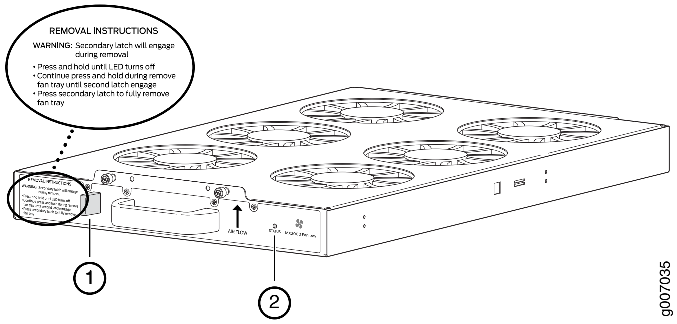
Figure 27: Airflow Through the Chassis



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 28: Upper/Lower Fan Tray

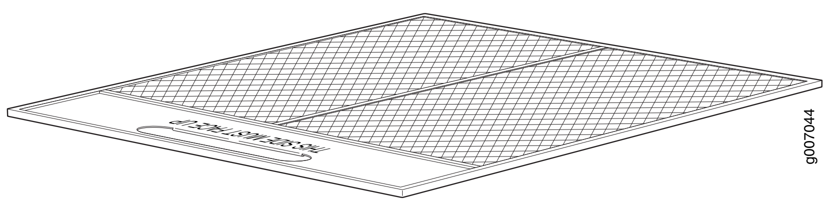


1— Safety double latch system	2—**STATUS** LED

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 29: 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 on page 534
- Maintaining the MX2020 Air Filter on page 341
- Maintaining the MX2020 Fan Trays on page 345
- Maintaining the MX2020 Air Baffle on page 344

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 23 on page 56). 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" on page 39.

Table 23: 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

- MX2020 Cooling System Description on page 53
- Maintaining the MX2020 Fan Trays on page 345
- Troubleshooting the MX2020 Cooling System on page 534
- MX2020 Component LEDs on the Craft Interface on page 39

CHAPTER 7

Host Subsystem Components

MX2020 Host Subsystem Description

The host subsystem provides routing protocol processes, as well as software processes that control the router's interface, the chassis components, system management, and user access to the router. These routing processes run on top of a kernel that interacts with the Packet Forwarding Engine (PFE). The CB-RE provides control plane functions. The user can install one or two host subsystems on the router. Each host subsystem functions as a unit; the Control Board and Routing Engine (CB-RE).

NOTE: Install two CB-RE host subsystems for redundant protection. If you install only one CB-RE host subsystem, you can install it in slot 0 or slot 1.

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

Supported CB-RE

The CB-RE is hot-pluggable. Some key attributes of the MX2020 CB-RE are:

- CB-RE into one FRU.
- Air diverter to isolate upper and lower cooling zones.

The MX2020 router supports the following CB-RE:

- RE-MX2000-1800x4 supported for Junos OS Release 12.3R2 and later.

CB-RE Function

The CB-RE runs the 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.

CB-RE Slots

The user can install one or two CB-REs in the router. Each CB-RE is a combined Routing Engine and Control Board in one unit. A USB port on the CB-RE accepts a USB memory device that allows you to load Junos OS. The CB-RE installs into the front of the chassis in vertical slots labeled **0** and **1**. If two CB-REs are installed, one functions as the master and the other acts as the backup. If the master CB-RE fails or is removed and the backup is configured appropriately, the backup takes over as the master. 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 of the CB-REs fails, do not remove the failed CB-RE until you have a replacement or blank panel to install.**

CB-RE Interface Ports

Three ports, located on the CB-RE, connect the CB-RE to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router. In addition, four ports located on the CB-RE include, two 10 Gigabit Ethernet SFP+ interface connectors supporting hardware diagnostics (JCS port testing), and two external clock interfaces for BITS and GPS function.

The CB-RE interface ports with the indicated labels function as follows:

- **AUX**—Connects the CB-RE to a laptop, modem, or other auxiliary device through a serial cable with an RJ-45 connector.
- **CONSOLE**—Connects the CB-RE to a system console through a serial cable with an RJ-45 connector.

- **MGMT**—Connects the CB-RE through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support 10-Mbps or 100-Mbps connections. Two small LEDs on the bottom of the port indicate the connection in use: the LED flashes yellow or green for a 10-Mbps or 100-Mbps connection, and the LED is lit green when traffic is passing through the port.

  The control board interface ports function as follows:

- **XGE-0** and **XGE-1**—Two SFP+ connects the CB-RE through an Ethernet to support 2 x 10-Gbps connections to any external control box. Two small LEDs on the side of each SFP+ port indicate the connection in use: the LED flashes yellow when there is no link, flashes green when there is activity, or is lit green for a 10-Gbps connection.
- **ExtClk-0** and **ExtClk-1**—Connect the CB-RE to an external clock device through a serial cable with an RJ-45 connector.

Related Documentation

- MX2020 CB-RE LEDs on page 62
- Maintaining the MX2020 Host Subsystem on page 370
- Taking an MX2020 Host Subsystem Offline on page 401
- Effect of Taking the MX2020 Host Subsystem Offline on page 402
- Removing an MX2020 CB-RE on page 419
- RJ-45 Connector Pinouts for MX Series CB-RE Auxiliary and Console Ports on page 145
- RJ-45 Connector Pinouts for an MX Series CB-RE Management Port on page 146

MX2020 CB-RE Description

Figure 30 on page 59 shows the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4.

Table 24 on page 59 describes the Control Board and Routing Engine (CB-RE)—RE-MX2000-1800x4 ports.

Figure 30: RE-MX2000-1800x4 CB-RE Front View

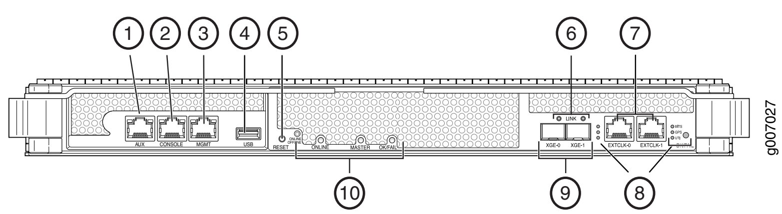


Table 24: Components on the RE-MX2000-1800x4

Function No.	Label	Description
1	**AUX**	This port is used to connect a laptop, modem, or other auxiliary unit.

Table 24: Components on the RE-MX2000-1800x4 *(continued)*

Function No.	Label	Description
2	**CONSOLE**	This port is used to configure the MX2020 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 MX2020 router remotely.
4	**USB**	This port is used to install a USB flash drive that contains Junos OS.
5	**RESET**	Reset button used to reboot the CB-RE.
6	**LINK**	These LEDs are associated with each of the SFP+ ports (XGE-0 and XGE-1) indicates the connection in use.
7	**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.
8	**GPS**, and **BITS**	There is one bicolor LED for each external clock interface—BITS and GPS.
9	**XGE-0** and **XGE-1**	Two SFP+ ports connects the CB-RE through an Ethernet connection to support hardware diagnostics and JCS port testing. The port uses an RJ-45 connector to support 2 x 10-Gbps connections.
10	**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 master Control Board and Routing Engine (CB-RE) , and the **OK/FAIL** LED indicates the CB-RE has failed.

Related Documentation

- RJ-45 Connector Pinouts for MX Series CB-RE Auxiliary and Console Ports on page 145
- RJ-45 Connector Pinouts for an MX Series CB-RE Management Port on page 146
- Removing an MX2020 CB-RE on page 419
- MX2020 Host Subsystem Description on page 57

RE-MX2000-1800x4 CB-RE Description

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 SFP+ ports (**XGE-0** and **XGE-1**) provide support for hardware diagnostics and JCS port testing. 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 Boot Sequence

The router is shipped with the Junos OS preinstalled 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 on page 145
- RJ-45 Connector Pinouts for an MX Series CB-RE Management Port on page 146
- Removing an MX2020 CB-RE on page 419
- MX2020 Host Subsystem Description on page 57

MX2020 CB-RE LEDs

Each Routing Engine on the CB-RE (model number RE-MX2000-1800X4) 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 25 on page 63 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 25 on page 63 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 "MX2020 Component LEDs on the Craft Interface" on page 39.

Table 25: 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 master.
OK/FAIL	Red	On steadily	CB-RE has failed.
LINK	Green	On steadily	SFP+ ports (XGE-0 and XGE-1) link connection.
		Blinking steadily	Activity on SFP+ ports (XGE-0 and XGE-1).
	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.

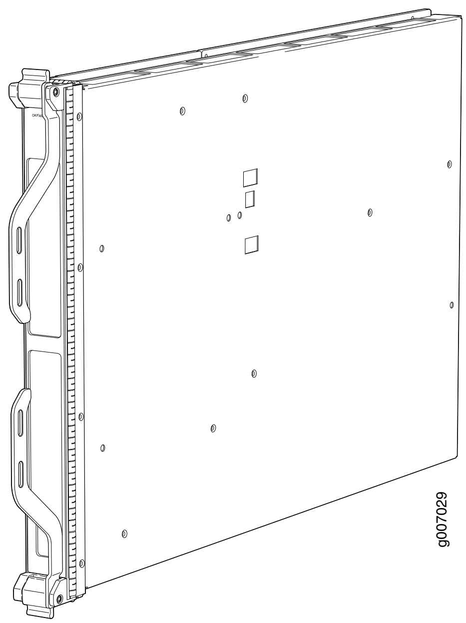
Related Documentation

- MX2020 Host Subsystem Description on page 57
- Maintaining the MX2020 Host Subsystem on page 370
- Taking an MX2020 Host Subsystem Offline on page 401

MX2020 Switch Fabric Board Description

The MX2020 Switch Fabric Board (SFB) straddles the two backplanes. It has connectors connecting to both backplanes, (see Figure 31 on page 64).

Figure 31: SFB



SFB Slots

The user can install up to eight SFBs in the MX2020 router. The SFBs 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.

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

SFB Redundancy

Seven of eight SFBs are required for line rate operation. The system can continue operating with fewer than seven SFBs, but forwarding performance will be impacted.

SFB Components

Each SFB consists of the following components:

- PCIe control of three XF ASICs
- I2C bus logic interface, used for component management and monitoring of temperature, and voltage

- Switch fabric—Provides the switching functions for the MPCs
- Fabric capacity—Supports a 750-Gbps MPC with redundancy and 860-Gbps without redundancy
- Circuits for chassis management and control
- Power circuits for the SFB
- LED—Provide status of the SFB

Related Documentation

- MX2020 Host Subsystem Description on page 57
- MX2020 Switch Fabric Board LED on page 65
- Replacing an MX2020 SFB on page 494

MX2020 Switch Fabric Board LED

One bicolor LED on the SFB indicate the status of the SFB. The LED, labeled **OK/FAIL**, is located directly on the SFB. Table 26 on page 65 describes the functions of the SFB LED.

Table 26: Switch Fabric Board LED

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

Each SFB also has a set of bicolor LED on the craft interface that indicate its status. The SFB LED, labeled **0** through **7**, are located along the bottom center of the craft interface. For more information about the SFB LED on the craft interface, see “MX2020 Component LEDs on the Craft Interface” on page 39.

Related Documentation

- MX2020 Switch Fabric Board Description on page 64
- MX2020 Host Subsystem Description on page 57
- Replacing an MX2020 SFB on page 494

CHAPTER 8

Interface Modules—ADCs, MPCs, and MICs

MX2020 Adapter Card (ADC) Description

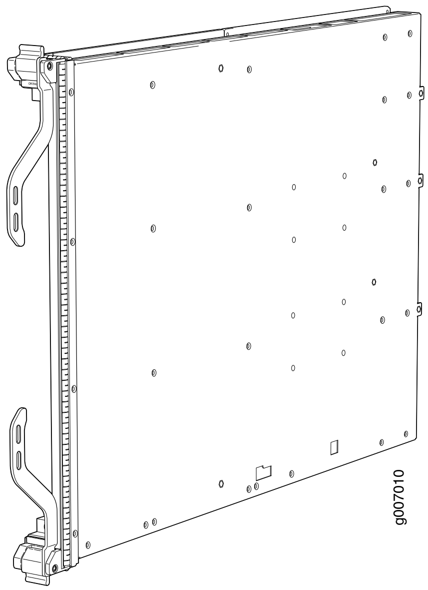
The current MX2020 router requires an adapter card (ADC) to house the MPCs. The MPCs attach to the ADCs which in turn attach to the backplane. Future MPCs for the MX2020 can be used without an ADC.

The MX2020 router has 20 dedicated line card slots, which means a maximum of 20 ADCs can be installed. The dedicated slots are numbered **0** though **9** (bottom), and **10** though **19** (top), left to right. ADCs install vertically in the front of the router.

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

ADCs are hot-removable and hot-insertable. Figure 32 on page 68 shows a typical ADC supported on the MX2020 router.

Figure 32: Typical ADC Supported on the MX2020 Router



Related Documentation

- Removing an MX2020 MPC with Adapter Card on page 485
- Maintaining the MX2020 Adapter Cards on page 338

MX2020 Modular Port Concentrator Description

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

NOTE: The MX2020 router also supports fixed port MPCs.

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

The MX2020 router supports up to 20 MPCs. For power requirements, see "Calculating DC Power Requirements for MX2020 Routers" on page 180 and "Calculating AC Power Requirements for MX2020 Routers" on page 165.

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. The user can install any combination of MPC types in the router.

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

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

Figure 33 on page 69 shows a typical MPC supported on the MX2020 router. Figure 34 on page 69 shows an MPC installed vertically in the MX2020 router. For more information about MPCs, see the *MX Series Interface Module Reference*.

Figure 33: Typical MPC Supported on the MX2020 Router

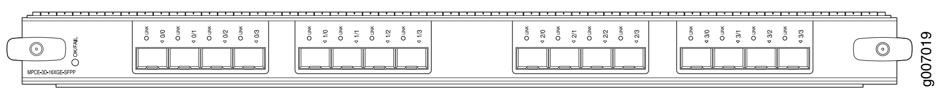
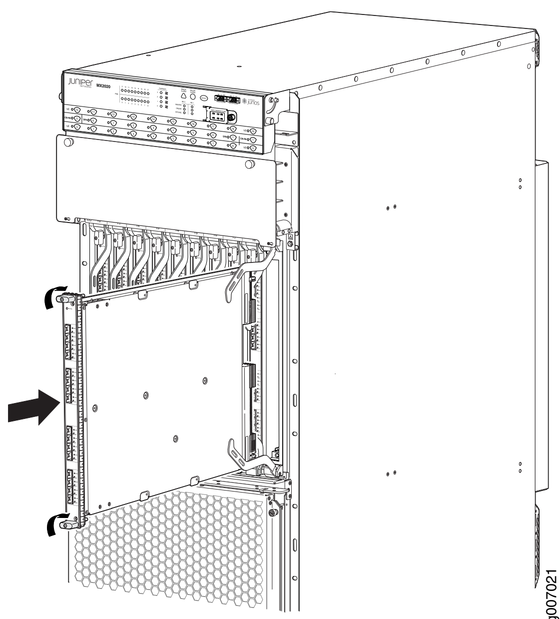


Figure 34: MPC Installed in the MX2020 Router



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 LEDs on the MPC faceplate, see the *MX Series Interface Module Reference*.

Related Documentation

- MX2020 Modular Port Concentrator LEDs on page 70
- MX2020 Field-Replaceable Units on page 16
- Maintaining MX2020 MPCs on page 375
- Troubleshooting the MX2020 MPCs on page 538
- Replacing an MX2020 MPC on page 485
- MX2020 Adapter Card (ADC) Description on page 67

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" on page 39.

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

Related Documentation

- MX2020 Modular Port Concentrator Description on page 68
- Maintaining MX2020 MPCs on page 375
- Troubleshooting the MX2020 MPCs on page 538
- Replacing an MX2020 MPC on page 485
- MICs Supported by MX Series Routers on page 74

MPCs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers

Table 27 on page 71 lists the MPCs and their first supported Junos OS release on MX240, MX480, MX960, MX2010, and MX2020 routers.

Table 27: MPCs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers
Fixed Configuration MPCs				
16x10GE MPC	MPC-3D-16XGE-SFP	10.0R2	12.3	12.3
Multiservices MPC	MS-MPC	13.2R4	–	–
32x10GE MPC4E	MPC4E-3D-32XGE-SFPP	12.3R2	12.3R2	12.3R2
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	12.3R2	12.3R2	12.3R2
6x40GE + 24x10GE MPC5E	MPC5E-40G10G	13.3R2	13.3R2	13.3R2
6x40GE + 24x10GE MPC5EQ	MPC5EQ-40G10G	13.3R2	13.3R2	13.3R2
2x100GE + 4x10GE MPC5E	MPC5E-100G10G	13.3R3	13.3R3	13.3R3
2x100GE + 4x10GE MPC5EQ	MPC5EQ-100G10G	13.3R3	13.3R3	13.3R3
MPCs				
MPC1	MX-MPC1-3D	10.2	12.3	12.3
MPC1E	MX-MPC1E-3D	11.2R4	12.3	12.3
MPC1 Q	MX-MPC1-3D-Q	10.2	12.3	12.3
MPC1E Q	MX-MPC1E-3D-Q	11.2R4	12.3	12.3
MPC2	MX-MPC2-3D	10.1	12.3	12.3
MPC2E	MX-MPC2E-3D	11.2R4	12.3	12.3
MPC2 Q	MX-MPC2-3D-Q	10.1	12.3	12.3
MPC2E Q	MX-MPC2E-3D-Q	11.2R4	12.3	12.3
MPC2 EQ	MX-MPC2-3D-EQ	10.1	12.3	12.3
MPC2E EQ	MX-MPC2E-3D-EQ	11.2R4	12.3	12.3
MPC2E P	MX-MPC2E-3D-P	12.2	12.3	12.3

Table 27: MPCs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers *(continued)*

MPC Name	MPC Model Number	First Junos OS Release on MX240, MX480, and MX960 Routers	First Junos OS Release on MX2010 Routers	First Junos OS Release on MX2020 Routers
MPC2E NG	MX-MPC2E-3D-NG	14.1R4, 14.2R3 and Junos Continuity 15.1	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	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1
MPC3E	MX-MPC3E-3D	12.1	12.3	12.3
MPC3E NG	MX-MPC3E-3D-NG	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1
MPC3E NG Q	MX-MPC3E-3D-NG-Q	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1	14.1R4, 14.2R3 and Junos Continuity 15.1
MPC6E	MX2K-MPC6E	–	13.3R2	13.3R2

Related Documentation

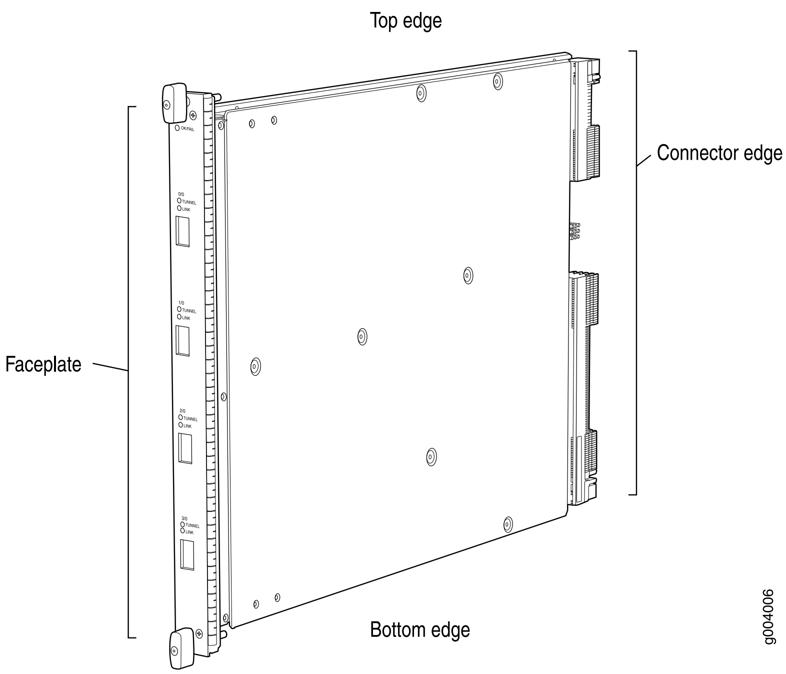
- *MX Series MPC Overview*
- *Protocols and Applications Supported by MX240, MX480, MX960, MX2010, and MX2020 MPCs*
- *Protocols and Applications Supported by the MX240, MX480, MX960, MX2010, and MX2020 MPC3E*
- *Protocols and Applications Supported by the MX240, MX480, MX960, MX2010, and MX2020 MPC4Es*
- *Protocols and Applications Supported by the MX240, MX480, MX960, MX2010, and MX2020 MPC5Es*
- *Protocols and Applications Supported by the MX2010 and MX2020 MPC6E*
- *MIC/MPC Compatibility*
- *MX Series MIC Overview*
- MICs Supported by MX Series Routers on page 74

MX2020 MPC Terminology

Regardless of whether you are holding an MPC vertically or horizontally, this information uses the same terms for all four edges of the MPC (see Figure 35 on page 73):

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

Figure 35: MPC Edges



Related Documentation

- MX2020 Modular Port Concentrator Description on page 68
- MX2020 Component LEDs on the Craft Interface on page 39
- Holding an MX2020 MPC on page 404
- Troubleshooting the MX2020 MPCs on page 538
- Replacing an MX2020 MPC on page 485

MX2020 Modular Interface Card Description

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

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

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

Related Documentation

- MX2020 Modular Interface Card LEDs on page 78
- Maintaining MX2020 MICs on page 374
- Troubleshooting the MX2020 MICs on page 537
- Replacing an MX2020 MIC on page 477
- MICs Supported by MX Series Routers on page 74

MICs Supported by MX Series Routers

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

- Table 28 on page 74 lists the first supported Junos OS release for MICs on MX240, MX480, MX960, MX2010, and MX2020 routers.
- Table 29 on page 76 lists the first supported Junos OS release for MICs on MX5, MX10, MX40, MX80, and MX104 routers.

Table 28: MICs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2010 Routers	MX2020 Routers
ATM					
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	8	12.1	12.3	12.3
DS3/E3					
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	12.3	12.3
Circuit Emulation					
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	12.3	–	–
Gigabit Ethernet					
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	10.1	12.3	12.3

Table 28: MICs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers *(continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2010 Routers	MX2020 Routers
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.3	13.3	13.3
10-Gigabit Ethernet					
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	10.2	12.3	12.3
10-Gigabit Ethernet MICs with XFP	MIC-3D-4XGE-XFP	4	10.1	12.3	12.3
10-Gigabit Ethernet MIC with SFP+	MIC3-3D-10XGE-SFPP	10	12.3	12.3	12.3
10-Gigabit Ethernet MIC with SFP+ (24 Ports)	MIC6-10G	24	-	13.3R2	13.3R2
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	24	-	13.3R3	13.3R3
40-Gigabit Ethernet					
40-Gigabit Ethernet MIC with QSFP+	MIC3-3D-2X40GE-QSFPP	2	12.2	12.3	12.3
100-Gigabit Ethernet					
100-Gigabit Ethernet MIC with CFP	MIC3-3D-1X100GE-CFP	1	12.1	12.3	12.3
100-Gigabit Ethernet MIC with CXP	MIC3-3D-1X100GE-CXP	1	12.2	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
Multi-Rate					
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	11.2	12.3	12.3
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	11.2	12.3	12.3

Table 28: MICs Supported by MX240, MX480, MX960, MX2010, and MX2020 Routers *(continued)*

MIC Name	MIC Model Number	Ports	MX240, MX480, and MX960 Routers	MX2010 Routers	MX2020 Routers
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	11.4	12.3	12.3
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	11.4	12.3	12.3
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	4	12.2	12.3	12.3
Tri-Rate					
Tri-Rate MIC	MIC-3D-40GE-TX	40	10.2	12.3	12.3
Services					
Multiservices MIC	MS-MIC-16G	0	13.2	13.2 NOTE: Only Junos Traffic Vision is supported.	13.2 NOTE: Only Junos Traffic Vision is supported.
SONET/SDH					
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	1	12.2	12.3	12.3

Table 29: MICs Supported by MX5, MX10, MX40, MX80, and MX104 Routers

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40	MX80	MX104
ATM							
ATM MIC with SFP	MIC-3D-8OC3-2OC12-ATM	8	12.1	12.1	12.1	12.1	13.3
DS3/E3							
DS3/E3 MIC	MIC-3D-8DS3-E3, MIC-3D-8CHDS3-E3-B	8	11.4	11.4	11.4	11.4	13.3
Circuit Emulation							
Channelized E1/T1 Circuit Emulation MIC	MIC-3D-16CHE1-T1-CE	16	13.2R2	13.2R2	13.2R2	13.2R2	13.2R2

Table 29: MICs Supported by MX5, MX10, MX40, MX80, and MX104 Routers *(continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40	MX80	MX104
Channelized E1/T1 Circuit Emulation MIC (H)	MIC-3D-16CHE1-T1-CE-H	16	13.2R2	13.2R2	13.2R2	13.2R2	13.2R2
Gigabit Ethernet							
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	11.2R4	11.2R4	11.2R4	10.2	13.2R2
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.2R2	13.2R2	13.2R2	13.2R2	13.2R2
Gigabit Ethernet MIC with SFP (EH)	MIC-3D-20GE-SFP-EH	20	–	–	–	–	13.2R2
10-Gigabit Ethernet							
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	11.2R4	11.2R4	11.2R4	10.2	13.2R2
Multi-Rate							
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4OC3OC12-1OC48	4	11.2R4	11.2R4	11.2R4	11.2	13.3
SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8OC3OC12-4OC48	8	11.2R4	11.2R4	11.2R4	11.2	13.3
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-4CHOC3-2CHOC12	4	11.4	11.4	11.4	11.4	13.3
Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP	MIC-3D-8CHOC3-4CHOC12	8	11.4	11.4	11.4	11.4	13.3
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP	MIC-3D-4COC3-1COC12-CE	4	12.2	12.2	12.2	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	–	11.2R4	11.2R4	10.2	13.2R2
Services							
Multiservices MIC	MS-MIC-16G	0	13.2 Rear slot only.	13.2 Rear slot only.	13.2 Rear slot only.	13.2 Rear slot only.	13.3R2

Table 29: MICs Supported by MX5, MX10, MX40, MX80, and MX104 Routers *(continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40	MX80	MX104
SONET/SDH							
SONET/SDH OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	1	12.2	12.2	12.2	12.2	13.3

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

- MX2020 Modular Interface Card Description on page 73
- Maintaining MX2020 MICs on page 374
- Troubleshooting the MX2020 MICs on page 537
- Replacing an MX2020 MIC on page 477

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
```

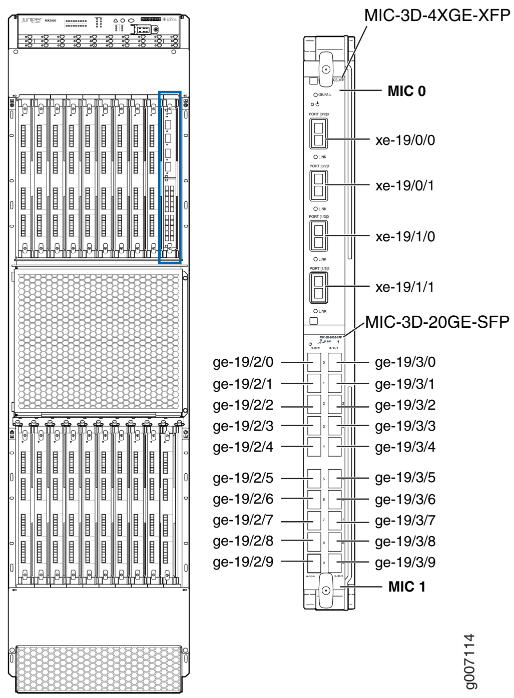
```
    PIC 3                   BUILTIN        BUILTIN           10x 1GE(LAN) SFP
      Xcvr 0      REV 01    740-011613     P9F13CH           SFP-SX
      Xcvr 1      REV 01    740-011782     PAR1L2E           SFP-SX
      Xcvr 2      REV 01    740-011782     P9M0TLC           SFP-SX
      Xcvr 3      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 36 on page 80 shows how the interfaces correspond to the ports on the MIC.

Figure 36: 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 on page 17

CHAPTER 9

Power Subsystem

MX2020 Power Subsystem Description

The MX2020 router uses AC or DC power distribution modules (PDMs) and AC or DC power supply modules (PSMs). The MX2020 router is configurable with up to four AC or DC PDMs (two per subsystem), and up to eighteen AC or DC PSMs. The PSMs connect to the top and bottom power backplanes, which distribute the output voltages produced by the PSMs to the router components.

- DC power subsystem—The MX2020 DC power system is made up of two subsystems. Each subsystem provides power to ten line card slots, one local fan tray and critical FRUs. These critical FRUs consist of two CB-REs, eight SFBs located in the center of the chassis, and two fan trays (one for each zone). Specifically, each power subsystem has enough power delivery capacity to power ten line card slots, three fan trays, two CB-REs, and eight SFBs. There are nine DC power supply modules (PSMs), and two DC power distribution modules (PDMs) in each subsystem. This means, if one power subsystem stops functioning for any reason, only the MPCs will stop functioning, but the router will continue functioning.
- DC PDMs— In the DC configuration, each subsystem provides N+1 power supply module 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 kicks in to provide full power. A total of four PDMs can be installed into a router. Each DC PDM operates with up to nine separate feeds of either 60-amp or 80-amp current limit . The capacity of these feeds is relayed to system software through a switch located on the DC PDM.

- DC PSMs—The DC PSMs are hot-removable and hot-insertable. The DC PSMs are a dual redundant feed (**INP0** and **INP1**). Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy when both input feeds are present, power will be drawn from the feed supplying higher DC voltage. These feeds are set by the input mode DIP switch located on the DC PSM (see "MX2020 DC Power Supply Module Description" on page 96). 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. Each DC PSM is capable of delivering 2500 W of power if 80 A feeds are connected.

  The maximum inrush current for a high-capacity DC power supply is 30A for 230ms.

- AC power subsystem—The MX2020 supports connection of a three-phase AC power system. There are two types of three-phase power systems: the three–phase delta and three-phase wye. The AC power going to the PSMs is split into three individual phases—each PSM works on a single phase. This means the power system works independent of the kind of AC feed is connected. The user can connect one or two feeds, depending on the power system configuration (number of PSMs, redundancy, etc.). 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 PDMs—The MX2020 supports connection of a three-phase AC power system. There are two types of three-phase power systems. The three-phase delta and three-phase wye. The AC power going to the PSMs is split into three individual phases (wye) or pair of phases (delta). This means the power system works independent of the kind of AC feed is connected. Each PDM requires two feeds connected—both are three-phase. 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 PSMs—The 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" on page 158). 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 maximum inrush current for a high-capacity AC power supply is 36A for half cycle.

The MX2020 router supports the power systems in Table 30 on page 85.

NOTE: The MX2020 systems configured for DC input power must use only DC PDMs and DC PSMs. Systems configured for three-phase wye AC input power must use only three-phase wye AC PDMs and AC PSMs. Systems configured for three-phase delta AC input power must use only three-phase delta AC PDMs and AC PSMs. AC and DC PSMs or PDMs must not be mixed within a single system.

Table 30: Supported MX2020 Power System Components

Name	Model Number	Junos OS Release
AC PSM	MX2000-PSM-AC	12.3R2 and later
Three-phase delta AC PDM	MX2000-PDM-AC-DELTA	12.3R2 and later
Three-phase wye AC PDM	MX2000-PDM-AC-WYE	12.3R2 and later
DC PSM	MX2000-PSM-DC	12.3R2 and later
DC PDM	MX2000-PDM-DC	12.3R2 and later

NOTE: Routers configured with AC or DC PDMs and PSMs are shipped with blank panels installed.

Related Documentation

- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- MX2020 AC Power Supply Module Description on page 158
- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Supply Module Description on page 96
- Maintaining the MX2020 Power Supply Modules on page 386
- MX2020 AC Power Requirements on page 147
- MX2020 DC Power Requirements on page 171

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 or DC) to the input of the PSMs (AC or DC) 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 Router Overview on page 3
- MX2020 Chassis Description on page 5
- MX2020 Modular Port Concentrator Description on page 68
- MX2020 Switch Fabric Board Description on page 64
- MX2020 Host Subsystem Description on page 57
- MX2020 Modular Interface Card Description on page 73
- MX2020 Power Subsystem Description on page 83
- MX2020 Backplane Description on page 11

MX2020 Three-Phase Delta AC Power Distribution Module Description

Each three-phase delta 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 serves six 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 **PDM3/Input1**, (bottom to top). LEDs provide the status of the PDM. Figure 37 on page 86 shows the three-phase delta AC PDM.

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

Figure 37: Three-Phase Delta AC Power Distribution Module

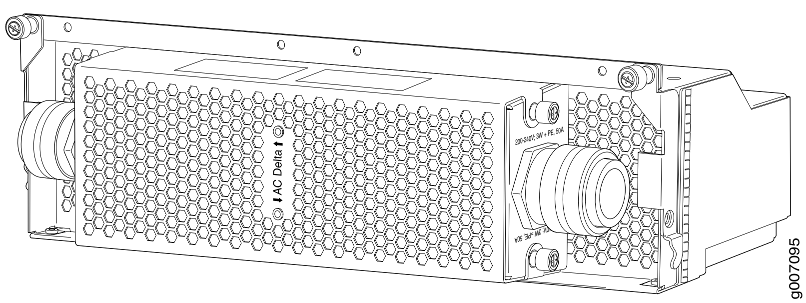


Figure 38 on page 87 shows the three-phase delta AC PDM connections.

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 CW or CCW will operate correctly.

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

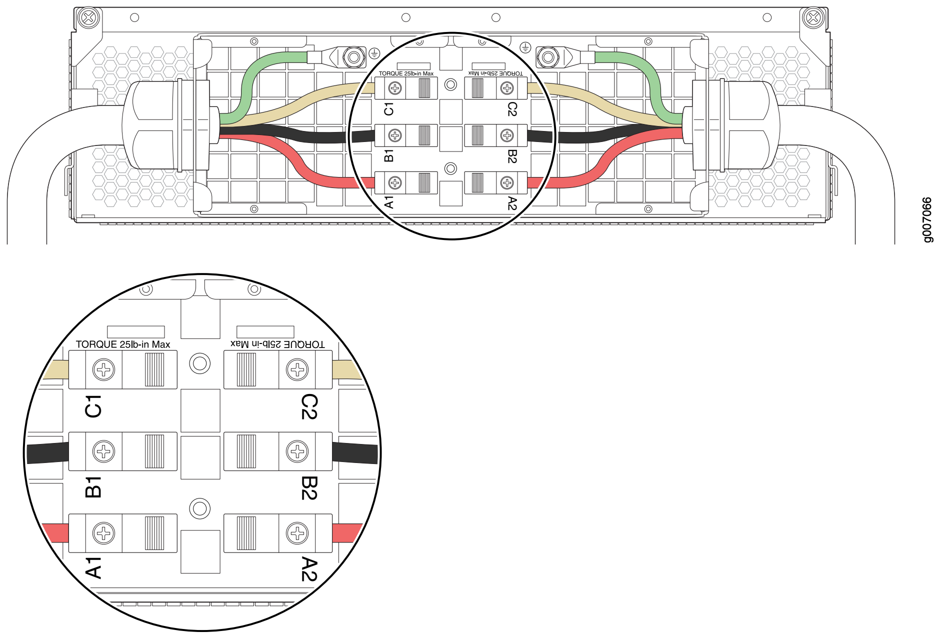
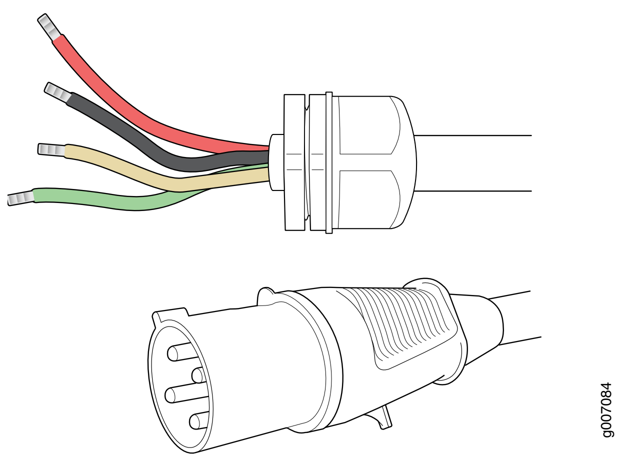


Figure 39 on page 87 shows the three-phase delta AC power cord.

Figure 39: Three-Phase Delta AC Power Cord



Related Documentation

- MX2020 Power Subsystem Description on page 83
- Maintaining the MX2020 Power Supply Modules on page 386
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Requirements on page 147
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154

MX2020 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 serves 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 **PDM3/Input1**, (bottom to top). LEDs provide the status of the PDM. Figure 40 on page 88 shows the three-phase wye AC PDM.

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

Figure 40: Three-Phase Wye AC Power Distribution Module

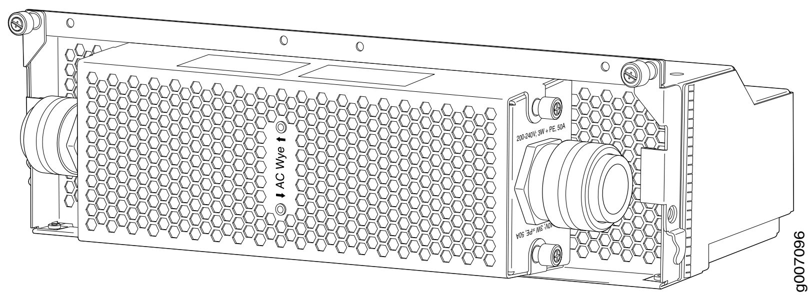
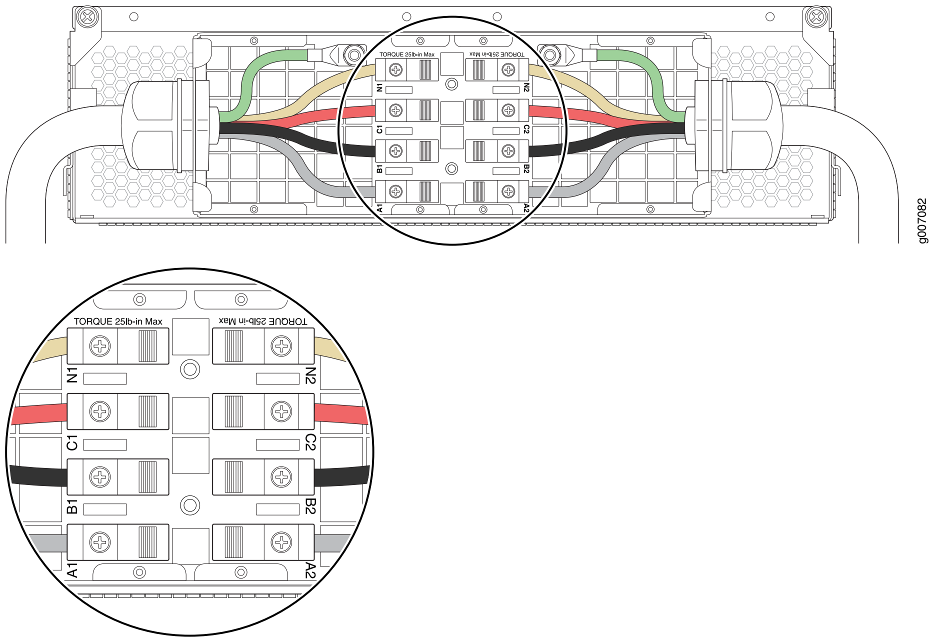


Figure 41 on page 89 shows the three-phase wye AC PDM connections.

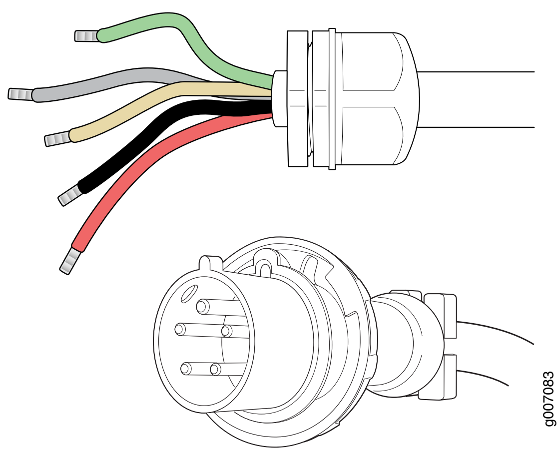
NOTE: The three-phase wye AC PDM must be installed and secured in the chassis before connecting the power input cables. If the PDM must be removed, both input power cables must be uninstalled and removed from the PDM before the PDM can be removed from the chassis. The MX2020 chassis is not sensitive to phase rotation sequence—either CW or CCW will operate correctly.

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



[Figure 42 on page 89](#) shows the three-phase wye AC power cord.

Figure 42: Three-Phase Wye AC Power Cord



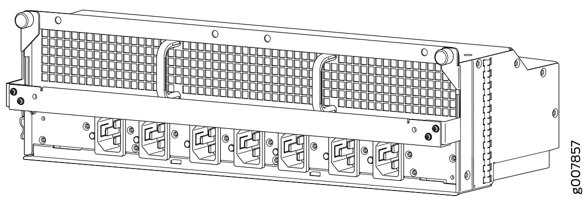
Related Documentation

- MX2020 Power Subsystem Description on page 83
- Maintaining the MX2020 Power Supply Modules on page 386
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Requirements on page 147
- MX2020 AC Power Cord Specifications on page 154

MX2010 Seven-Feed Single Phase AC Power Distribution Module Description

Each single-phase seven-feed AC PDM weighs approximately 12 lb (5.44 kg). The front of the PDM has seven type C21 power cord connections for connecting single-phase AC power. Figure 37 on page 86 shows the single-phase seven-feed AC PDM. Figure 43 on page 90 shows the single-phase seven-feed AC PDM. Figure 43 on page 90 shows the single-phase seven-feed AC PDM.

Figure 43: Seven Feed Single Phase AC Power Distribution Module



Related Documentation

- MX2020 Power Subsystem Description on page 83
- Maintaining the MX2020 Power Supply Modules on page 386
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Requirements on page 147
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154

MX2010 DC Power Distribution Module Description

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

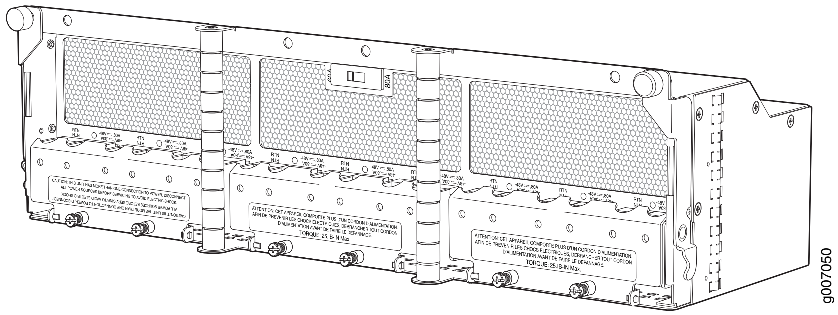
Four PDMs provide full redundancy.

NOTE: Power backplane distributes regulated 52 VDC to all boards supplied by that system.

Each DC PDM has nine DC inputs (–48 VDC and return terminals for each input) (see Figure 44 on page 91). Select 60 A or 80 A input feed capacity on the DC PDM by setting the switch to the rated amperage of DC power input feeds.

NOTE: This switch applies to all inputs of this PDM. Selecting 60 A reduces the available power output capacity of the PSMs supplied by this PDM.

Figure 44: DC Power Distribution Module



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

- *MX2010 DC Power Distribution Module LEDs*
- *MX2010 Router Grounding Specifications*
- *Calculating DC Power Requirements for MX2010 Routers*
- *DC Power Circuit Breaker Requirements for the MX2010 Router*
- *MX2010 DC Power Distribution Description*
- *DC Power Cable Specifications for the MX2010 Router*
- Site Electrical Wiring Guidelines for MX Series Routers on page 592

MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs

Figure 45 on page 92 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 31 on page 92 indicate the status of the AC PDM. In addition, a PDM failure triggers the red alarm LED on the craft interface.

Figure 45: Three-Phase Delta AC PDM LEDs

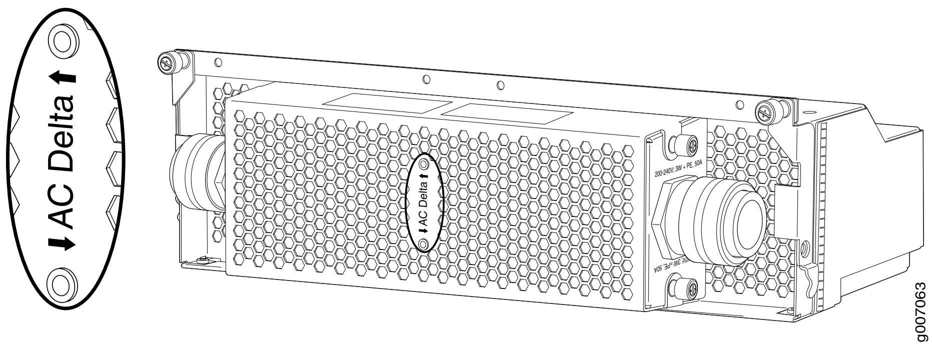


Table 31: Three-Phase Delta AC PDM LEDs

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.

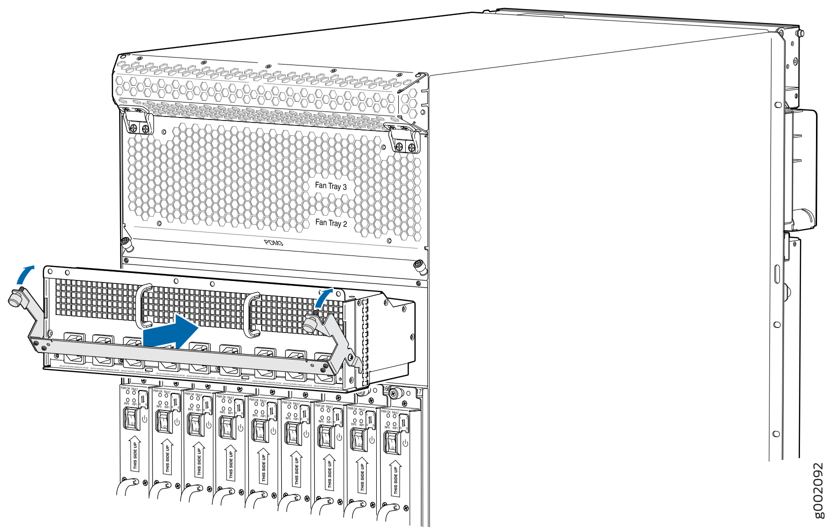
Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Maintaining the MX2020 Power Supply Modules on page 386
- MX2020 Component LEDs on the Craft Interface on page 39
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Requirements on page 147

MX2020 Nine-Feed Single Phase AC Power Distribution Module Description

Each single-phase nine-feed AC PDM weighs approximately 12 lb (5.44 kg). The front of the PDM has nine type C22 power cord connections for connecting single-phase AC power. Figure 37 on page 86 shows the single-phase nine-feed AC PDM.

Figure 46: Single-Phase Nine-Feed AC Power Distribution Module



Related Documentation

- MX2020 Power Subsystem Description on page 83
- Maintaining the MX2020 Power Supply Modules on page 386
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Requirements on page 147
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154

MX2020 AC Power Supply Module LEDs

Each AC PSM faceplate contains four LEDs. These LEDs are described in Table 32 on page 94. 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 32: 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.

Related Documentation

- MX2020 Component LEDs on the Craft Interface on page 39
- MX2020 Power Subsystem Description on page 83
- MX2020 AC Power Supply Module Description on page 158
- MX2020 AC Power Subsystem Electrical Specifications on page 158

MX2020 DC Power Distribution Module Description

In the DC power configuration, the 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 provides power interface to nine PSMs.

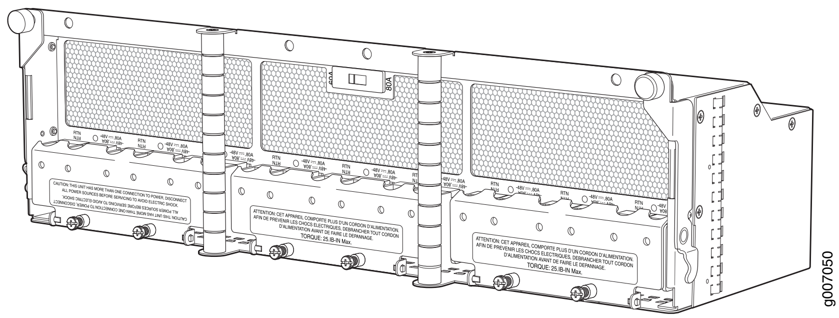
Four PDMs provide full redundancy.

NOTE: Power backplane distributes regulated 52VDC to all boards supplied by that subsystem.

Each DC PDM has nine DC inputs (–48 VDC and return terminals for each input), (see Figure 44 on page 91). Select 60 A or 80 A input feed capacity on the DC PDM by setting the switch to the rated amperage of DC power input feeds.

NOTE: This switch applies to all inputs of this PDM. Selecting 60 A reduces the available power output capacity of the PSMs supplied by this PDM.

Figure 47: DC Power Distribution Module



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 LEDs on page 95
- MX2020 Router Grounding Specifications on page 117
- Calculating DC Power Requirements for MX2020 Routers on page 180
- DC Power Circuit Breaker Requirements for the MX2020 Router on page 184
- MX2020 DC Power Distribution Description on page 177
- DC Power Cable Specifications for the MX2020 Router on page 184
- Site Electrical Wiring Guidelines for MX Series Routers on page 592

MX2020 DC Power Distribution Module LEDs

Each DC PDM faceplate contains one bicolor LED for each of the nine –48 V input power feeds, indicating the correct or incorrect polarity connection of each feed. SeeTable 33 on page 96. See Figure 48 on page 96.

Figure 48: DC Power Distribution Module LEDs

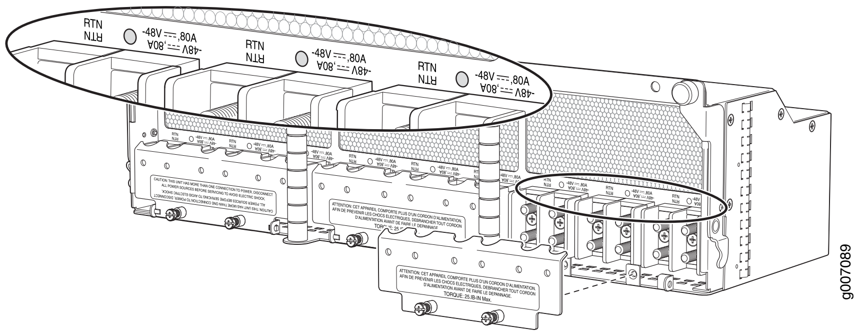


Table 33: DC Power Distribution Module LEDs

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

Related Documentation

- MX2020 Component LEDs on the Craft Interface on page 39
- MX2020 Power Subsystem Description on page 83
- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Subsystem Electrical Specifications on page 179

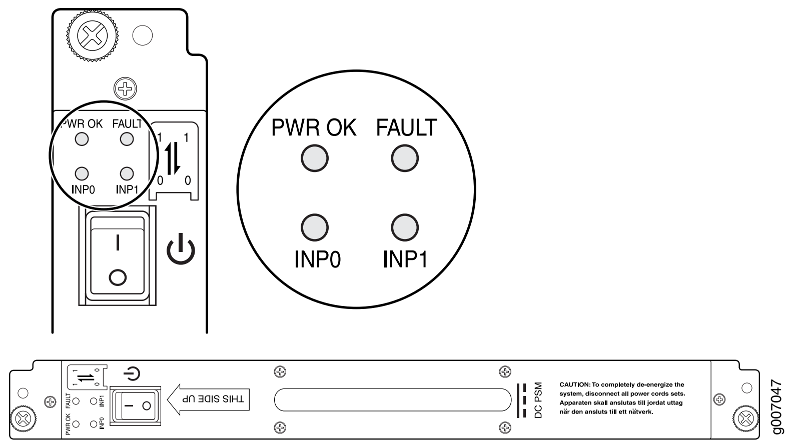
MX2020 DC Power Supply Module Description

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 49 on page 97) shows the DC PSM.

Figure 49: DC Power Supply Module

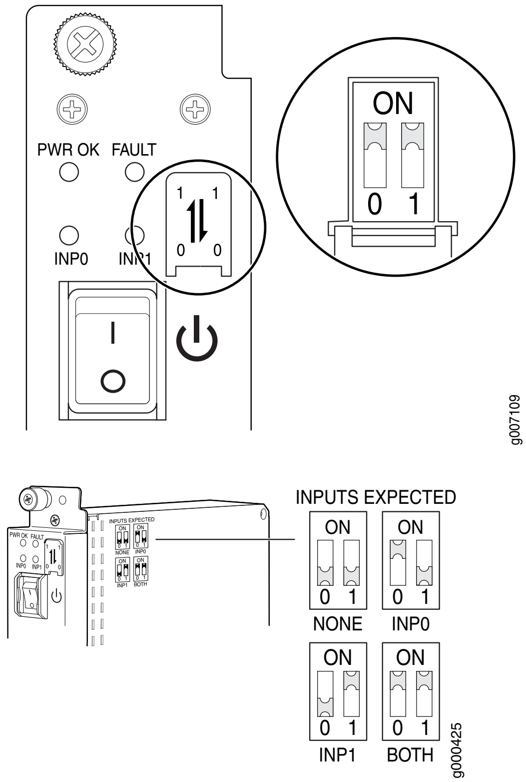


The DC power subsystem is feed redundant. Each DC PSM can be connected to two separate feeds from different sources that are used to provide feed redundancy. If two feeds are connected, PSM input power will be drawn from the feed with the higher voltage present. There are two PDMs per power subsystem 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 34 on page 97 and Figure 50 on page 98). 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 DC Power Subsystem Electrical Specifications” on page 179.

Table 34: DIP Switch Positions on the DC 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 50: Selecting Input Feed on the DC Power Supply Module



Related Documentation

- MX2020 DC Power Supply Module LEDs on page 98
- MX2020 Router Grounding Specifications on page 117
- DC Power Circuit Breaker Requirements for the MX2020 Router on page 184
- MX2020 DC Power Distribution Description on page 177
- DC Power Cable Specifications for the MX2020 Router on page 184
- Site Electrical Wiring Guidelines for MX Series Routers on page 592
- Installing the MX2020 Air Filter on page 296
- Removing the MX2020 Air Filter on page 431

MX2020 DC Power Supply Module LEDs

Each DC PSM faceplate contains four LEDs. These LEDs are described in Table 35 on page 99. 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 35: 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.
	–	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 on page 39
- MX2020 Power Subsystem Description on page 83
- MX2020 DC Power Supply Module Description on page 96
- MX2020 DC Power Subsystem Electrical Specifications on page 179

PART 2

Site Planning, Preparation, and Specifications

CHAPTER 10

Planning and Preparing the Site

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 116
2. Verify that the site and installation plan meets all safety guidelines and requirements. See:
   - General Safety Guidelines for Juniper Networks Devices on page 555
3. Locate sites for connection of system grounding. See:
   - MX2020 Router Grounding Specifications on page 117
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 on page 584
    - MX2020 AC Power Subsystem Electrical Specifications on page 158
    - MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163
    - MX2020 Three-Phase Wye AC Power Distribution Module Specifications on page 163
    - MX2020 AC Power Requirements on page 147
    - MX2020 AC Power Cord Specifications on page 154
  - DC Power:
    - MX2020 DC Power Electrical Safety Guidelines on page 585
    - MX2020 DC Power Subsystem Electrical Specifications on page 179
    - MX2020 DC Power Supply Module Description on page 96
    - MX2020 DC Power Requirements on page 171
    - DC Power Cable Specifications for the MX2020 Router on page 184
    - MX2020 DC Power Distribution Description on page 177

5. Plan rack location, including required space clearances. See:
   - Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router on page 121
   - MX2020 Physical Specifications on page 108
6. Verify that the plan for power installation meets all electrical safety guidelines. See:
   - General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 583
7. Verify that your rack meets the minimum requirements for the installation of the router. See:
   - MX2020 Rack Requirements on page 110
   - MX2020 Chassis Description on page 5
8. Plan to secure the rack to the floor and building structure. See:
   - MX2020 Rack Requirements on page 110
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*
     - Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers on page 135

- 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 on page 128
  - Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 127

10. Plan the cable routing and management. See:
    - MX2020 Cable Manager Description on page 45
    - Maintaining Cables That Connect to MX2020 MPCs or MICs on page 338

Related Documentation

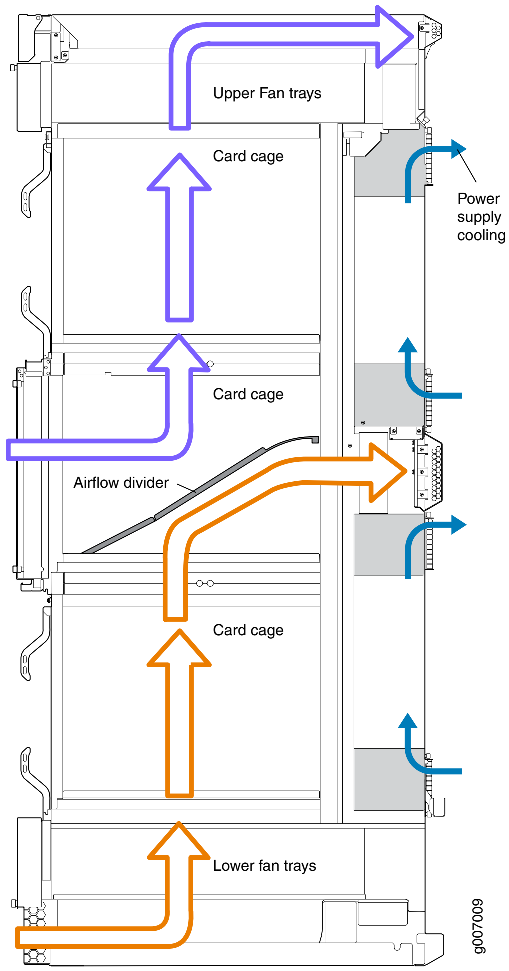
- MX2020 Router Overview on page 3

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 51 on page 106.
- 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 51: Airflow Through Chassis



Related Documentation

- Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router on page 121
- MX2020 Cabinet Size and Clearance Requirements on page 106
- MX2020 Rack Requirements on page 110
- MX2020 Rack-Mounting Hardware on page 50

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 36.22 in. (92 cm) to accommodate the standard cable managers or 40.15 in. (102 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 on page 121
- MX2020 Cabinet Airflow Requirements on page 105
- MX2020 Rack-Mounting Hardware on page 50
- MX2020 Rack Requirements on page 110

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 103 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 Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556

MX2020 Physical Specifications

Table 36 on page 108 and Table 37 on page 108 summarize the physical specifications for the router chassis and the components.

Table 36: MX2020 Shipping Weight Specifications

Item	Shipping Weight
Shipping crate and pallet	527 lb (239.04 kg)
Unpopulated MX2020	429.6 lb (194.86 kg)
Unpopulated MX2020 with shipping crate and pallet	956.6 lb (433.9 kg)
Fully populated MX2020	1,515 lb (687.19 kg)
Fully populated MX2020 with shipping crate and pallet	2,042 lb (926.23 kg)

Table 37: Physical Specifications

Description	Weight	Width	Depth	Height
Chassis dimensions	• Chassis with components removed: 429.6 lb (194.86 kg) • Chassis with maximum configuration: 1,515 lb (687.19 kg)	19 in. (48.3 cm) (including the mounting flanges)	• With standard cable manager: 36.22 in. (92 cm) • With extended cable manager: 40.15 in. (102 cm)	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)
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)

Table 37: Physical Specifications *(continued)*

Description	Weight	Width	Depth	Height
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 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)
DC PDM	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)
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)
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)
Control Board and Routing Engine (CB-RE)	15 lb (6.8 kg) Fully populated with 2 total: 30 lb (13.60 kg)	1.7 in. (4.31 cm)	• 23.6 in. (59.94 cm) • With ejector handle: 26.14 in. (66.39 cm)	16.225 in. (41.21 cm)
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)

Table 37: Physical Specifications *(continued)*

Description	Weight	Width	Depth	Height
Standard cable manager (bottom)	7.0 lb (3.17 kg)	18.99 in. (48.23 cm)	2.80 in. (7.11 cm)	7.428 in. 18.86 cm)
Middle card cage cable manager with air filter	4.5 lb (2.04 kg)	19.26 in. (48.92 cm)	2.80 in. (7.11 cm)	8.226 in. 20.89 cm)
Standard DC cable manager (rear)	1.2 lb (0.3 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 (0.54 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 on page 107
- MX2020 Router Overview on page 3
- MX2020 Chassis Description on page 5

MX2020 Rack Requirements

- Rack Size and Strength on page 110
- Spacing of Mounting Bracket Holes on page 112
- Connection to the Building Structure on page 113

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 (http://www.etsi.org). The horizontal spacing between the rails in a rack that complies with this standard is usually wider than the mounting brackets, which measure 19.2 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 121.

For instructions about installing the mounting hardware, see "Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet" on page 205.

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 52 on page 112).

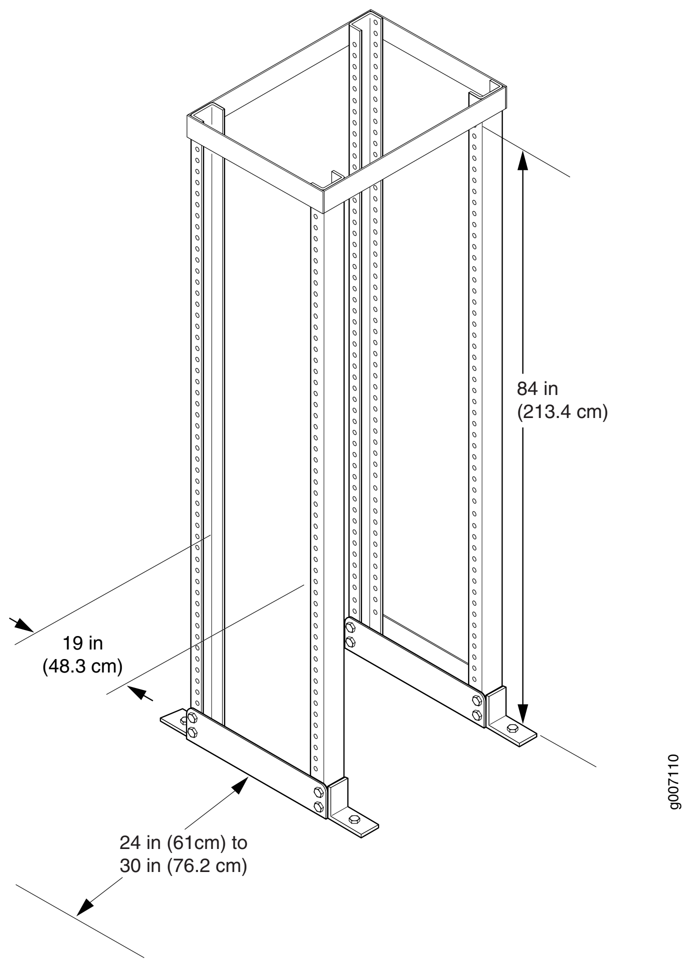
  NOTE: A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310-D) published by the Electronics Industry Association (http://www.eia.org).

- 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 36.22 in. (92 cm) deep.
- The chassis with the extended cable management system is 40.15 in. (102 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 108.

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

Figure 52: 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 on page 121
- MX2020 Rack-Mounting Hardware on page 50
- MX2020 Cabinet Size and Clearance Requirements on page 106
- MX2020 Cabinet Airflow Requirements on page 105
- MX2020 Moving Requirements and Guidelines Using a Router Transport Kit on page 113

MX2020 Moving Requirements and Guidelines Using a Router Transport Kit

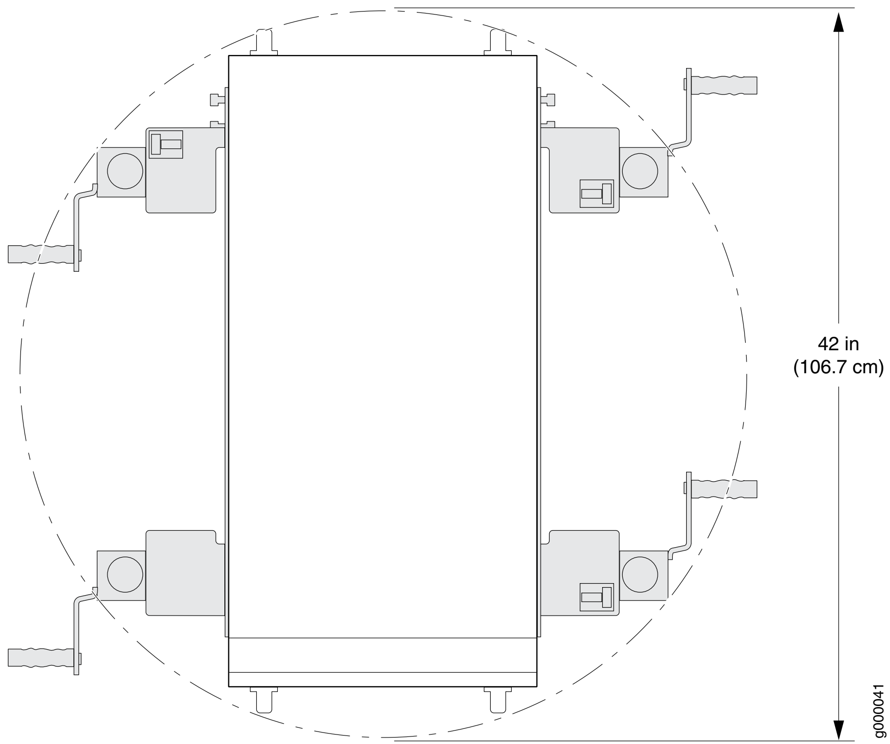
- Router Transport Kit Turning Radius on page 113
- Router Transport Kit Requirements on page 114

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 53 on page 114.

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

Figure 53: Turning Diameter of Router Transport Kit

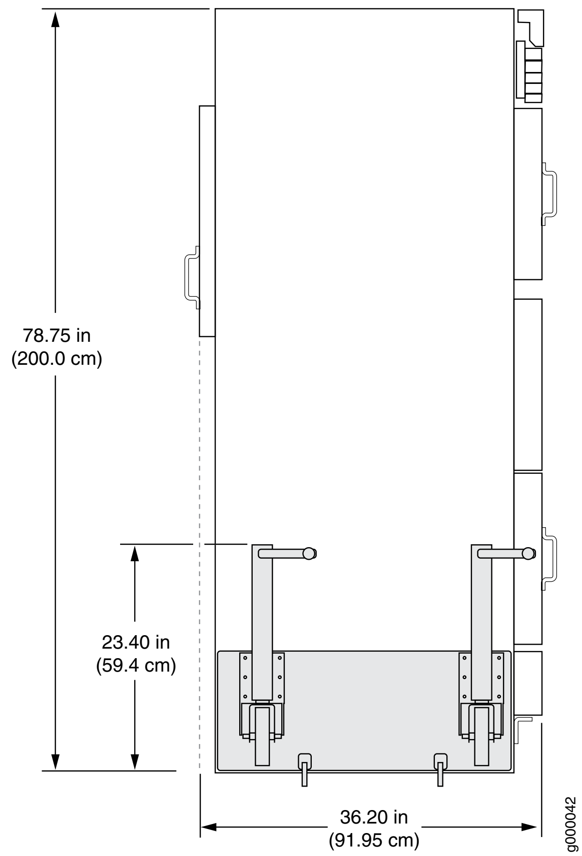


The weight of the router transport kit is 138.5 lb (63 kg). The maximum recommended height the MX2020 should be lifted from the floor using the router transport kit is 1.5 in. (3.8 cm).

Router Transport Kit Requirements

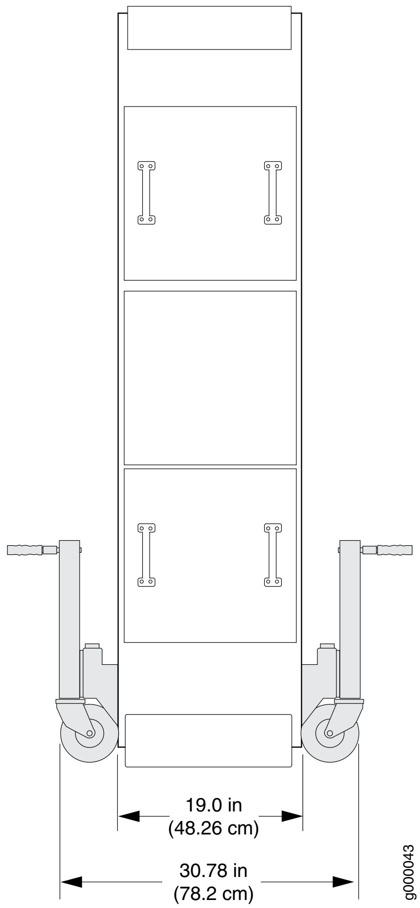
The side view measurements of the MX2020 router with the router transport kit installed is: 78.75 in. (200 cm) high, 36.20 in. (91.95 cm) wide, and 23.40 in. (59.4 cm) high (see Figure 54 on page 115).

Figure 54: 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 55 on page 116).

Figure 55: 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 on page 121
- MX2020 Rack-Mounting Hardware on page 50
- MX2020 Cabinet Size and Clearance Requirements on page 106
- MX2020 Cabinet Airflow Requirements on page 105

MX2020 Router Environmental Specifications

Table 38 on page 116 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 38: Router Environmental Specifications

Description	Value
Relative humidity	Normal operation ensured in relative humidity range of 5% to 90%, noncondensing

Table 38: Router Environmental Specifications *(continued)*

Description	Value
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

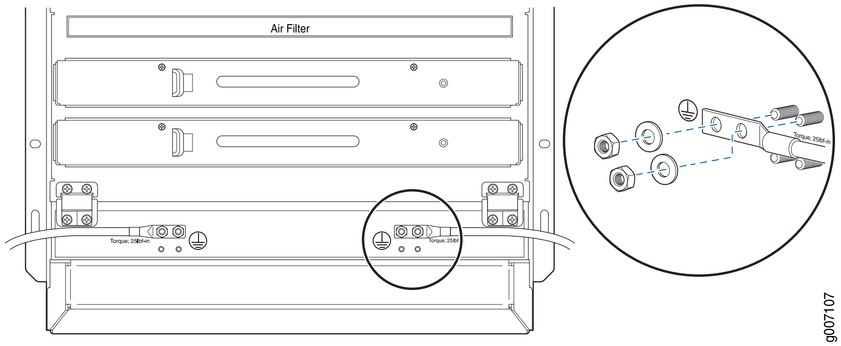
- Tools and Parts Required to Maintain the MX2020 Hardware Components on page 193
- Definition of Safety Warning Levels on page 553

MX2020 Router Grounding Specifications

MX2020 Chassis Grounding Points Specifications

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. To ground AC-powered or DC-powered routers, you must connect a grounding cable to earth ground and then attach it to the chassis grounding points using the two screws provided. (see Figure 56 on page 118).

Figure 56: Connecting Chassis Grounding Points on the MX2020 Router



MX2020 Router Grounding Cable Lug Specifications

CAUTION: Before router installation begins, 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.

To ground AC-powered or DC-powered routers, connect a grounding cable to earth ground and then attach it to the chassis grounding points using two screws. The top pair of grounding points fits UNC 1/4–20 screws (American), and the lower pair fits M6 screws (European). The grounding points are spaced at 0.625-in. (15.86-mm) centers. The cable lugs get attached to the grounding cable, and the two UNC 1/4–20 screws are used to secure the grounding cable to the top pair of grounding points.

WARNING: The router is a pluggable type A equipment installed in a 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.

NOTE: The MX2020 supports 4-AWG DC power cable lugs for 80-A input (see Figure 57 on page 119), and 6-AWG DC power cable lugs for 60-A input (see Figure 58 on page 119).

Figure 57: 4-AWG DC Grounding Cable Lug

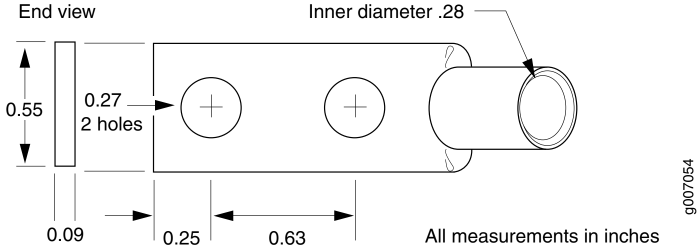


Figure 58: 6-AWG DC Grounding Cable Lug

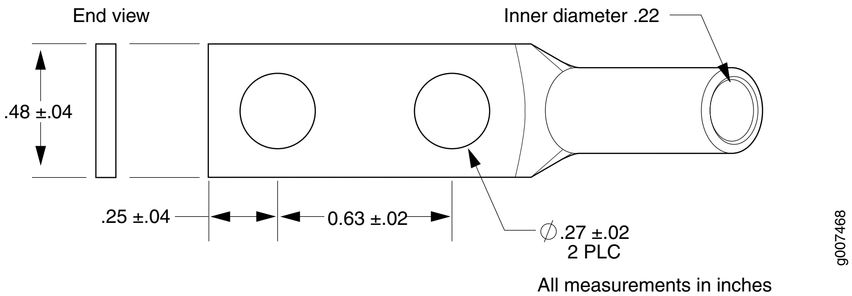


Table 39 on page 119 summarizes the specifications for the power cables, which you must supply.

Table 39: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 80-A PDM. Minimum 90ºC wire, or as required by the local code
Power	Eighteen pairs of 6-AWG (13.3 mm^2), used with 60-A PDM. Minimum 90ºC wire, or as required by the local code

MX2020 Router Grounding Cable Specifications

The 48 VDC facility must be equipped with a circuit breaker rated 60 A (–48 VDC), or 80 A (–48 VDC) for each PDM input, and the grounding cable must be minimum 10 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 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.

Related Documentation

- Grounding the MX2020 Router on page 247
- Tools and Parts Required for Connecting the MX2020 Router to Power on page 192
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 Site Preparation Checklist

The checklist in Table 40 on page 120 summarizes the tasks you must perform when preparing a site for router installation.

Table 40: 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 116		
Power			
Measure distance between external power sources and router installation site.	"MX2020 DC Power Distribution Module Description" on page 94		
Locate sites for connection of system grounding.	"MX2020 Router Grounding Specifications" on page 117		
Calculate the power consumption and requirements.	"MX2020 AC Power Requirements" on page 147 "MX2020 DC Power Requirements" on page 171		
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 110 "MX2020 Cabinet Size and Clearance Requirements" on page 106		

Table 40: MX2020 Site Preparation Checklist *(continued)*

Item or Task	For More Information	Performed By	Date
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 106, "MX2020 Rack Requirements" on page 110, "Clearance Requirements for Airflow and Hardware Maintenance for the MX2020 Router" on page 121		
If a rack is used, secure rack to floor and building structure.	"MX2020 Rack Requirements" on page 110		
Cables and Transceivers			
Acquire cables and transceivers: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. choose the length of cable based on the distance between the hardware components being connected.	"Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion" on page 127 "Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 128		
Plan the cable routing and management.	"Maintaining Cables That Connect to MX2020 MPCs or MICs" on page 338		

Related Documentation

- Installing an MX2020 Router Overview on page 189
- Unpacking the MX2020 Router on page 195

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 (see Figure 59 on page 122 and Figure 60 on page 122):

- 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 40.15 in. (102 cm).

Figure 59: Chassis Dimensions and Clearance Requirements for the MX2020 Router with the Standard Cable Manager

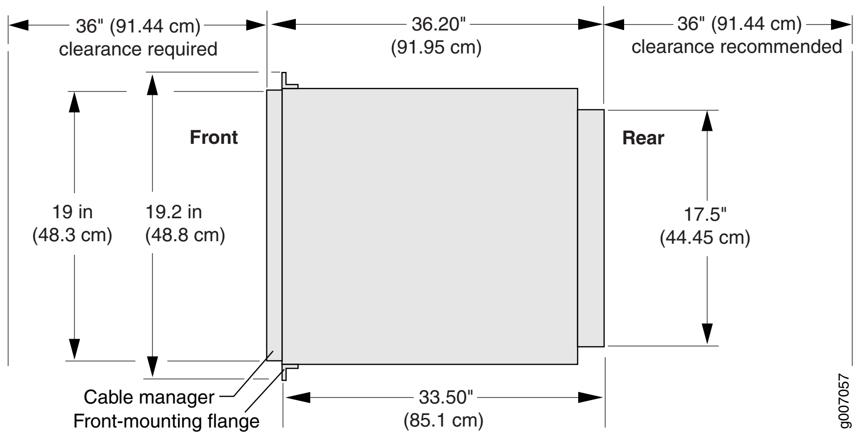
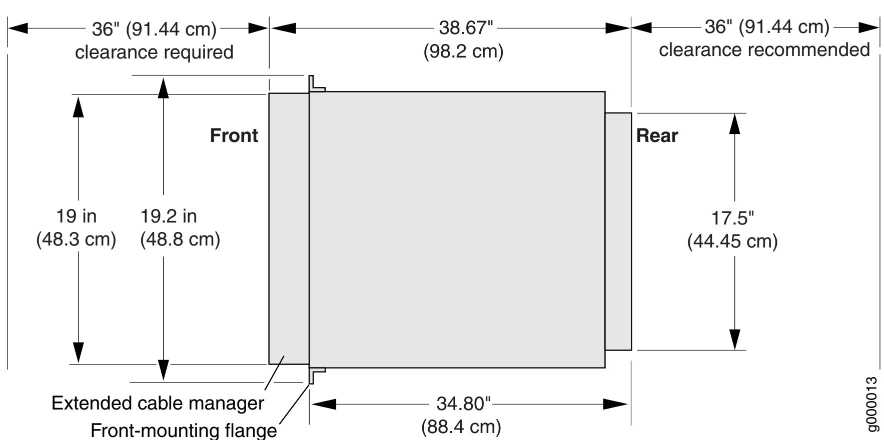


Figure 60: Chassis Dimensions and Clearance Requirements for the MX2020 Router with the Extended Cable Manager



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 on page 110
- MX2020 Rack-Mounting Hardware on page 50
- MX2020 Cabinet Size and Clearance Requirements on page 106
- MX2020 Cabinet Airflow Requirements on page 105

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 61 on page 125).

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, 38.67 in. (98.2 cm) deep (see Figure 61 on page 125).
- 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 36 on page 108 for MX2020 shipping weight specifications.

Table 41: MX2020 Shipping Weight Specifications

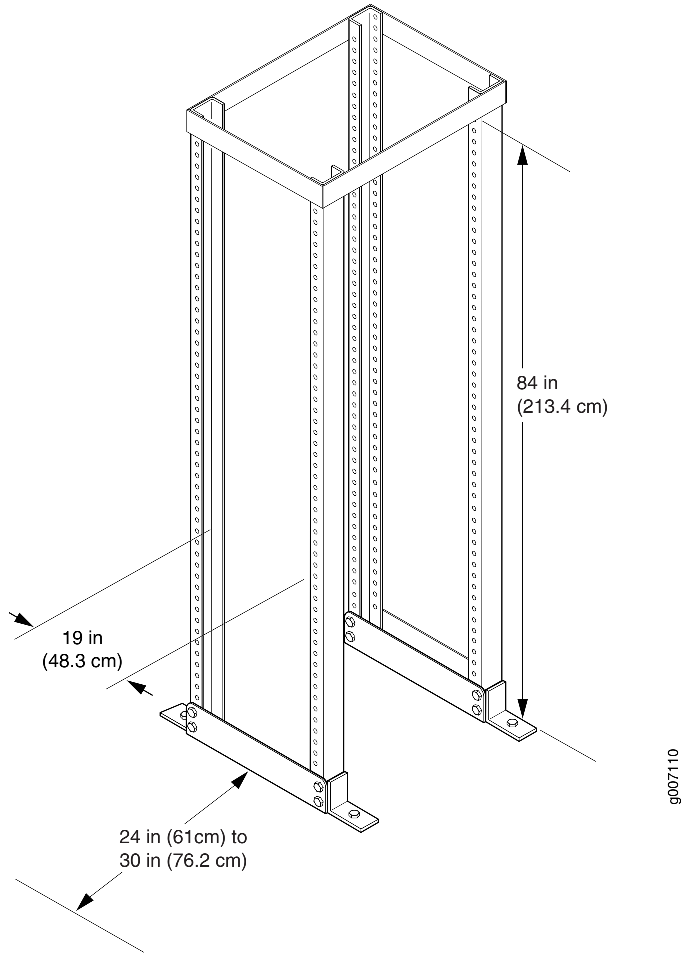
Item	Shipping Weight
Shipping crate and pallet	180 lb (81.8 kg)
Unpopulated MX2020	300 lb (136.4 kg)
Unpopulated MX2020 with shipping crate and pallet	480 lb (218.2 kg)
Fully populated MX2020 with shipping crate and pallet	1,680 lb (763.6 kg)

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

- 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 61: Typical Four-Post Rack



CHAPTER 11

Transceiver and Cable Specifications

Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

This topic describes signal loss, attenuation, and dispersion in fiber-optic cable. For information about calculating power budget and power margin for fiber-optic cable, see "Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 128 and "Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers" on page 135 or *Supported Network Interface Standards by Transceiver for PTX Series Routers*.

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

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

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

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

Attenuation and Dispersion in Fiber-Optic Cable

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

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

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

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

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

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

Related Documentation

Calculating Power Budget and Power Margin for Fiber-Optic Cables

Use the information in this topic and the information in “Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers” on page 135 or *Supported Network Interface Standards by Transceiver for PTX Series Routers* to calculate the power budget and power margin for fiber-optic cables.

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

1. Calculating Power Budget for Fiber-Optic Cable on page 129
2. Calculating Power Margin for Fiber-Optic Cable on page 129

Calculating Power Budget for Fiber-Optic Cable

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

$$P_B = P_T – P_R$$

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

$$P_B = P_T – P_R$$

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

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

Calculating Power Margin for Fiber-Optic Cable

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

$$P_M = P_B – LL$$

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

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 42 on page 129 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 42: 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

Table 42: Estimated Values for Factors Causing Link Loss *(continued)*

Link-Loss Factor	Estimated Link-Loss Value
Connector	0.5 dB
Splice	0.5 dB
Fiber attenuation	Single-mode—0.5 dB/km Multimode—1 dB/km

The following sample calculation for a 2-km-long multimode link with a power budget (P_B) of 13 dB uses the estimated values from Table 42 on page 129 to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 db). The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

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

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

P_M = 7 dB

The following sample calculation for an 8-km-long single-mode link with a power budget (P_B) of 13 dB uses the estimated values from Table 42 on page 129 to calculate link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

P_M = 13 dB – 8 km (0.5 dB/km) – 7(0.5 dB)

P_M = 13 dB – 4 dB – 3.5 dB

P_M = 5.5 dB

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

Related Documentation

- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 127

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

Table 43 on page 131 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

Table 43: Cable and Wire Specifications for Routing Engine Management and Alarm Interfaces

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
Routing Engine console or auxiliary interface	RS-232 (EIA-232) serial cable	One 6-ft (1.83-m) length with RJ-45/DB-9 connectors	6 ft (1.83 m)	RJ-45 female
Routing Engine Ethernet interface	Category 5 cable or equivalent suitable for 100Base-T operation	One 15-ft (4.57-m) length with RJ-45/RJ-45 connectors	328 ft (100 m)	RJ-45 autosensing
Alarm relay contacts	Wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm^2)	No	None	—

Related Documentation

- MX2020 Host Subsystem Description on page 57
- Removing an MX2020 CB-RE on page 419
- Installing an MX2020 CB-RE on page 301

Installing an MX2020 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 62 on page 132). 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 44 on page 133 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**.

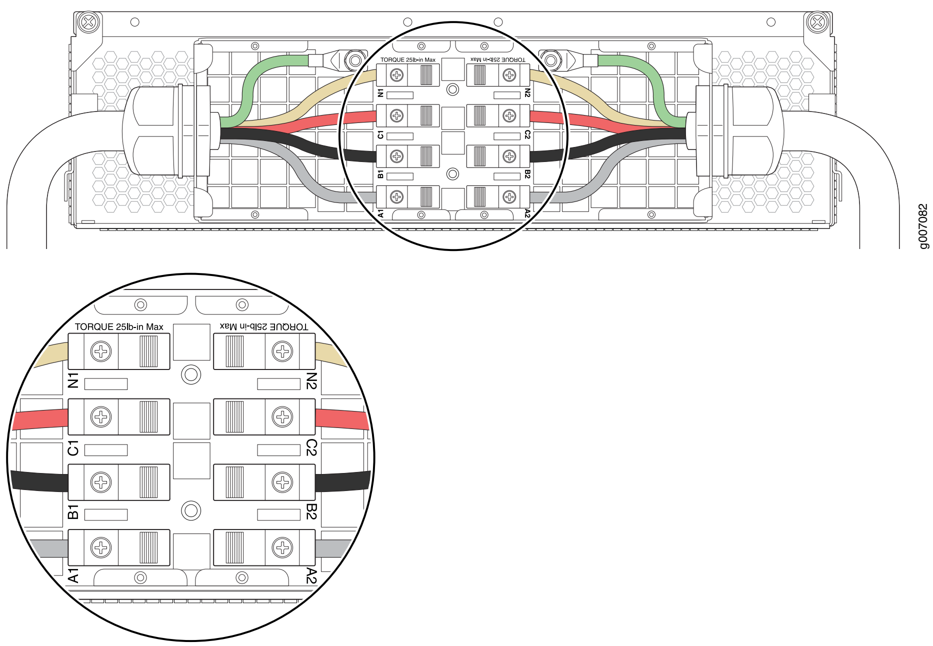
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    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 62: 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 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**.

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 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-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye 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 wye AC wire assembly kits can be purchased from Juniper Networks.

Table 44: 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.

Related Documentation

- *Removing an MX2020 Three-Phase Wye AC Power Cord*

Network Cable and Transceiver Overview for ACX Series, M Series, and MX Series Routers

Juniper Networks devices support a variety of fixed and pluggable transceivers and network cable, including multimode and single-mode fiber-optic cable. For a list of transceivers, see "Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers" on page 135. To determine which transceivers and network cables are supported in a particular device, see the "Cables and connectors" section in the PIC guide or the *MX Series Interface Module Reference*.

For transceiver and cable specifications, see:

- *Ethernet 10BASE-T Copper Interface Specifications*
- *Fast Ethernet 100BASE-T Copper Interface Specifications*
- *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*
- *Fast Ethernet 100BASE-FX Optical Interface Specifications*
- *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
- *Gigabit Ethernet 1000BASE Optical Interface Specifications*
- *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
- *40-Gigabit Ethernet 40GBASE-R Optical Interface Specifications*
- *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
- *SONET/SDH OC3/STM1 Optical Interface Specifications*
- *SONET/SDH OC12/STM4 Optical Interface Specifications*
- *SONET/SDH OC48/STM16 Optical Interface Specifications*
- *SONET/SDH OC192/STM64 Optical Interface Specifications*

Related Documentation

- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 127
- Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 128

Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers

Table 45 on page 136 and Table 46 on page 141 list the transceivers supported by ACX, M, MX, and T Series devices.

NOTE: Not all transceivers are supported on all devices. To determine which transceivers are supported in a particular device, see the "Cables and Connectors" section for each PIC, MIC, or line card in the *Interface Module Reference* for your device.

- Table 45 on page 136 lists the supported Ethernet standards for each transceiver.
- Table 46 on page 141 lists the supported SONET standards for each transceiver.

Some transceivers support monitoring by using the operational mode CLI command **show interfaces diagnostics optics**. To determine which transceivers support monitoring, refer to the "Monitoring Available" column in Table 45 on page 136 and Table 46 on page 141.

For a description of the monitoring fields displayed by the transceiver, see *show interfaces diagnostics optics (Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and 100-Gigabit Ethernet)* or *show interfaces diagnostics optics (SONET)*.

CAUTION: If you are having a problem running a Juniper Networks device that is using a third-party optic or cable, the Juniper Networks Technical Assistance Center (JTAC) can help you diagnose the source of the problem. Your JTAC engineer might recommend that you check the third-party optic or cable and potentially replace it with an equivalent Juniper Networks optic or cable that is qualified for the device.

NOTE: For XFP transceivers that can support either the 10-Gigabit Ethernet or SONET OC192/STM64 specifications, check the standard supported for the device into which the transceiver is installed. For example, the XFP-10G-E-OC192-IR2 transceiver installed in a 10-Gigabit Ethernet PIC supports the 10GBASE-E standard. However, the XFP-10G-E-OC192-IR2 transceiver installed in a SONET OC192/STM64 PIC supports the SONET OC192/STM64 IR2 standard.

Table 45 on page 136 is organized by transmission speed and then alphabetically by model number.

Table 45: Supported Ethernet Standards

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
Ethernet 10BASE, Fast Ethernet 100BASE, and Gigabit Ethernet 1000BASE Specifications					
SFP-1FE-FX	SFP	LC	No	100BASE-FX	• *Fast Ethernet 100BASE-FX Optical Interface Specifications*
SFP-1GE-FE-E-T	SFP	RJ-45	No	10/100/1000 BASE-T	• *Ethernet 10BASE-T Copper Interface Specifications* • *Fast Ethernet 100BASE-T Copper Interface Specifications* • *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*
SFP-1GE-LH	SFP	LC	Yes	1000BASE-LH	• *Gigabit Ethernet 1000BASE Optical Interface Specifications*
SFP-1GE-LX	SFP	LC	Yes	1000BASE-LX 1000BASE-LX10	• *Gigabit Ethernet 1000BASE Optical Interface Specifications*

Table 45: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
SFP-1GE-SX	SFP	LC	Yes	1000BASE-SX	• *Gigabit Ethernet 1000BASE Optical Interface Specifications*
SFP-1GE-T	SFP	RJ-45	No	1000BASE-T	• *Gigabit Ethernet 1000BASE-T Copper Interface Specifications*
SFP-FE20KT13R15	SFP	LC	No	100BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-FE20KT15R13	SFP	LC	No	100BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE10KT13R14	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE10KT13R15	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE10KT14R13	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE10KT15R13	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE40KM	SFP	LC	Yes	1000BASE-EX	• *Gigabit Ethernet 1000BASE Optical Interface Specifications*
SFP-GE40KT13R15	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*
SFP-GE40KT15R13	SFP	LC	Yes	1000BASE-BX	• *Fast Ethernet and Gigabit Ethernet Bidirectional SFP Optical Interface Specifications*

Table 45: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
SFP-GE80KCW1470-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1490-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1510-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1530-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1550-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1570-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1590-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
SFP-GE80KCW1610-ET	SFP	LC	Yes	NA	• *Gigabit Ethernet SFP CWDM Optical Interface Specifications*
10-Gigabit Ethernet 10GBASE Specifications					
PC-1XGE-DWDM-CBAND	Fixed	SC	Yes	10-Gigabit Ethernet dense wavelength-division multiplexing (DWDM)	• *10-Gigabit Ethernet DWDM Optical Interface Specifications* • *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
PC-1XGE-DWDM-OTN	Fixed	SC	Yes	10-Gigabit Ethernet dense wavelength-division multiplexing (DWDM) OTN	• *10-Gigabit Ethernet DWDM OTN Optical Interface Specifications* • *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10G-CT50-ZR	SFP+	LC	Yes	10GBASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*

Table 45: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
SFPP-10G-DT-ZRC2	SFP+	LC	Yes	10BASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10G-ZR-OTN-XT	SFP+	LC	Yes	10GBASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10GE-ER	SFP+	LC	Yes	10GBASE-ER	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10GE-LR	SFP+	LC	Yes	10GBASE-LR	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10GE-LRM	SFP+	LC	Yes	10GBASE-LRM	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10GE-SR	SFP+	LC	Yes	10GBASE-SR	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
SFPP-10GE-ZR	SFP+	LC	Yes	10GBASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XENPAK-1XGE-ER	XENPAK	SC	Yes	10GBASE-ER	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XENPAK-1XGE-LR	XENPAK	SC	Yes	10GBASE-LR	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XENPAK-1XGE-SR	XENPAK	SC	Yes	10GBASE-SR	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XENPAK-1XGE-ZR EOL (see PSN-2010-02-649)	XENPAK	SC	Yes	10GBASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XFP-10G-CBAND-T50-ZR	XFP	LC	Yes	10GBASE-Z 10-Gigabit Ethernet dense wavelength-division multiplexing (DWDM)	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*

Table 45: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
XFP-10G-E-OC192-IR2	XFP	LC	Yes	10GBASE-E	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XFP-10G-L-OC192-SR1	XFP	LC	Yes	10GBASE-L	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XFP-10G-S	XFP	LC	Yes	10GBASE-S	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
XFP-10G-Z-OC192-LR2	XFP	LC	Yes	10GBASE-Z	• *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*
40-Gigabit Ethernet 40GBASE Specifications					
CFP-40GBASE-LR4	CFP	SC	Yes	40GBASE-LR4	• *40-Gigabit Ethernet 40GBASE-R Optical Interface Specifications*
QSFPP-40GBASE-LR4	QSFP+	LC	Yes	40GBASE-LR4	• *40-Gigabit Ethernet 40GBASE-R Optical Interface Specifications*
QSFPP-40GBASE-SR4	QSFP+	12-fiber MPO	Yes	40GBASE-SR4	• *40-Gigabit Ethernet 40GBASE-R Optical Interface Specifications*
100-Gigabit Ethernet 100GBASE-R Specifications					
CFP-100GBASE-ER4	CFP	LC	Yes	100GBASE-ER4	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
CFP-GEN2-CGE-ER4	CFP	LC	Yes	100GBASE-ER4	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
CFP-100GBASE-LR4	CFP	SC	Yes	100GBASE-LR4	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
CFP-GEN2-100GBASE-LR4	CFP	LC	Yes	100GBASE-LR4	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*

Table 45: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
CFP-100GBASE-SR10	CFP	24-fiber MPO	Yes NOTE: Optical power monitoring is not supported.	100GBASE-SR10	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*
CFP-100GBASE-ZR	CFP	LC	Yes	None	• See the Juniper Networks specification in the *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*.
CFP2-100GBASE-LR4	CFP2	LC	Yes	100GBASE-LR4	• See the Juniper Networks specification in the *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*.
CXP-100GBASE-SR10	CXP	24-fiber MPO	Yes	100GBASE-SR10	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*

Table 46 on page 141 is organized by transmission speed and then alphabetically by model number.

Table 46: Supported SONET Standards

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
SONET OC3/STM1 Specifications					
SFP-OC3-IR	SFP	LC	Yes	SONET/SDH OC3/STM1 Intermediate Reach	• *SONET/SDH OC3/STM1 Optical Interface Specifications*
SFP-OC3-LR	SFP	LC	Yes	SONET/SDH OC3/STM1 Long Reach	• *SONET/SDH OC3/STM1 Optical Interface Specifications*
SFP-OC3-SR	SFP	LC	Yes	SONET/SDH OC3/STM1 Multimode	• *SONET/SDH OC3/STM1 Optical Interface Specifications*
SONET OC12/STM4 Specifications					

Table 46: Supported SONET Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	Specifications
SFP-OC12-IR	SFP	LC	Yes	SONET/SDH OC12/STM4 Intermediate Reach (IR-1)	• *SONET/SDH OC12/STM4 Optical Interface Specifications*
SFP-OC12-LR	SFP	LC	Yes	SONET/SDH OC12/STM4 Long Reach (LR-1)	• *SONET/SDH OC12/STM4 Optical Interface Specifications*
SFP-OC12-LR2	SFP	LC	Yes	SONET/SDH OC12/STM4 Long Reach (LR-2)	• *SONET/SDH OC12/STM4 Optical Interface Specifications*
SFP-OC12-SR	SFP	LC	Yes	SONET/SDH OC12/STM4 Short Reach (SR-1)	• *SONET/SDH OC12/STM4 Optical Interface Specifications*
SONET OC48/STM16 Specifications					
SFP-1OC48-IR	SFP	LC	No	SONET/SDH OC48/STM16 Intermediate Reach (IR-1)	• *SONET/SDH OC48/STM16 Optical Interface Specifications*
SFP-1OC48-LR	SFP	LC	Yes	SONET/SDH OC48/STM16 Long Reach (LR-2)	• *SONET/SDH OC48/STM16 Optical Interface Specifications*
SFP-1OC48-SR	SFP	LC	No	SONET/SDH OC48/STM16 Short Reach (SR-1)	• *SONET/SDH OC48/STM16 Optical Interface Specifications*
SONET OC192/STM64 Specifications					
XFP-10G-E-OC192-IR2	XFP	LC	Yes	SONET/SDH OC192/STM64 Intermediate Reach (IR-2)	• *SONET/SDH OC192/STM64 Optical Interface Specifications*
XFP-10G-L-OC192-SR1	XFP	LC	Yes	SONET/SDH OC192/STM64 Short Reach (SR-1)	• *SONET/SDH OC192/STM64 Optical Interface Specifications*
XFP-10G-Z-OC192-LR2	XFP	LC	Yes	SONET/SDH OC192/STM64 Long Reach (LR-2)	• *SONET/SDH OC192/STM64 Optical Interface Specifications*
SONET OC768/STM256 Specifications					
PD-1OC768-SON-SR	Fixed	SC	Yes	SONET/SDH OC768/STM256 Short Reach (SR)	• *SONET/SDH OC768/STM256 Optical Interface Specifications*

Related Documentation

- *Supported Network Interface Standards by Transceiver for PTX Series Routers*

CHAPTER 12

Pinout Specifications

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 47 on page 145 describes the RJ-45 connector pinout.

Table 47: 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
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

- MX2020 Host Subsystem Description on page 57
- Removing an MX2020 CB-RE on page 419
- Installing an MX2020 CB-RE on page 301
- CB-RE Interface Cable and Wire Specifications for MX Series Routers on page 130

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

The port on the Control Board and Routing Engine (CB-RE) labeled **MGMT** is an autosensing 10/100-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). Table 48 on page 146 describes the RJ-45 connector pinout.

Table 48: RJ-45 Connector Pinout for the CB-RE Management Port

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

Related Documentation

- MX2020 Host Subsystem Description on page 57
- Removing an MX2020 CB-RE on page 419
- Installing an MX2020 CB-RE on page 301
- CB-RE Interface Cable and Wire Specifications for MX Series Routers on page 130

CHAPTER 13

AC Power Requirements, Specifications, and Guidelines

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 PDM (delta or wye).

If you do not plan to provision 2800 W for each AC PSM, you can use the information in Table 49 on page 148 and Table 50 on page 148 to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output, as shown in the following examples for an AC-powered router.

Table 51 on page 148 lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

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

Table 49: 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, and craft interface, eight PSMs, and two PDMs	9.439 W (based on 55º C operation) 2142 W (Typical)

Table 50: 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
SFB—slots 0 through 7	MX2000-SFB	200 W * 8 = 1600 W
MX2020 three-phase delta AC power subsystem (PDM and PSM) @ 50 A/25 A MX2020 three-phase wye power subsystem (PDM and PSM) @ 30 A/15 A		2800 W 2800 W

If you do not plan to provision as recommended above, you can use the information in Table 51 on page 148 to calculate the power consumption for your hardware configuration.

Table 51: MX2020 FRU AC Power Requirements

Component	Model Number	Maximum Power Requirement
Switch Fabric Boards (SFBs)		
SFB	MX2000-SFB	200 W (Typical) 220 W at 55º C 220 W at 40º C 220 W at 25º C
Fan Trays		

Table 51: MX2020 FRU AC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
Fan trays, upper	MX2000-FANTRAY	200 W (Typical) 1700 W at 55º C 1150 W at 40º C 350 W at 25º C
Fan trays, lower		200 W (Typical) 1700 W at 55º C 1150 W at 40º C 350 W at 25º 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 55º C 250 W at 40º C 250 W at 25º C
MPCs		
16x10GE MPC	MPC-3D-16XGE-SFPP	440 W at 55º C ambient
MPC1	MX-MPC1-3D MX-MPC1E-3D	165 W With MICs and optics: 239 W at 55º C 227 W at 40º C 219 W at 25º C
MPC1 Q	MX-MPC1-3D-Q MX-MPC1E-3D-Q	175 W With MICs and optics: 249 W at 55º C 237 W at 40º C 228 W at 25º C

Table 51: MX2020 FRU AC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
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
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 51: MX2020 FRU AC 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
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 51: MX2020 FRU AC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
10-Gigabit Ethernet MIC with SFP+	MIC6-10G	74 W With optics: 53 W at 55º C, 40º C and 25º C with 10G BASE-SR and 10G BASE-LR optics 66 W at 55º C, 40º C and 25º C with 10G BASE-ER optics 74 W at 55º C, 40º C and 25º C with 10G BASE-ZR optics
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	84 W With optics: 63 W at 55º C with 10G BASE-LR OTN optics 63 W at 40º C with 10G BASE-LR OTN optics 63 W at 25º 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 55º C with 100G BASE-LR4 OTN optics 86 W at 40º C with 100G BASE-LR4 OTN optics 74 W at 25º C with 100G BASE-LR4 OTN optics

Table 51: 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 55º C with CXP SR10 optics 49 W at 40º C with CXP SR10 optics 49 W at 25º C with CXP SR10 optics
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48 8-Port: MIC-3D-8OC3OC12-4OC48	4-Port: 24 W at 55º C 22.75 W at 40º C 21.5 W at 25º C 8-Port: 29 W at 55º C 27.75 W at 40º C 26.5 W at 25º C
OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55º C 38.5 W at 40º C 36 W at 25º 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 55º C 40 W at 40º C 39 W at 25º C 8-Port: 52 W at 55º C 50.5 W at 40º C 49 W at 25º C
Channelized OC48/STM16 MIC with SFP	MIC-3D-1CHOC48	56.5 W at 55º C 54.5 W at 40º C 53 W at 25º C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W

Table 51: MX2020 FRU AC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
DS3/E3 MIC	MIC-3D-8DS3-E3 MIC-3D-8CHDS3-E3-B	36 W at 55º C 35 W at 40º C 34 W at 25º 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 on page 83
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 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 PDM to the power distribution panel.

For more information on AC PDM input power mapping, see “Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on the MX2020 Router” on page 168.

Detachable AC power cords, each 4.5 m (approximately 14.8 ft) long, are supplied with the router. The AC power cord wires insert into the AC input terminal block by screwdriver. The plug end of the power cord fits into the power source receptacle for your geographical location.

Table 52 on page 154 and Table 53 on page 155 provide specifications and Figure 63 on page 155 and Figure 64 on page 156 depict the plug on the AC power cord provided for each region supported.

Table 52: Three-Phase Delta and Wye AC Power Cord Specifications

Country	Model Number
North America	CBL-MX2000-3PH-DELTA

Table 52: Three-Phase Delta and Wye AC Power Cord Specifications *(continued)*

Country	Model Number
Europe	CBL-MX2000-3PH-WYE

Table 53: Single-Phase AC Power Cord Specifications

Country	Part Number
CBLCBL-PWR-C21S-AU	AC Power Cable, Australia
CBL-PWR-C21S-CH AC	Power Cable, China
CBL-PWR-C21S-EU	AC Power Cable, Europe
CBL-PWR-C21S-INTL	AC Power Cable, International
CBL-PWR-C21S-IT	AC Power Cable, Italy
CBL-PWR-C21S-JP	AC Power Cable, Japan
CBL-PWR-C21S-US	AC Power Cable, US/Canada

Figure 63: Three-Phase Delta AC Power Cord

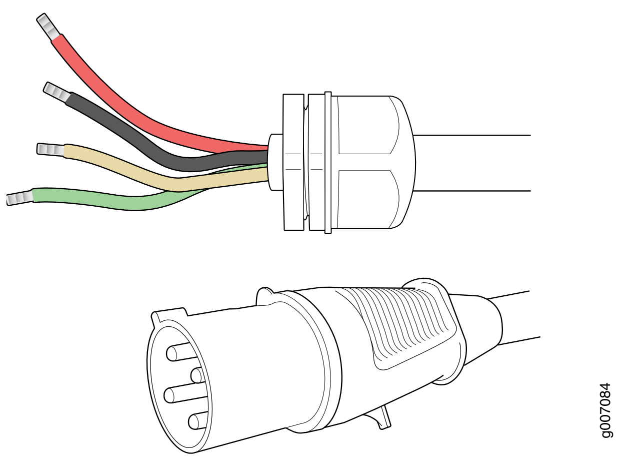


Figure 64: Three-Phase Wye AC Power Cord

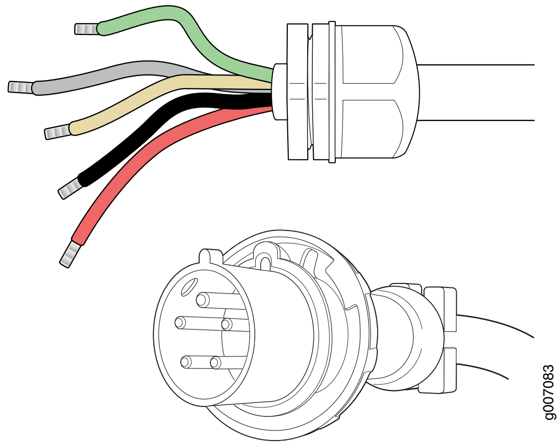


Table 54 on page 156 provides specifications for the three-phase delta and wye AC power cord mating connectors. Figure 65 on page 157 and Figure 66 on page 157 depict the mating connectors for the three-phase AC power cord.

Table 54: Three-Phase Delta and Wye AC Power Cord Mating Cable Connector Specifications

Cable	Manufacturer Part Number	Description
Three-phase delta	460C9W	60-A, 250 V 3-phase, 3-pole, 4-wire, North American pin and sleeve connector, industrial grade, IP67, watertight (blue)
Three-phase wye	PCE 225-6	32-A, 400 VIP44 3 pole, 5 wire with brass contacts (red)

NOTE: The three-phase delta and wye AC power cord mating connectors are not supplied by Juniper Networks.

Figure 65: Three-Phase Delta AC Power Cord Mating Connector

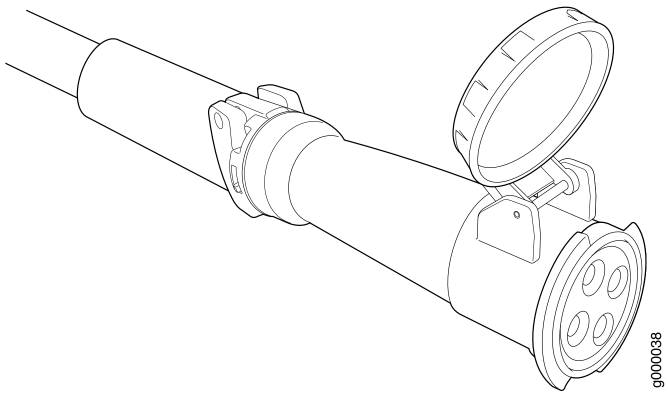
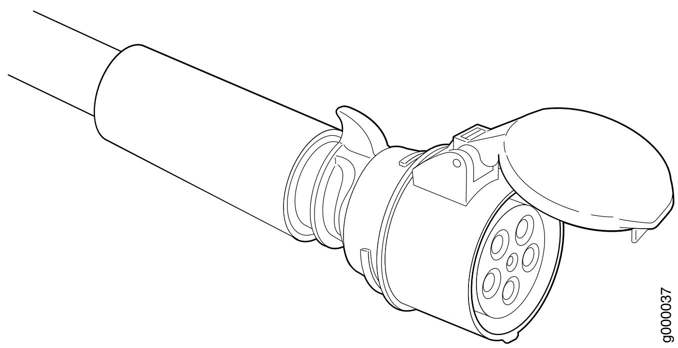


Figure 66: Three-Phase Wye AC Power Cord Mating Connector



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). 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 (size 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 cable must not block access to device components or drape where people could trip on them.

Related Documentation

- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249

- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- Replacing an MX2020 Three-Phase Delta AC Power Cord on page 504
- *Replacing an MX2020 Three-Phase Wye AC Power Cord*
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163
- MX2020 Three-Phase Wye AC Power Distribution Module Specifications on page 163
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 AC Power Subsystem Electrical Specifications

Table 55 on page 158 lists the AC power subsystem electrical specifications.

Table 55: MX2020 AC Power Subsystem 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)
AC input line frequency	Delta: 50/60 Hz (+/-3Hz) Wye: 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)
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

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163
- MX2020 Three-Phase Wye AC Power Distribution Module Specifications on page 163
- MX2020 AC Power Electrical Safety Guidelines on page 584

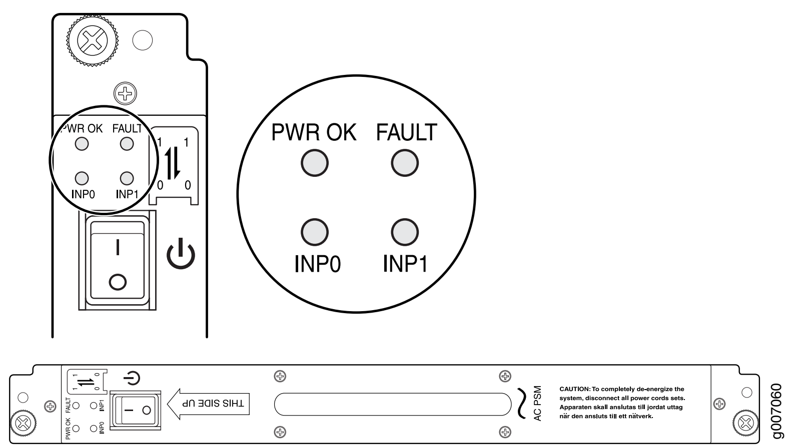
MX2020 AC Power Supply Module Description

The MX2020 supports a three-phase AC power system. There are two types of three-phase power systems that can be installed in the router—three-phase delta or three-phase wye. The PSMs work with a single phase only. Each phase from the each of the two feeds is distributed among one or two PSMs. This means up to six different phases can come into the PDM and get distributed among nine AC PSMs. There are a total of eighteen AC PSMs located at the rear of the chassis in slots **PSM0** through **PSM8** (bottom), and slots **PSM9** through **PSM17** (top) (left to right). The AC PSMs in slots **PSM0** through **PSM8** provide power to the lower fan trays (**0**, **1**, and upper **2**), and MPCs in slot **0** through **9**, CB-REs in slot **0** and **1**, and SFBs in slot **0** through **7**. The PSMs in slots **PSM9** through **PSM17** provide power to the upper fan trays upper (**2**, **3**, and lower **0**), and MPCs in slot **10** through **19**, CB-REs in slot **0** and slot **1**, and SFBs in slot **0** through **7**.

NOTE: **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. AC and DC PSMs or PDMs must not be mixed within a single system.**

Up to nine PSMs may be connected in parallel per power subsystem to increase available power for MPCs as needed and provide redundancy. Figure 67 on page 159 shows the AC PSM.

Figure 67: AC Power Supply Module

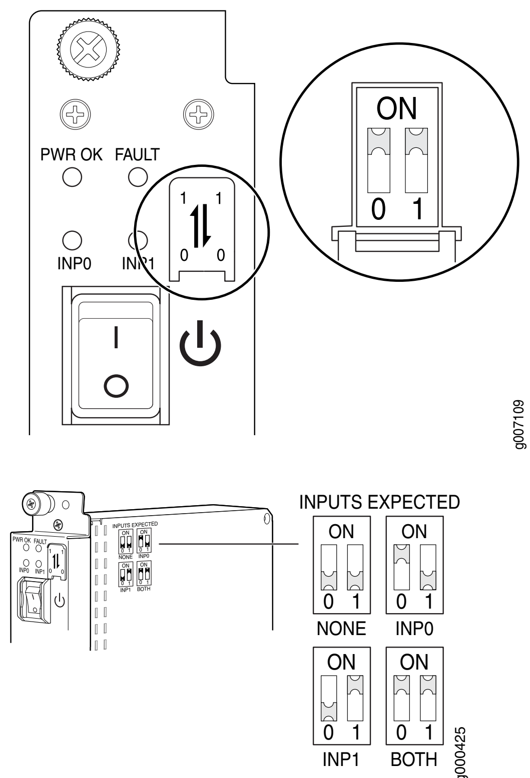


The AC power system provides dual redundant feed. Each PSM takes in two AC feeds and uses one of the two. Only one of the two feeds is active during power operation. Each feed is a single phase AC system 200-240 VAC derived from a three-phase delta or wye AC input system. Move the input mode DIP switch to the on or off position to determine the power supply feeds (see Table 56 on page 160 and Figure 68 on page 160). 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 AC Power Subsystem Electrical Specifications” on page 158.

Table 56: 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 68: Selecting Input Feed on the AC Power Supply Module



Related Documentation

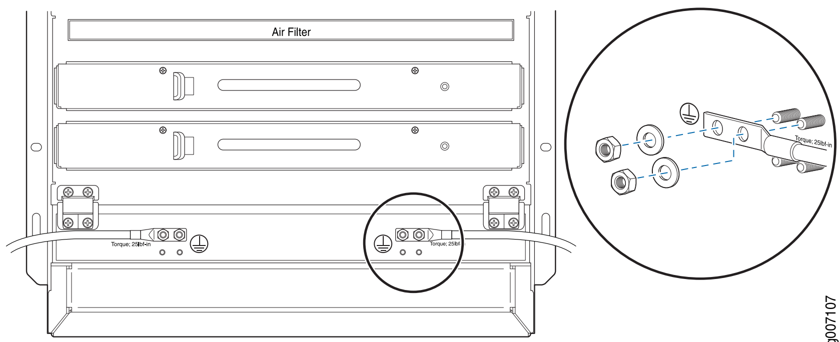
- MX2020 AC Power Supply Module LEDs on page 93
- MX2020 AC Power Cord Specifications on page 154
- Installing the MX2020 Air Filter on page 296
- Removing the MX2020 Air Filter on page 431

MX2020 Router Grounding Specifications

MX2020 Chassis Grounding Points Specifications

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. To ground AC-powered or DC-powered routers, you must connect a grounding cable to earth ground and then attach it to the chassis grounding points using the two screws provided. (see Figure 56 on page 118).

Figure 69: Connecting Chassis Grounding Points on the MX2020 Router



MX2020 Router Grounding Cable Lug Specifications

CAUTION: Before router installation begins, 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.

To ground AC-powered or DC-powered routers, connect a grounding cable to earth ground and then attach it to the chassis grounding points using two screws. The top pair of grounding points fits UNC 1/4–20 screws (American), and the lower pair fits M6 screws (European). The grounding points are spaced at 0.625-in. (15.86-mm) centers. The cable lugs get attached to the grounding cable, and the two UNC 1/4–20 screws are used to secure the grounding cable to the top pair of grounding points.

WARNING: The router is a pluggable type A equipment installed in a 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.

NOTE: The MX2020 supports 4-AWG DC power cable lugs for 80-A input (see Figure 57 on page 119), and 6-AWG DC power cable lugs for 60-A input (see Figure 58 on page 119).

Figure 70: 4-AWG DC Grounding Cable Lug

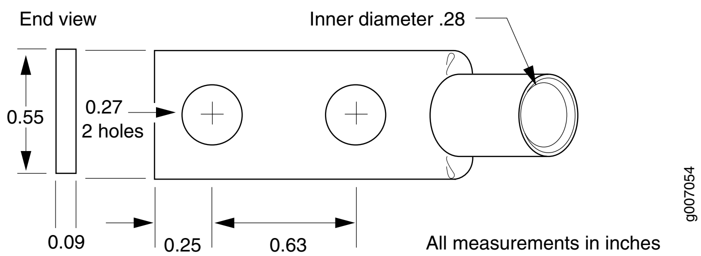


Figure 71: 6-AWG DC Grounding Cable Lug

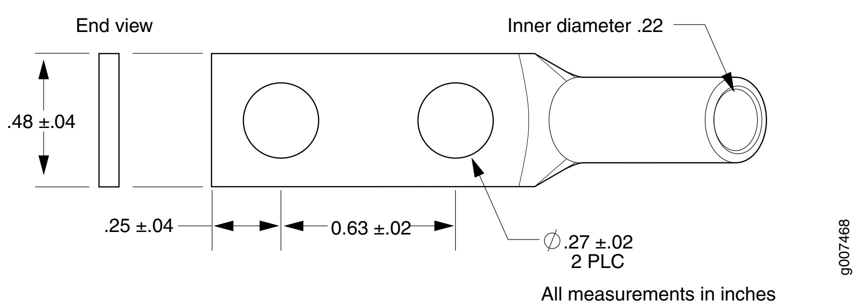


Table 39 on page 119 summarizes the specifications for the power cables, which you must supply.

Table 57: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 80-A PDM. Minimum 90ºC wire, or as required by the local code
Power	Eighteen pairs of 6-AWG (13.3 mm^2), used with 60-A PDM. Minimum 90ºC wire, or as required by the local code

MX2020 Router Grounding Cable Specifications

The 48 VDC facility must be equipped with a circuit breaker rated 60 A (–48 VDC), or 80 A (–48 VDC) for each PDM input, and the grounding cable must be minimum 10 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 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.

Related Documentation

- Grounding the MX2020 Router on page 247
- Tools and Parts Required for Connecting the MX2020 Router to Power on page 192
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 Three-Phase Delta AC Power Distribution Module Specifications

Table 58 on page 163 lists the three-phase delta AC PDM electrical specifications.

Table 58: 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)

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 Three-Phase Wye AC Power Distribution Module Specifications

Table 59 on page 163 lists the three-phase wye AC PDM electrical specifications.

Table 59: 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)

Table 59: Three-Phase Wye AC Power Distribution Module Electrical Specifications *(continued)*

Item	Specification
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

- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2020 Seven-Feed AC Power Distribution Module Specifications

Table 58 on page 163 lists the seven-feed single-phase delta AC PDM electrical specifications.

Table 60: Seven-Feed Single-Phase 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	14 A @ 200 VAC

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- MX2020 AC Power Electrical Safety Guidelines on page 584

MX2010 Nine-Feed AC Power Distribution Module Specifications

Table 58 on page 163 lists the single-phase AC PDM electrical specifications.

Table 61: 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)
AC input current rating	14 A @ 200 VAC

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 147).
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.

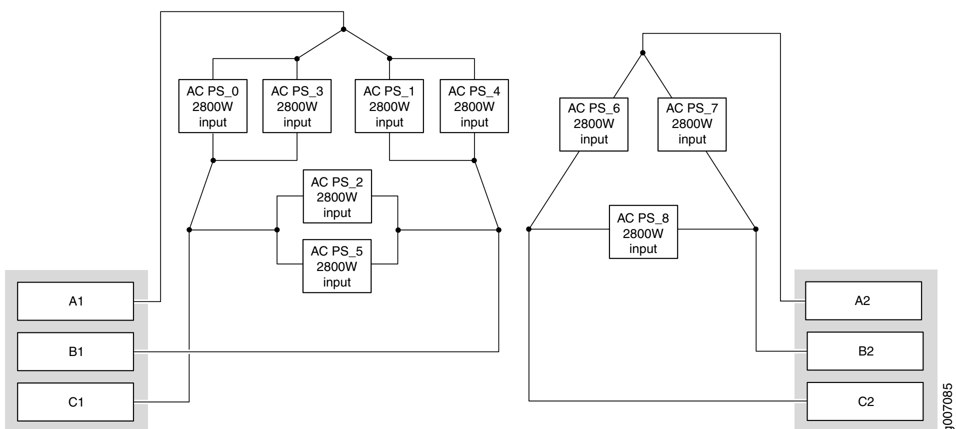
   Table 62 on page 166 lists the three-phase delta and wye feed requirements, maximum input and output power per PSM, and power efficiency.

Table 62: 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 72 on page 166).

Figure 72: 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.

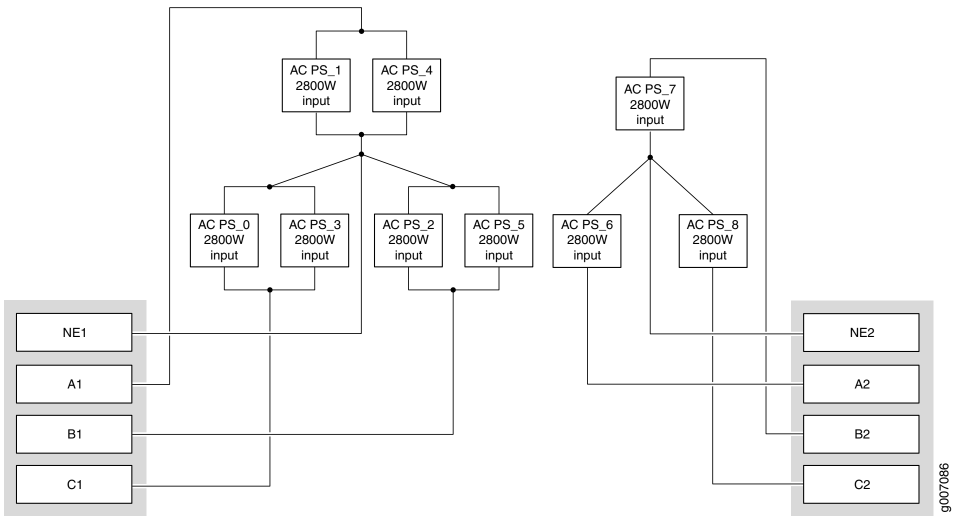
g. Nominal value of input current for one AC PSM is 2800 W/200 V=14 A.

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 73 on page 167).

Figure 73: 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 63 on page 168.

Table 63: 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 147 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 147 to calculate maximum power, which is dependent on configuration and temperature.

Related Documentation

- MX2020 Power Subsystem Description on page 83
- MX2020 AC Power Requirements on page 147
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- MX2020 AC Power Electrical Safety Guidelines on page 584

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on the MX2020 Router

You connect AC power to the router with AC PDMs by connecting two AC power cords to each PDM. One feed maps to six PSMs and the other maps to three PSMs (see Figure 74 on page 169). The arrangement matches the internal components of the PDM. Table 64 on page 169 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1**. Table 65 on page 170 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1**.

Figure 74: Mapping AC Power Distribution Modules Input to AC Power Supply Modules

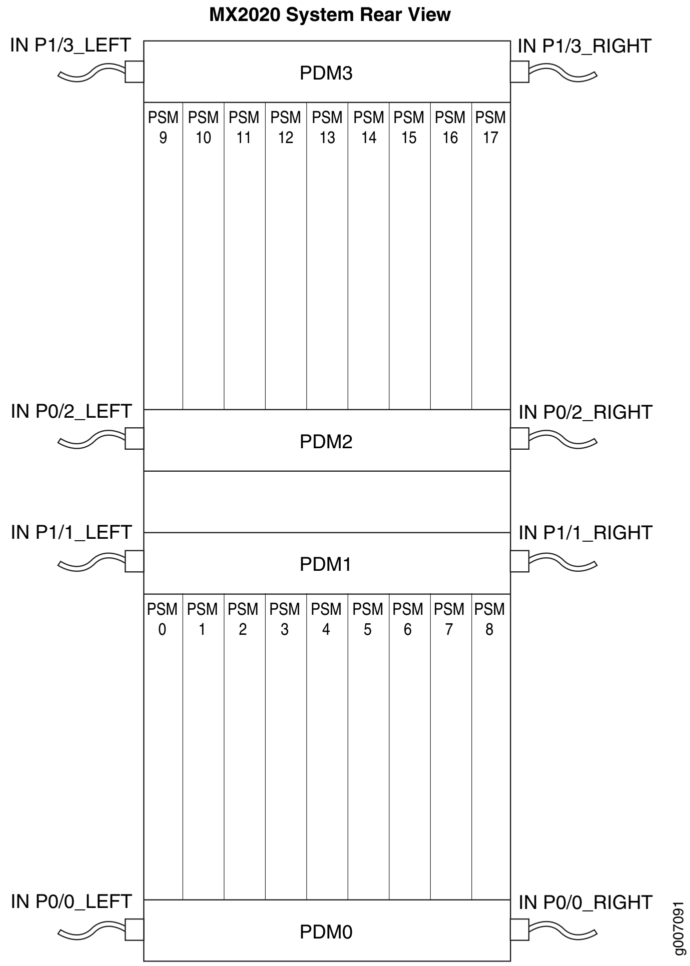


Table 64: Input AC Power Mapping for PDM0 and PDM1

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 65: 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	–

Related Documentation

- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- Powering On the AC-Powered MX2020 Router on page 260
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

CHAPTER 14

DC Power Requirements, Specifications, and Guidelines

MX2020 DC Power Requirements

Table 66 on page 172 lists the FRU power requirements for SFBs, CB-REs, MPCs, and MICs. In addition, Table 66 on page 172 lists the MPC power requirements with MICs and optics at various operating temperatures.

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

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

For PDMs with 80 A feeds, we recommend that you select the 80 A @ –48 VDC switch for each input.

If you do not plan to provision as recommended above, you can use the information in Table 66 on page 172 to calculate the power consumption for your hardware configuration.

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

Table 66: 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
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)		
CB-RE	RE-MX2000-1800X4	150 W (Typical) 250 W at 55° C 250 W at 40° C 250 W at 25° C
MPCs		
16x10GE MPC	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

Table 66: FRU DC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
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
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

Table 66: FRU DC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
32x10GE MPC4E	MPC4E-3D-32XGE-SFPP	610 W With optics: 610 W at 55º C, with SFPP ZR optics 560 W at 40º C, with SFPP ZR optics 550 W at 25º C, with SFPP ZR optics
2x100GE + 8x10GE MPC4E	MPC4E-3D-2CGE-8XGE	610 W With optics: 610 W at 55º C, with SFPP ZR and CFP LR4 optics 550 W at 40º C, with SFPP ZR and CFP LR4 optics 530 W at 25º C, with SFPP ZR and CFP LR4 optics
6x40GE + 24x10GE MPC5E *6x40GE + 24x10GE MPC5EQ*	MPC5E-40G10G MPC5EQ-40G10G	With optics: 607 W at 55º C 541 W at 40º C 511 W at 25º C
2x100GE + 4x10GE MPC5E *2x100GE + 4x10GE MPC5EQ*	MPC5E-100G10G MPC5EQ-100G10G	With optics: 607 W at 55º C 541 W at 40º C 511 W at 25º C
MPC6E	MX2K-MPC6E	1088 W with MICs and optics
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 66: 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 55º C, 40º C and 25º C with 10G BASE-SR and 10G BASE-LR optics 66 W at 55º C, 40º C and 25º C with 10G BASE-ER optics 74 W at 55º C, 40º C and 25º C with 10G BASE-ZR optics
10-Gigabit Ethernet DWDM OTN MIC	MIC6-10G-OTN	84 W **With optics:** 63 W at 55º C with 10G BASE-LR OTN optics 63 W at 40º C with 10G BASE-LR OTN optics 63 W at 25º 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 55º C with 100G BASE-LR4 OTN optics 86 W at 40º C with 100G BASE-LR4 OTN optics 74 W at 25º C with 100G BASE-LR4 OTN optics

Table 66: 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 55º C with CXP SR10 optics 49 W at 40º C with CXP SR10 optics 49 W at 25º C with CXP SR10 optics
SONET/SDH OC3/STM1 Multi-Rate MIC	4-Port: MIC-3D-4OC3OC12-1OC48 8-Port: MIC-3D-8OC3OC12-4OC48	4-Port: 24 W at 55º C 22.75 W at 40º C 21.5 W at 25º C 8-Port: 29 W at 55º C 27.75 W at 40º C 26.5 W at 25º C
OC192/STM64 MIC with XFP	MIC-3D-1OC192-XFP	41 W at 55º C 38.5 W at 40º C 36 W at 25º 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 55º C 40 W at 40º C 39 W at 25º C 8-Port: 52 W at 55º C 50.5 W at 40º C 49 W at 25º C
Channelized OC48/STM16 MIC with SFP	MIC-3D-1CHOC48	56.5 W at 55º C 54.5 W at 40º C 53 W at 25º C
Tri-Rate MIC	MIC-3D-40GE-TX	41 W

Table 66: FRU DC Power Requirements *(continued)*

Component	Model Number	Maximum Power Requirement
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 on page 83
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules on page 262
- MX2020 DC Power Subsystem Electrical Specifications on page 179
- MX2020 DC Power Distribution Description on page 177

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** that are each capable of carrying nine feeds. 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.

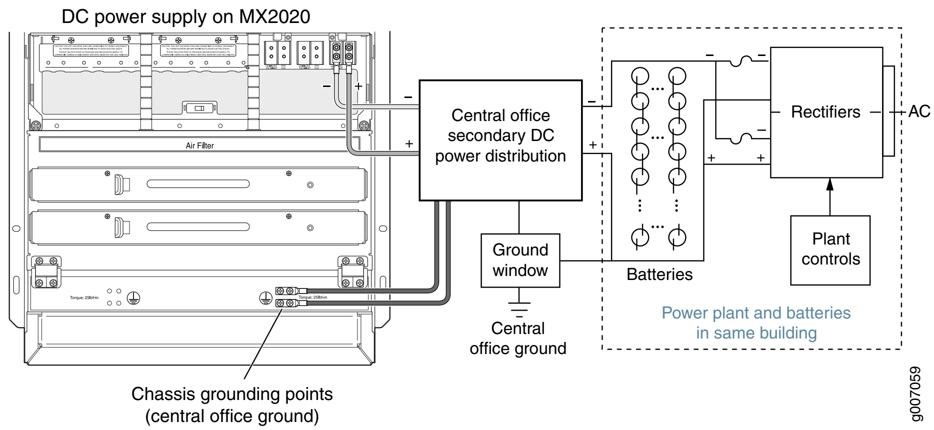
NOTE: **Depending on the voltage of the DC feeds, power can be drawn from both feeds. The feed with higher voltage provides more power. If the difference between the voltages is sufficient, then the higher voltage feed provides all the power. When the voltages are exactly the same, equal power is drawn from both feeds.**

These feeds are set by the input mode DIP switch located on the DC PSM (see “MX2020 DC Power Supply Module Description” on page 96). 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 kicks in to provide full power .

Figure 75 on page 178 shows a typical DC source cabling arrangement.

Figure 75: Typical DC Source Cabling to the Router



All DC PSMs in a subsystem share the load (the 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.

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 Description on page 94

- MX2020 DC Power Supply Module Description on page 96
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules on page 262
- Installing MX2020 DC Power Supply Modules on page 265
- Replacing an MX2020 DC Power Distribution Module Cable on page 462
- Connecting an MX2020 DC Power Distribution Module Cable on page 268
- DC Power Cable Specifications for the MX2020 Router on page 184

MX2020 DC Power Subsystem Electrical Specifications

Table 67 on page 179 lists the DC power subsystem electrical specifications.

Table 67: DC PSM Electrical Specifications Per Input Configurations

Item	Specification
Maximum input current rating input voltage @ -40 VDC to -72 VDC	60 A (for 2100 W output) 73 A (for 2500 W output)
Maximum output power	2100 W @ 60 A 2500 W @ 73 A
Redundancy	N+1 PSM N+N feed redundancy
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%

Related Documentation

- Calculating DC Power Requirements for MX2020 Routers on page 180

- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Supply Module Description on page 96
- MX2020 DC Power Electrical Safety Guidelines on page 585

Calculating DC Power Requirements for MX2020 Routers

The information in this topic helps you determine which PSMs are suitable for various configurations, as well as which PSMs are not suitable because output power is exceeded. You determine suitability by subtracting the total power draw from the maximum output of the PSMs. Afterward, you calculate the required input current. Finally, you calculate the thermal output. A sample configuration is provided in Table 68 on page 181.

We recommend that you provision power according to the maximum input current listed in the power subsystem electrical specifications (see "MX2020 DC Power Subsystem Electrical Specifications" on page 179).

Use the following procedures to calculate the power requirement:

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

The MX2020 DC power subsystem is made up of two sub zones where each sub zone provides power to half of the FRUs in the chassis (see Table 68 on page 181 for information on power zoning). Each power subsystem is made up of two DC PDMs, nine PSMs, twenty MPCs (ten MPCs powered by one power zone and the remaining ten MPCs powered by the second power zone), two fan trays within the same power zone and one fan tray powered by the other power zone, eight SFBs, and two Control Board and Routing Engines (CB-REs).

When calculating power requirements, be sure that there is adequate power for each zone.

NOTE: Four DC PSMs per zone are mandatory for the MX2020 router with DC PDMs.

Table 68: MX2020 DC Power Zoning

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 • CB-RE slot 0 and slot 1 • SFB slots 0 through 7 • Fan tray 0, 1, 2
DC power to upper half of MX2020 components	Upper (zone 1)	PDM 2 and 3	PSM 9 through 17	• MPC slots 10 through 19 • CB-RE slot 0 through slot 1 • SFB slot 0 through 7 • Fan tray 0, 2, 3

NOTE: When a PSM is switch off, the software will indicate that the PSM is present, but not turned on.

The following sample configuration shows an MX2020 chassis with:

- Four DC PDMs
- Twenty 16-port 10GbE MPCs with SFP+ interfaces (slots 0 through 19)
- Two CB-REs (with one redundant CB-RE) (CB-RE slot 0 and CB-RE slot 1)
- Eight SFBs (with one redundant SFB) (SFB slots 0 through 7)
- Twenty ADCs (slots 0 through 19)

- Four fan trays

1. Calculate the power requirements (usage) using the values in "MX2020 DC Power Requirements" on page 171 as shown in Table 69 on page 182.

Table 69: Typical DC Power Requirements 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)		2100 W * 8 PSMs=16,800 W (+ 1 PSM@2100 W redundant capacity)
MX2020 DC power subsystem (upper and lower half of chassis, 80 A feeds to each PDM input)		2500 W * 8 PSMs=20,000 W (+ 1 PSM@2500 W redundant capacity)

NOTE: The power reservation for the critical FRUs was 7360 W. With power droop-sharing between the two zones, the power reservation for critical FRUs is reduced to 5662 W. This number is considering 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 PDM options.

Table 70 on page 183 lists the PSMs, their maximum output power, and unused power (or a power deficit).

Table 70: Calculating DC 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 (feed to each input)	2500	45,000

3. Calculate input power. Divide the total output requirement by the efficiency of the PSM as shown in Table 71 on page 183.

Table 71: 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	91%	2500	2747

4. Calculate thermal output (BTUs). Multiply the input power requirement (in watts) by 3.41 as shown in Table 72 on page 183.

Table 72: Calculating DC Thermal Output

Power Distribution Module	Thermal Output (BTUs per hour)
MX2020 DC PDM	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

- MX2020 Power Subsystem Description on page 83
- Overview of Preparing the Site for the MX2020 Router on page 103
- MX2020 DC Power Distribution Description on page 177
- MX2020 DC Power Subsystem Electrical Specifications on page 179

DC Power Circuit Breaker Requirements for the MX2020 Router

For PDMs, if you plan to operate a maximally configured DC-powered router, we recommend that you provision at least 80 A @ –48 VDC (nominal) for each DC input to the system. Use a customer site 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 circuit breaker according to respective National Electrical Code and customer site internal standards to maintain proper level of protection for the current specified above .

For PDMs, If you plan to operate a minimally configured DC-powered router, we recommend that you provision at least 60 A @ –48 VDC (nominal) for each input to the system. Use a customer site circuit breaker rated according to 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 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 –48 VDC.

Related Documentation

- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Electrical Safety Guidelines on page 585
- MX2020 DC Power Subsystem Electrical Specifications on page 179

DC Power Cable Specifications for the MX2020 Router

The cable lugs attach to the terminal studs of each PDM (see Figure 76 on page 185 and Figure 77 on page 185).

NOTE: The MX2020 supports 4-AWG DC power cable lugs for 80-A input, and 6-AWG DC power cable lugs for 60-A input.

Figure 76: 4-AWG DC Power Cable Lug

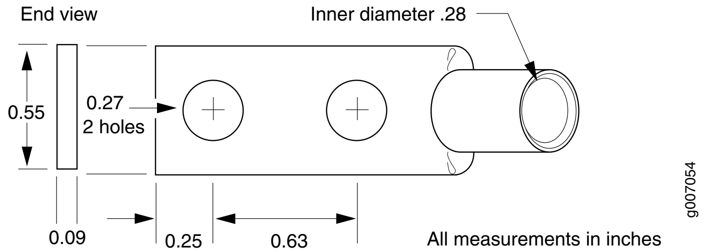
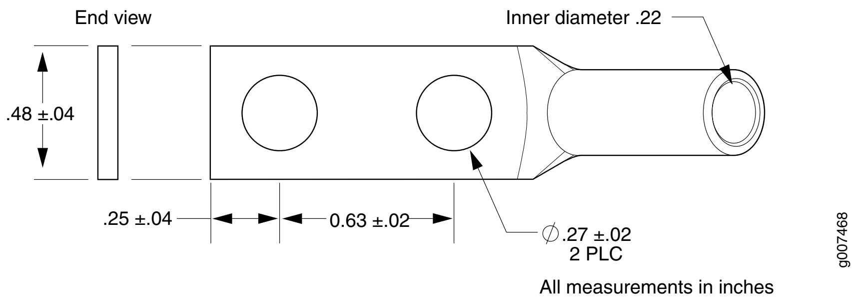


Figure 77: 6-AWG DC Power Cable Lug



CAUTION: Before router installation begins, 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 a pluggable type A equipment 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 73 on page 185 summarizes the specifications for the power cables, which you must supply.

Table 73: DC Power Cable Specifications

Cable Type	Quantity and Specification
Power	Eighteen pairs of 4-AWG (21.2 mm^2), used with 80-A PDM. Minimum 90°C wire, or as required by the local code
Power	Eighteen pairs of 6-AWG (13.3 mm^2), used with 60-A PDM. Minimum 90°C wire, or as required by the local code

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.

Related Documentation

- MX2020 DC Power Supply Module Description on page 96
- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Electrical Safety Guidelines on page 585
- MX2020 DC Power Distribution Description on page 177
- Connecting an MX2020 DC Power Distribution Module Cable on page 268

PART 3

Initial Installation and Configuration

CHAPTER 15

Installation Overview

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 103
2. Review the safety guidelines. See:
   - General Safety Guidelines for Juniper Networks Devices on page 555
3. Unpack the router and verify the parts. See:
   - Unpacking the MX2020 Router on page 195
   - Verifying the MX2020 Parts Received on page 199
   - Unpacking the Router Transport Kit on page 201
4. Install the mounting hardware. See:
   - Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet on page 205
5. Remove all components. See:
   - Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
6. Install the router into the rack. See:
   - Installing a MX2020 Router Using a Pallet Jack Overview on page 219

- Installing a MX2020 Router Using a Router Transport Kit Overview on page 224

7. Ground the router. See:
   - See: "Grounding the MX2020 Router" on page 247
8. Reinstall all components. See:
   - Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236
9. Connect cables to the network and external devices. See:
   - Connecting the MX2020 Router to Management and Alarm Devices on page 275
10. Connect the AC power cord or DC power cables. See:
    - Installing MX2020 AC Power Supply Modules on page 258
    - Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
    - Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
    - Installing MX2020 DC Power Supply Modules on page 265
    - Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules on page 262
11. Power on the router. See:
    - Powering On the AC-Powered MX2020 Router on page 260
    - Powering On the DC-Powered MX2020 Router on page 273
12. Perform the initial system configuration. See:
    - Initially Configuring the MX2020 Router on page 287

Related Documentation

- MX2020 Chassis Description on page 5
- Routine Maintenance Procedures for the MX2020 Router on page 407
- MX2020 Troubleshooting Resources on page 531

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 on page 195

- Unpacking the Router Transport Kit on page 201
- Verifying the MX2020 Parts Received on page 199
- MX2020 Router Overview on page 3

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 on page 103
- Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
- Installing the MX2020 Router Using a Pallet Jack with Attachment on page 220
- Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

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 on page 103
- Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
- Installing the MX2020 Router Using a Router Transport Kit on page 229
- Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

Tools and Parts Required for Connecting the MX2020 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 the MX2020 Router on page 247
- MX2020 Router Grounding Specifications on page 117
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252

- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules on page 262

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 on page 407
- Maintaining the MX2020 Host Subsystem on page 370
- Maintaining the MX2020 Power Supply Modules on page 386

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 on page 275
- Connecting the MX2020 Router to a Console or Auxiliary Device on page 276
- Connecting an MX2020 Router to an External Alarm-Reporting Device on page 277

CHAPTER 16

Unpacking the Router

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 190

2. Unpack the router.

   See: "Unpacking the MX2020 Router" on page 195

3. Unpack the router transport kit, if ordered.

   See: "Unpacking the Router Transport Kit" on page 201

4. Verify that all parts have been received.

   See: "Verifying the MX2020 Parts Received" on page 199

Related Documentation

- Installing an MX2020 Router Overview on page 189

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).

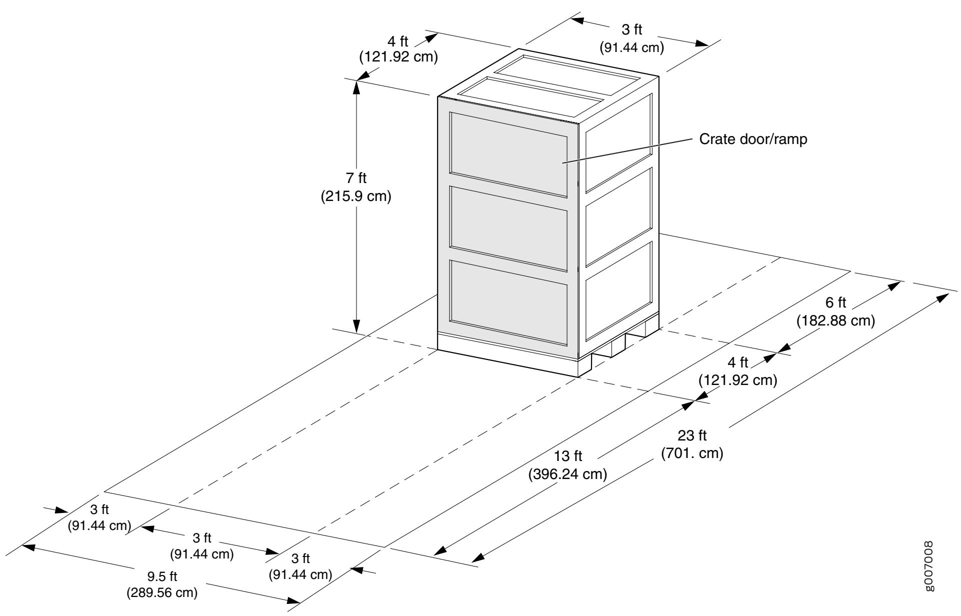
NOTE: Depending on your configuration, the MX2020 may be shipped with additional components already installed.

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

The shipping container measures 85.0 in. (215.9 cm) high, 42.0 in. (106.7 cm) wide, and 48.0 in. (121.9 cm) deep (see Figure 78 on page 196). See "MX2020 Physical Specifications" on page 108 for MX2020 shipping weight specifications.

NOTE: The total weight of the shipping crate with router and accessories will vary depending on your configuration.

Figure 78: MX2020 Shipping Crate Dimensions



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

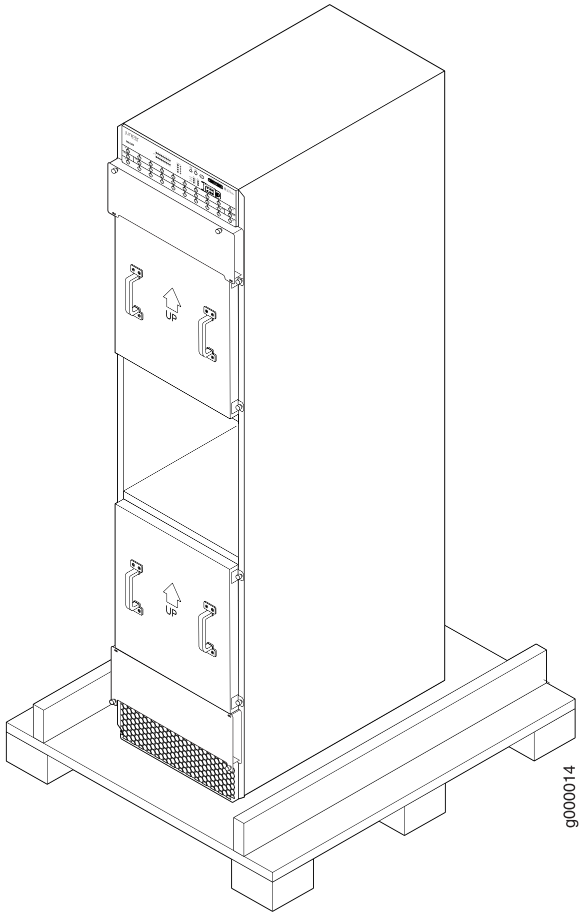
To unpack the router:

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 79 on page 198).
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 79: 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 201.

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 on page 190
- Verifying the MX2020 Parts Received on page 199

- Installing the MX2020 Router Using a Pallet Jack with Attachment on page 220
- Installing the MX2020 Router Using a Router Transport Kit on page 229

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 74 on page 199, and an accessory box, which contains the parts listed in Table 75 on page 200. The parts shipped with your router can vary depending on the configuration you ordered.

Table 74: Parts List for a Fully Configured MX2020 Router

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

Table 74: Parts List for a Fully Configured MX2020 Router *(continued)*

Component	Quantity
Standard upper cable manager	1
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 75: Accessory Box Parts List

Part	Quantity
Screws to mount chassis	14
RJ-45 cable, with RJ-45 jack to female DB-9, to connect the router through the serial port	1
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
Affidavit for T1 connection	1
Juniper Networks Product Warranty	1
End User License Agreement	1
Document sleeve	1
3" x 5" pink bag	2

Table 75: Accessory Box Parts List *(continued)*

Part	Quantity
9" x 12" pink bag, ESD	2
Accessory Box, 19 x 12 x 3"	1
Ethernet cable, RJ-45/RJ-45, 4-pair stranded UTP, Category 5E, 15 feet long	1
ESD wrist strap with cable	1

Related Documentation

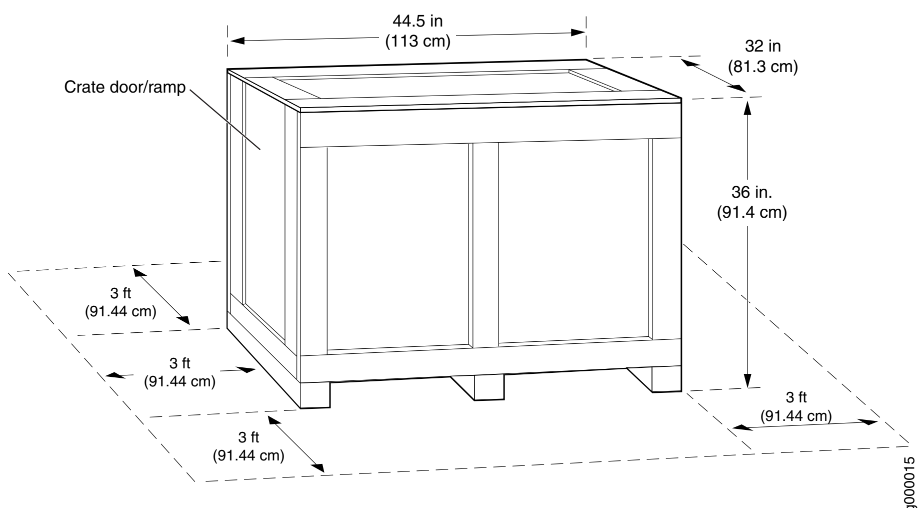
- Tools and Parts Required to Unpack the MX2020 Router on page 190
- Unpacking the MX2020 Router on page 195
- MX2020 Router Overview on page 3

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 80 on page 201). The total weight of the container containing the router transport kit is 200 lb (90.71 kg).

Figure 80: Router Transport Kit Crate Dimensions

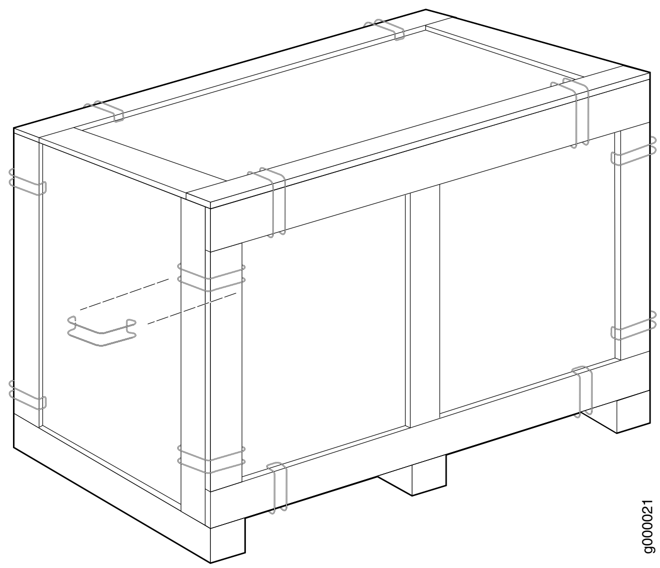


NOTE: The router transport kit is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the router transport kit:

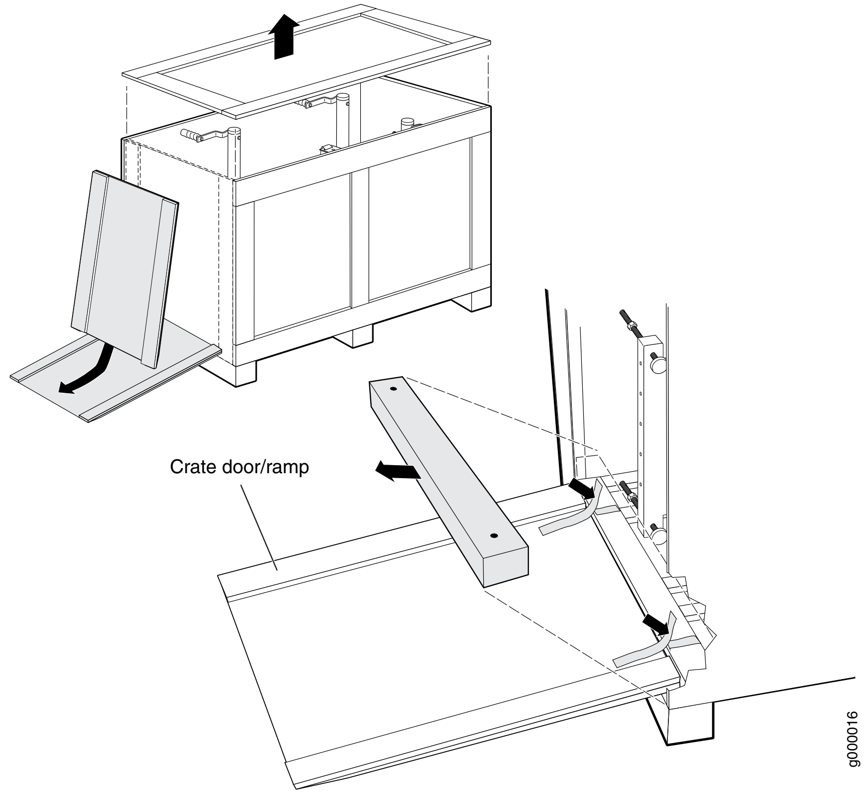
1. Move the router transport kit shipping crate to an ESD-approved staging area, where you have enough room to remove the kit for assembly.
2. Position the shipping crate with the arrows pointing up.
3. Remove the metal clips on the shipping crate that secure the top and front to the crate (see Figure 81 on page 202).

Figure 81: 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 82 on page 203).

Figure 82: 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 on page 190
- Verifying the MX2020 Parts Received on page 199
- Installing the MX2020 Router Using a Router Transport Kit on page 229

CHAPTER 17

Installing the Mounting Hardware

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

Installing Cage Nuts, If Needed

Insert cage nuts, if needed, into the holes listed in Table 76 on page 205 and Table 77 on page 206. 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 76 on page 205).
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 77 on page 206).

Table 76: Mounting Hole Locations for Installing the Four-Post Mounting Shelf

Hole	Distance Above U Division	
6	3.25 in. (8.3 cm)	1.86 U
5	2.63 in. (6.7 cm)	1.5 U
4	2.00 in. (5.1 cm)	1.14 U
3	1.50 in. (3.8 cm)	0.86 U
2	0.88 in. (2.2 cm)	0.50 U

Table 76: Mounting Hole Locations for Installing the Four-Post Mounting Shelf *(continued)*

Hole	Distance Above U Division	
1	0.25 in. (0.6 cm)	0.14 U

Table 77: Mounting Hole Locations for Installing a MX2020 Chassis in a Four-Post Rack or Cabinet

Hole	Distance Above U Division	
110	63.88 in. (162.2 cm)	36.50 U
101	58.63 in. (148.9 cm)	33.50 U
92	53.38 in. (135.6 cm)	30.50 U
83	48.13 in. (122.2 cm)	27.50 U
74	42.88 in. (108.9 cm)	24.50 U
65	37.63 in. (95.6 cm)	21.50 U
56	32.38 in. (82.2 cm)	18.50 U
47	27.13 in. (68.9 cm)	15.50 U
38	21.88 in. (55.6 cm)	12.50 U
29	16.63 in. (42.2 cm)	9.50 U
20	11.38 in. (28.9 cm)	6.50 U
11	6.13 in. (15.6 cm)	3.50 U

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

Installing the Four-Post Mounting Shelf

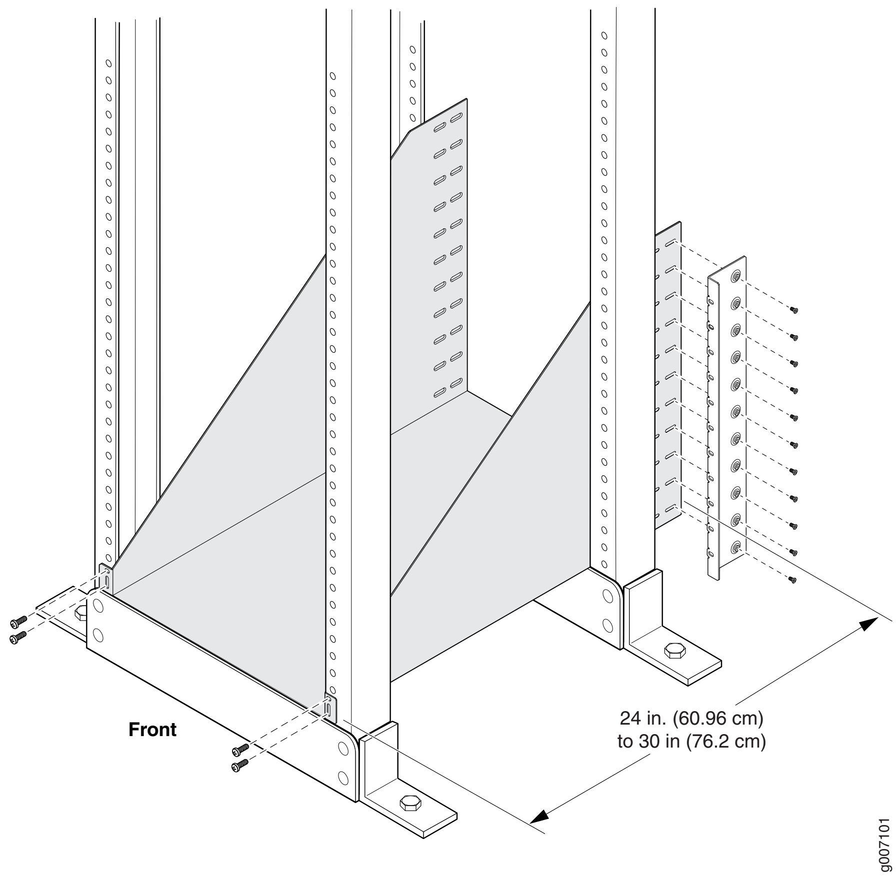
To install the four-post mounting shelf (see Figure 83 on page 208):

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



NOTE: The two rear flanges on the four-post mounting shelf are adjustable from 24 in. (60.96 cm) to 30 in. (76.2 cm) to accommodate different types of racks rails.

Related Documentation

- MX2020 Rack-Mounting Hardware on page 50

CHAPTER 18

Installing the Router

Removing Components from the MX2020 Router Chassis Before Installing It In a Rack

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 or DC PDM (see Figure 84 on page 211 and Figure 85 on page 211).

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 84: Removing an AC Power Distribution Module Before Installing the MX2020 Router

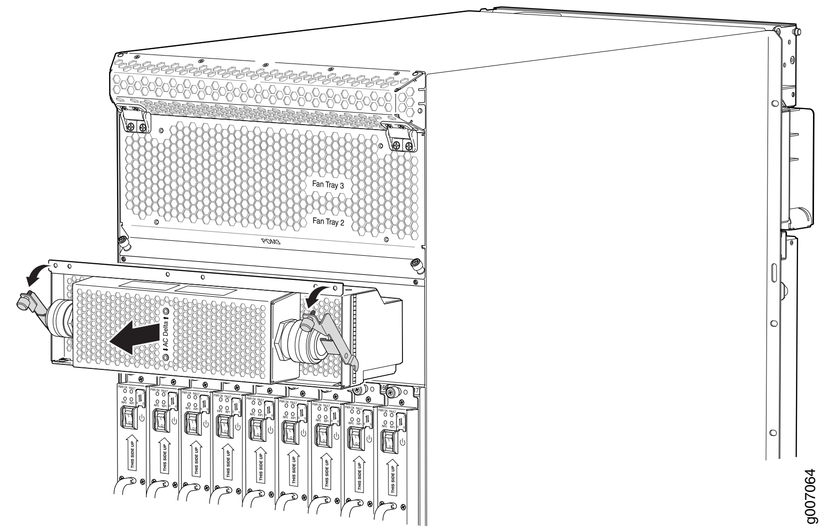
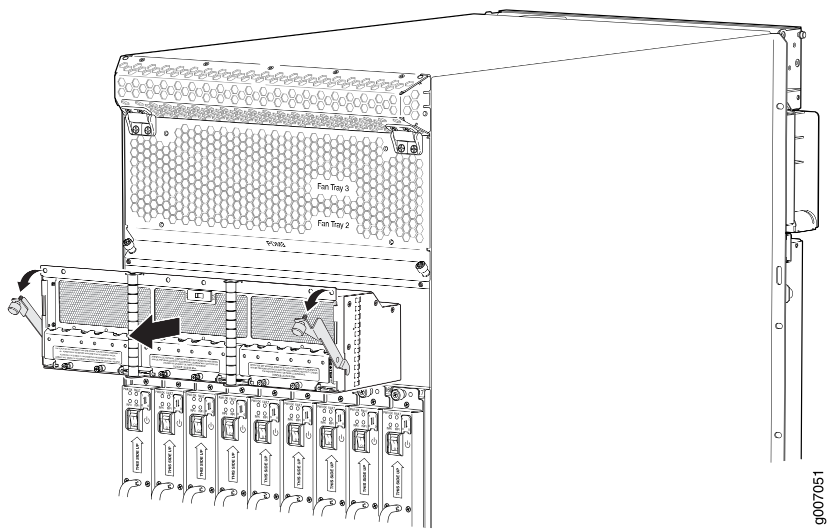


Figure 85: Removing a DC Power Distribution Module Before Installing the MX2020 Router



Removing the Power Supply Modules Before Installing an MX2020 Router

To remove the AC or DC PSMs (see Figure 86 on page 212 and Figure 87 on page 213):

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

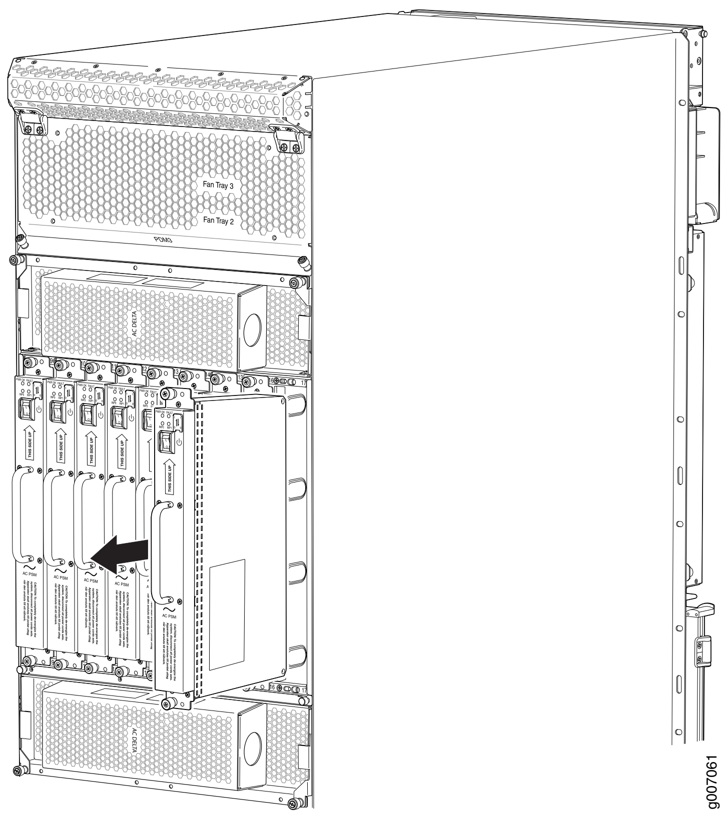
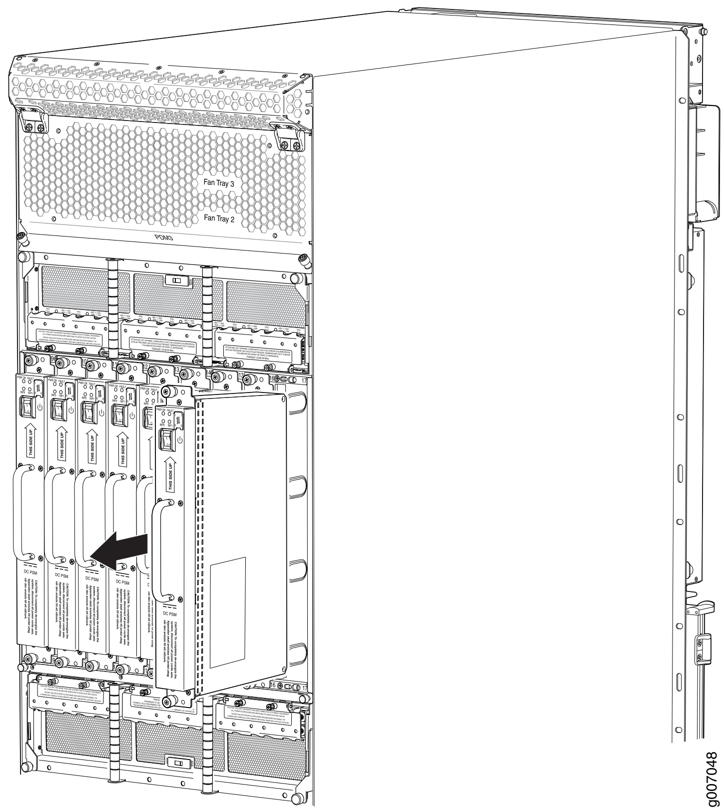


Figure 87: Removing a DC Power Supply Module Before Installing the MX2020 Router



Removing the Fan Trays Before Installing an MX2020 Router

To remove the upper and lower fan tray (see Figure 88 on page 214 and Figure 89 on page 214):

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 88: Removing Upper Fan Trays

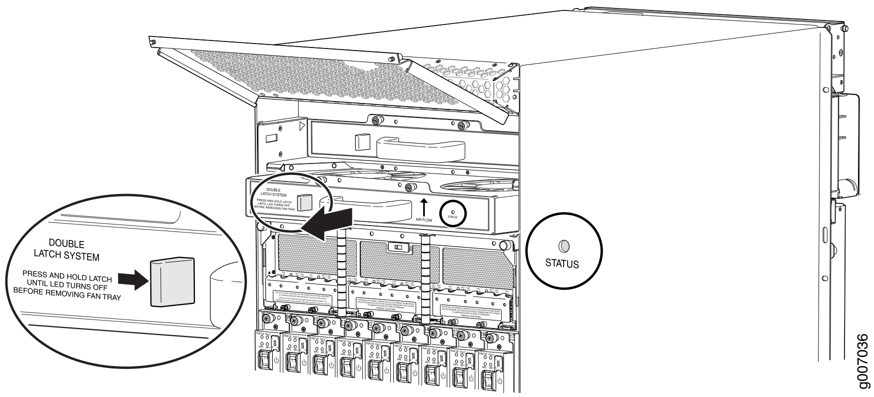
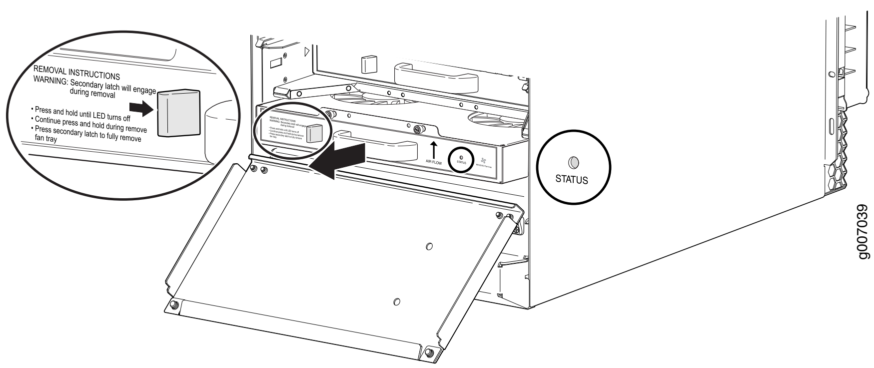


Figure 89: Removing Lower Fan Trays



Removing the SFBs Before Installing an MX2020 Router

To remove the SFBs (see Figure 90 on page 215):

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.

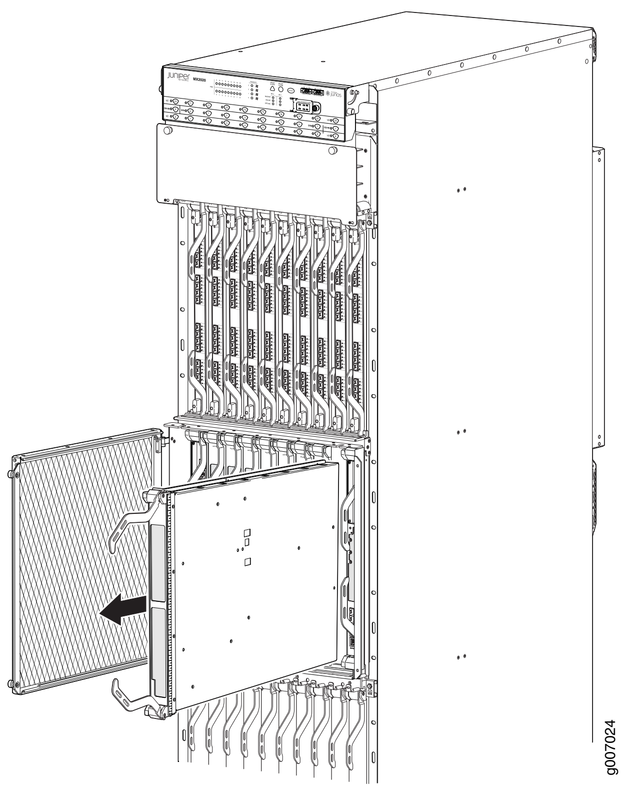
5. Place one hand underneath the SFB to support it, and slide it completely out of the chassis. Place it on the antistatic mat.

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 90: 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 91 on page 217):

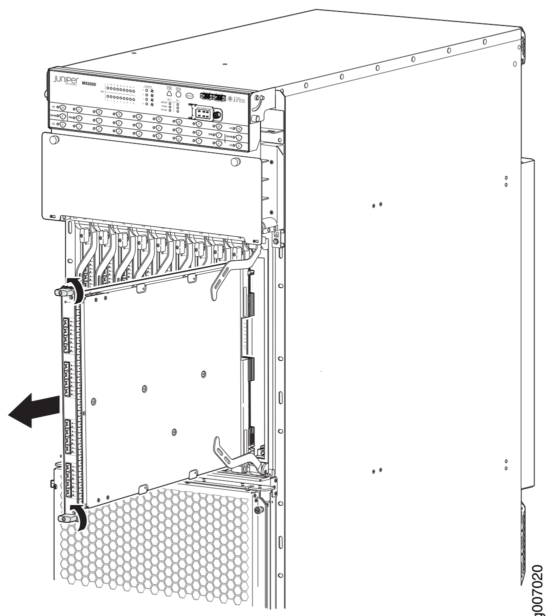
1. Have ready an antistatic mat for the MPC. Also have ready rubber safety caps for each MPC that uses an optical interface on the MPC that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See 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 91: Removing an MPC without the ADC



Removing the CB-REs Before Installing the MX2020 Router

To remove a CB-RE (see Figure 92 on page 218):

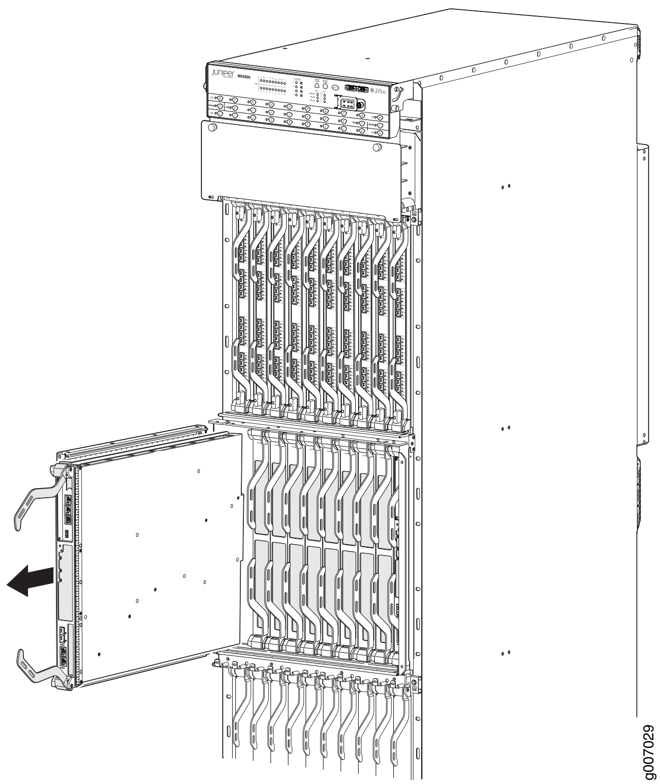
1. Have ready an antistatic mat for the CB-RE. Also have ready rubber safety caps for each SFP that uses an optical interface on the CB-RE that you are removing.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. 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 92: Removing a CB-RE



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Overview of Preparing the Site for the MX2020 Router on page 103
- Tools Required to Install the MX2020 Router Using a Router Transport Kit on page 191
- Installing the MX2020 Router Using a Router Transport Kit on page 229
- Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

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 229).

1. Verify that the mounting hardware has been installed.

   See: "Installing the MX2020 Mounting Hardware for a Four-Post Rack or Cabinet" on page 205

2. Remove the router from the shipping crate:

   See: "Overview of Unpacking the MX2020 Router" on page 195

3. Gather the tools required to install the router.

   See: "Tools Required to Install the MX2020 Router Using a Pallet Jack" on page 191

4. Remove the components.

   See: "Removing Components from the MX2020 Router Chassis Before Installing It In a Rack" on page 209

5. Install the MX2020 using the pallet jack attachment.

   See: "Installing the MX2020 Router Using a Pallet Jack with Attachment" on page 220

6. Reinstall the components.

   See: "Reinstalling Components in the MX2020 Chassis After Installing It In a Rack" on page 236

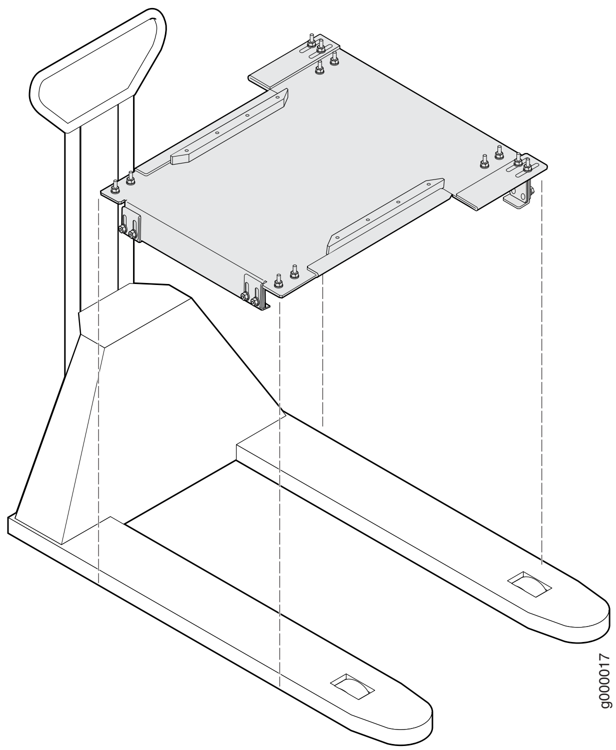
Installing the Pallet Jack Attachment

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 93 on page 220).

Figure 93: Installing Pallet Jack Attachment onto Pallet Jack



Related Documentation

- Overview of Preparing the Site for the MX2020 Router on page 103
- Tools Required to Install the MX2020 Router Using a Pallet Jack on page 191
- Installing the MX2020 Router Using a Pallet Jack with Attachment on page 220

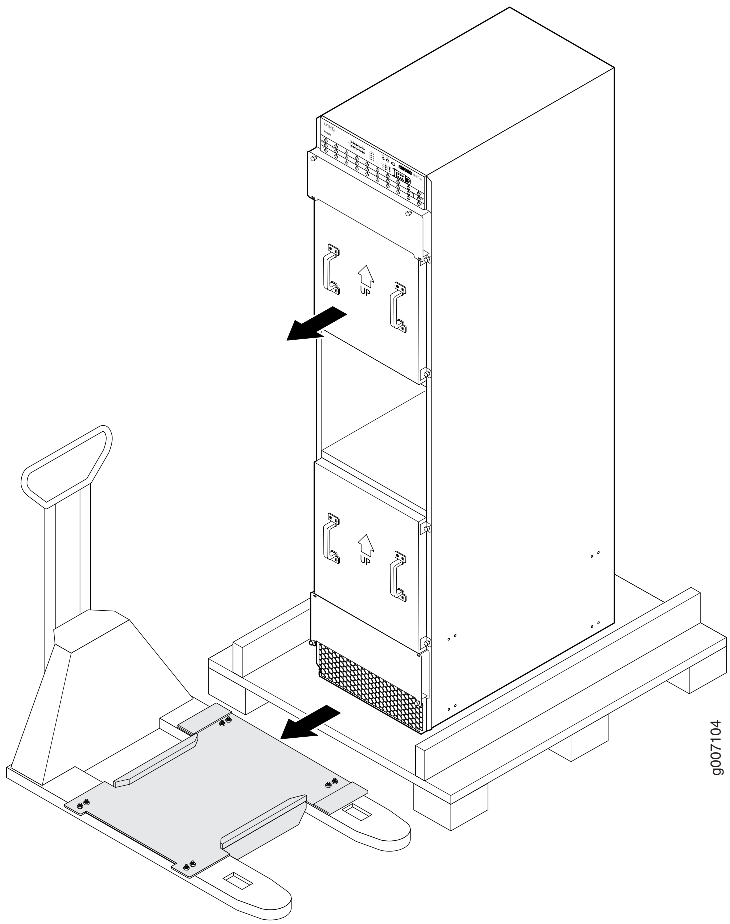
Installing the MX2020 Router Using a Pallet Jack with Attachment

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 209). 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 94: Loading the MX2020 Router onto the Pallet Jack



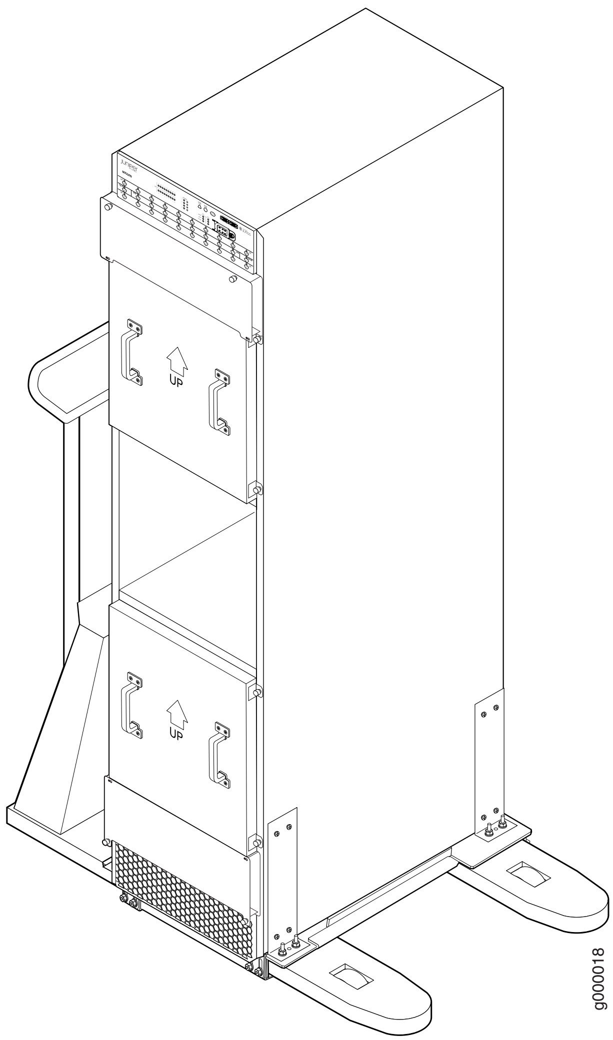
NOTE: Juniper Networks offers a router transport kit to install the router (see “Installing the MX2020 Router Using a Router Transport Kit” on page 229).

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 95 on page 222).

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

Figure 95: 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.

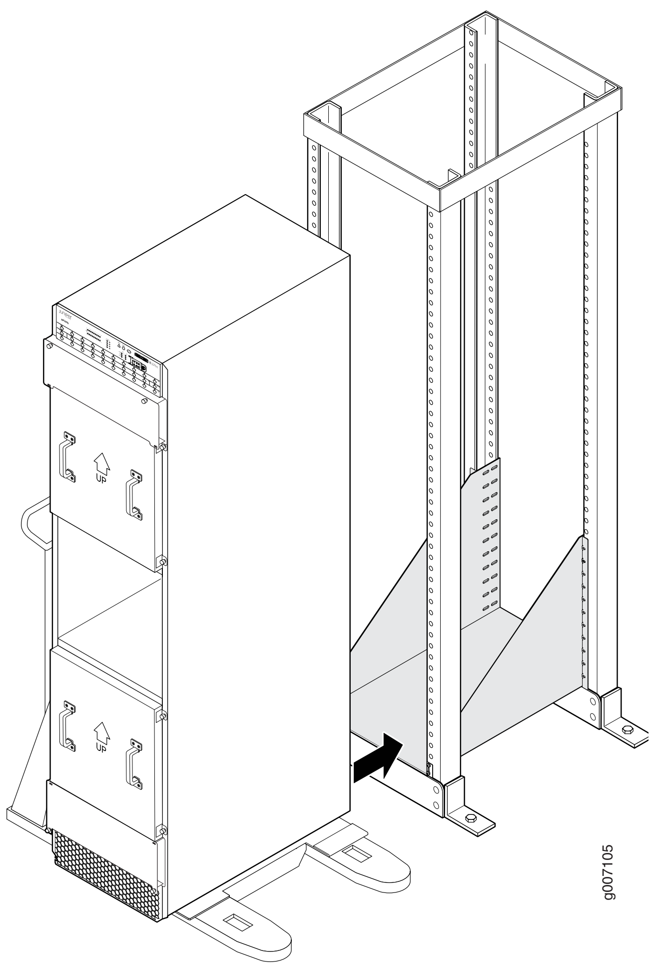
NOTE: An empty MX2020 router weighs approximately 300 lb (136.0 kg).

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 96 on page 223).

Figure 96: 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 on page 103
- Tools Required to Install the MX2020 Router Using a Pallet Jack on page 191
- Installing the Pallet Jack Attachment on page 219
- Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
- Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

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 220 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 191
2. Install the router transport kit. See:

   Installing the MX2020 Router Using a Router Transport Kit on page 229
3. Secure the router to the router transport platform. See:

   Securing the MX2020 Router to the Router Transport Platform on page 226
4. Install the MX2020 using the router transport kit. See:

   Installing the MX2020 Router Using a Router Transport Kit on page 229
5. Reinstall the components. See:

   Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

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

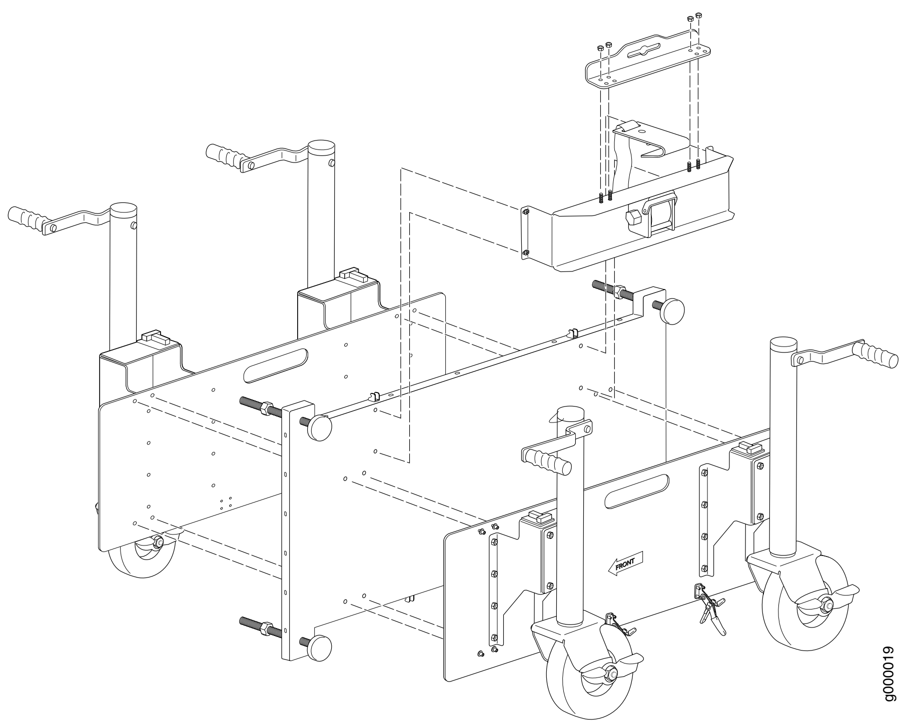
To install the router transport kit:

1. Remove the router transport kit from the shipping crate (see “Unpacking the Router Transport Kit” on page 201).

   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 97 on page 225).

Figure 97: 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.

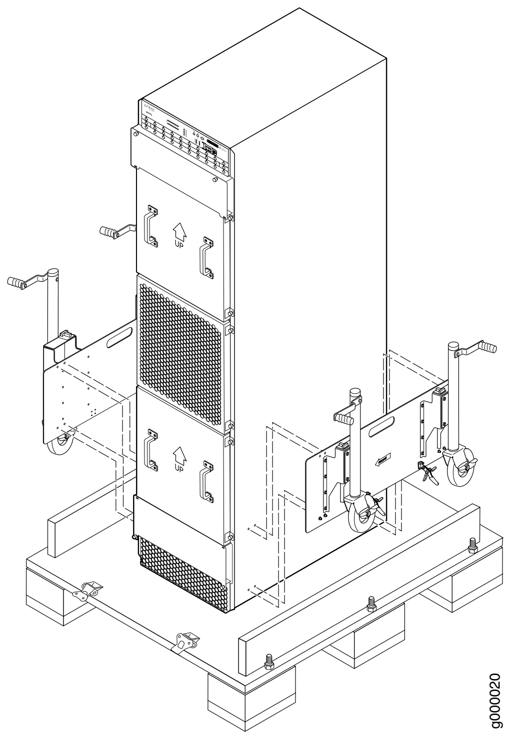
6. Align the left router transport mounting plate and wheel assembly (indicated by left arrow) with the holes on the left side of the chassis (see Figure 98 on page 226).

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 98 on page 226).

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 98: Installing the Router Transport Kit onto the MX2020



Related Documentation

- Overview of Preparing the Site for the MX2020 Router on page 103
- Installing the MX2020 Router Using a Router Transport Kit on page 229

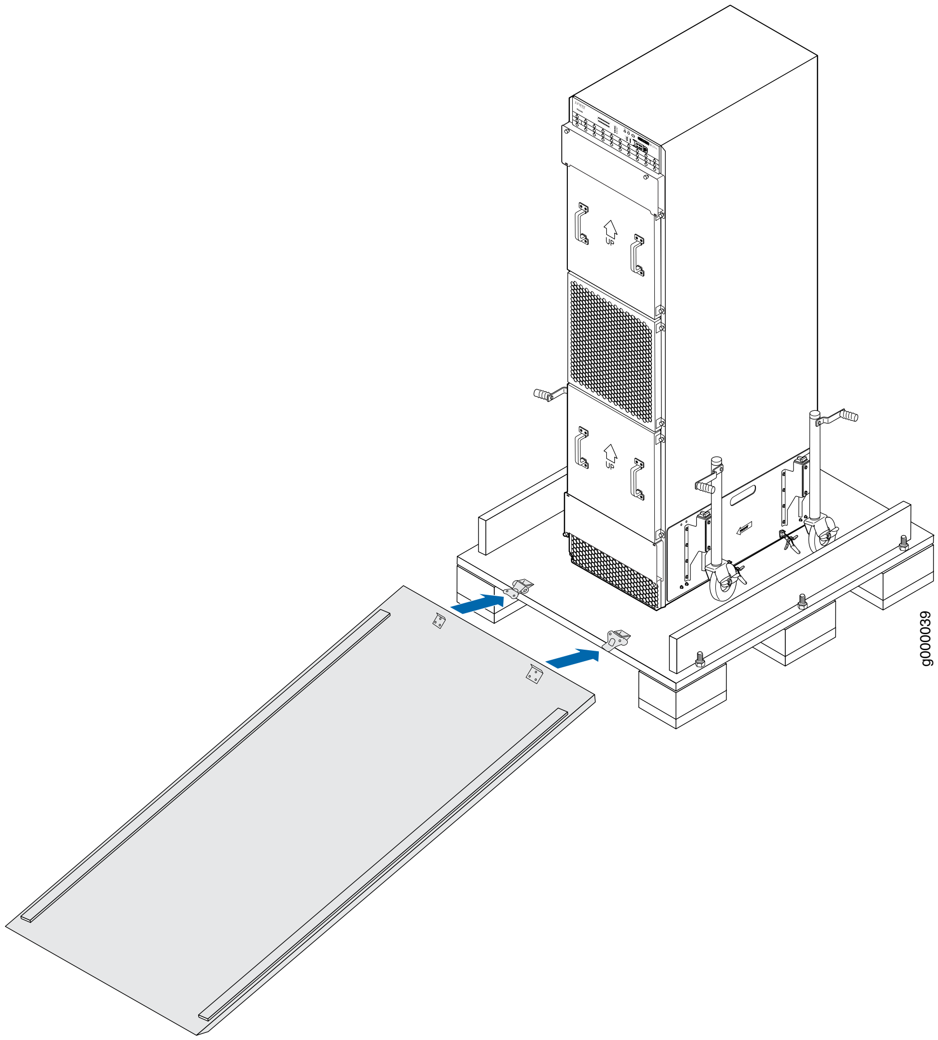
Securing the MX2020 Router to the Router Transport Platform

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 99 on page 227).

Figure 99: 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.

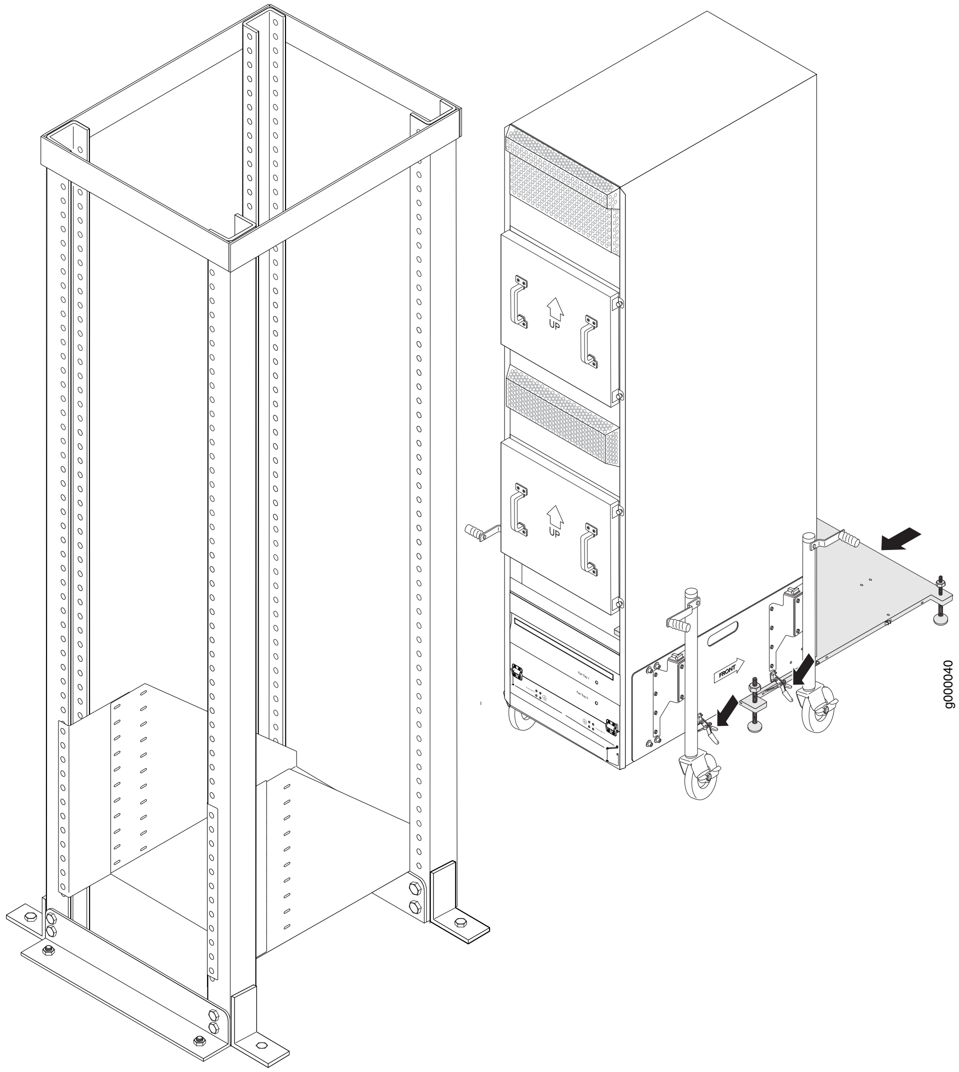
   CAUTION: Do not lift the router using the handles on the shipping covers. Use these handles only to help position the router.

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 100 on page 229).

Figure 100: 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.

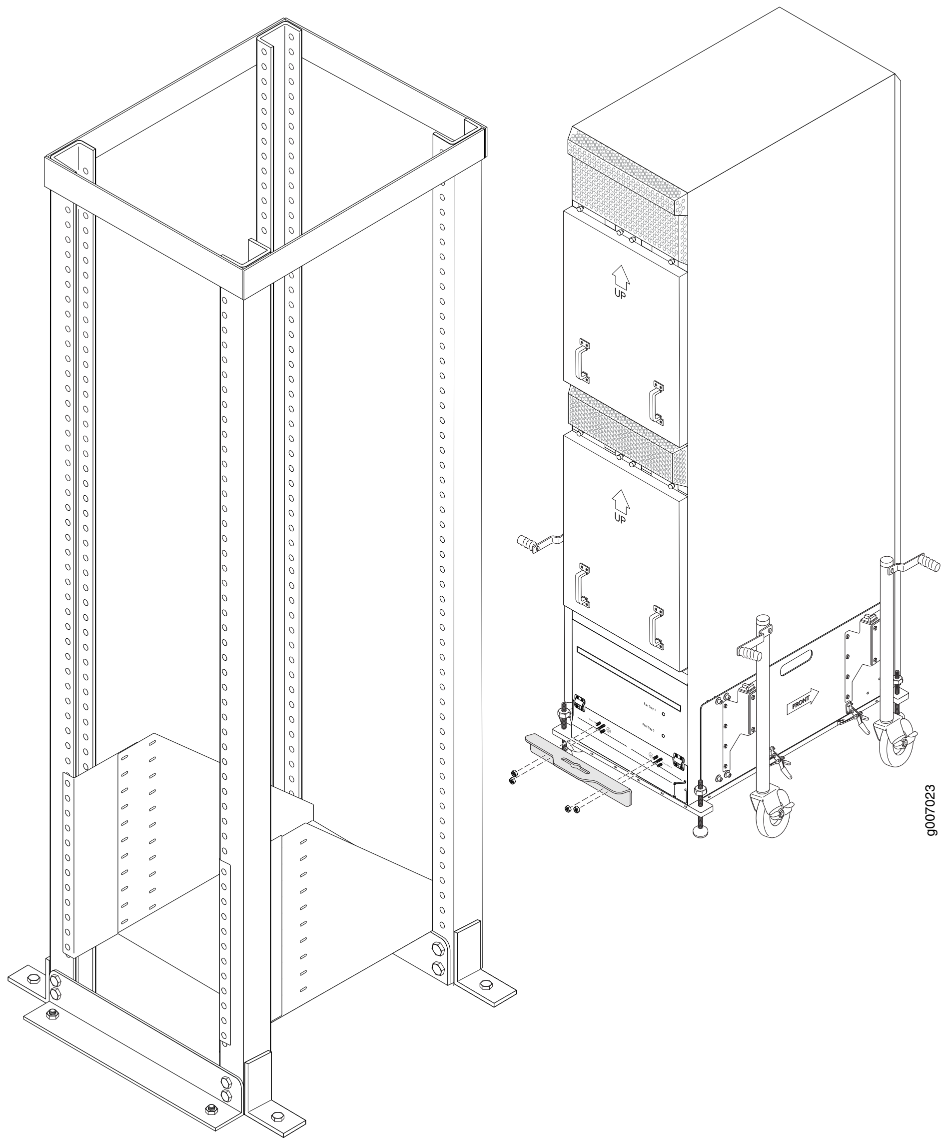
NOTE: Four persons are needed to install the router into a rack.

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 101 on page 230).

Figure 101: 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 113.

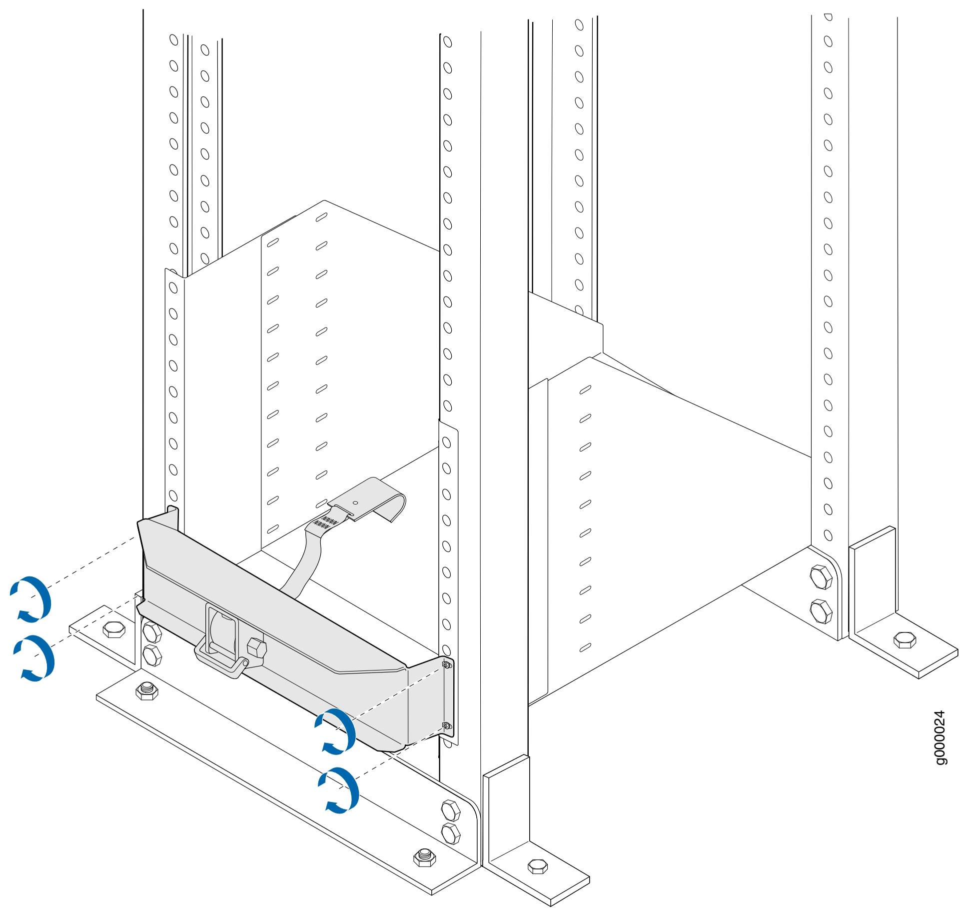
NOTE: A minimum of 38 in. (96.5 cm) of clearance is required to roll the chassis sideways.

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 102 on page 231).

Figure 102: Installing Winch Mount Bracket to Rack Rails

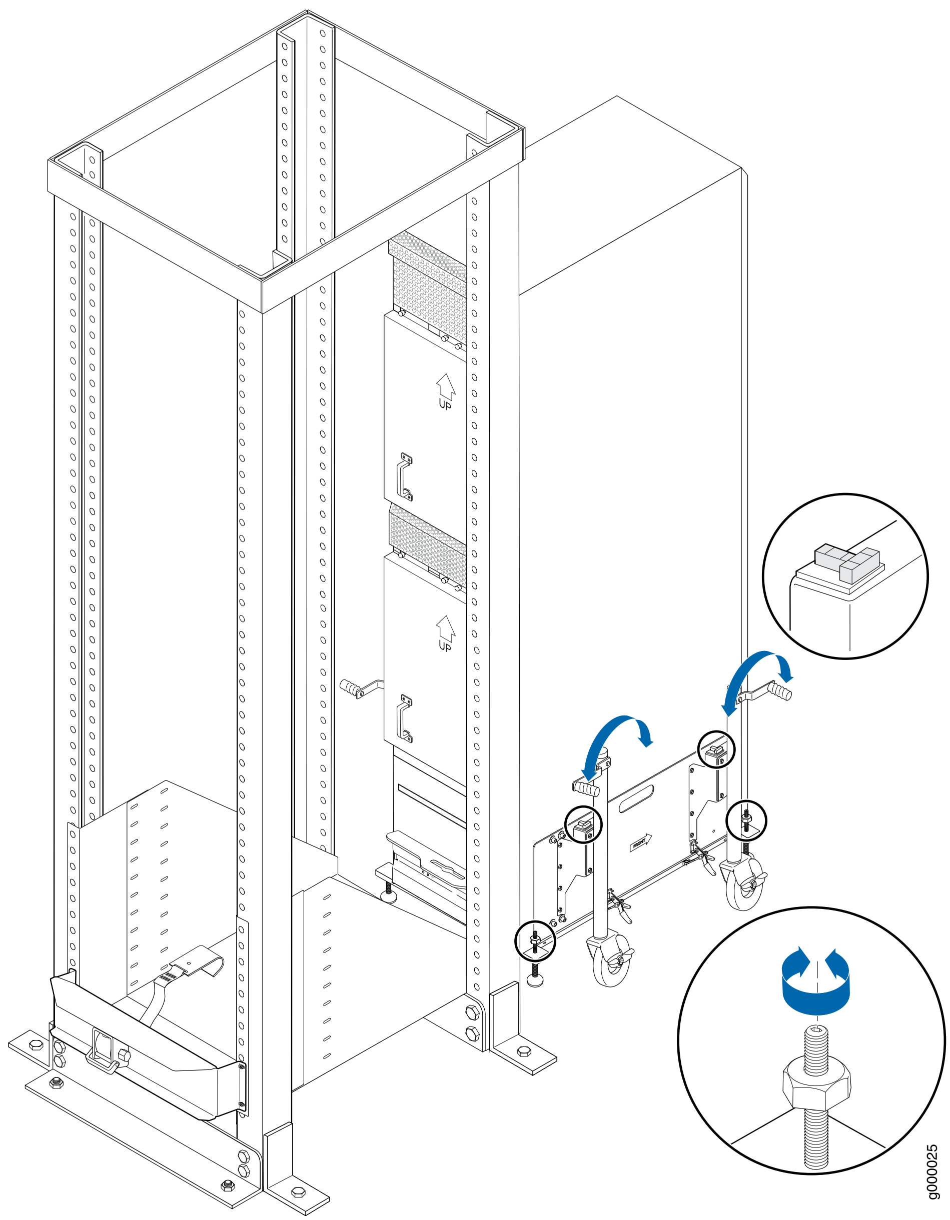


4. Adjust the height of the router by turning the handles clockwise until the router transport platform is aligned with the surface of the mounting shelf and slightly higher than the mounting shelf (see Figure 103 on page 232).

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 103 on page 232).

Figure 103: Align the MX2020 Router with Rack Mounting Shelf

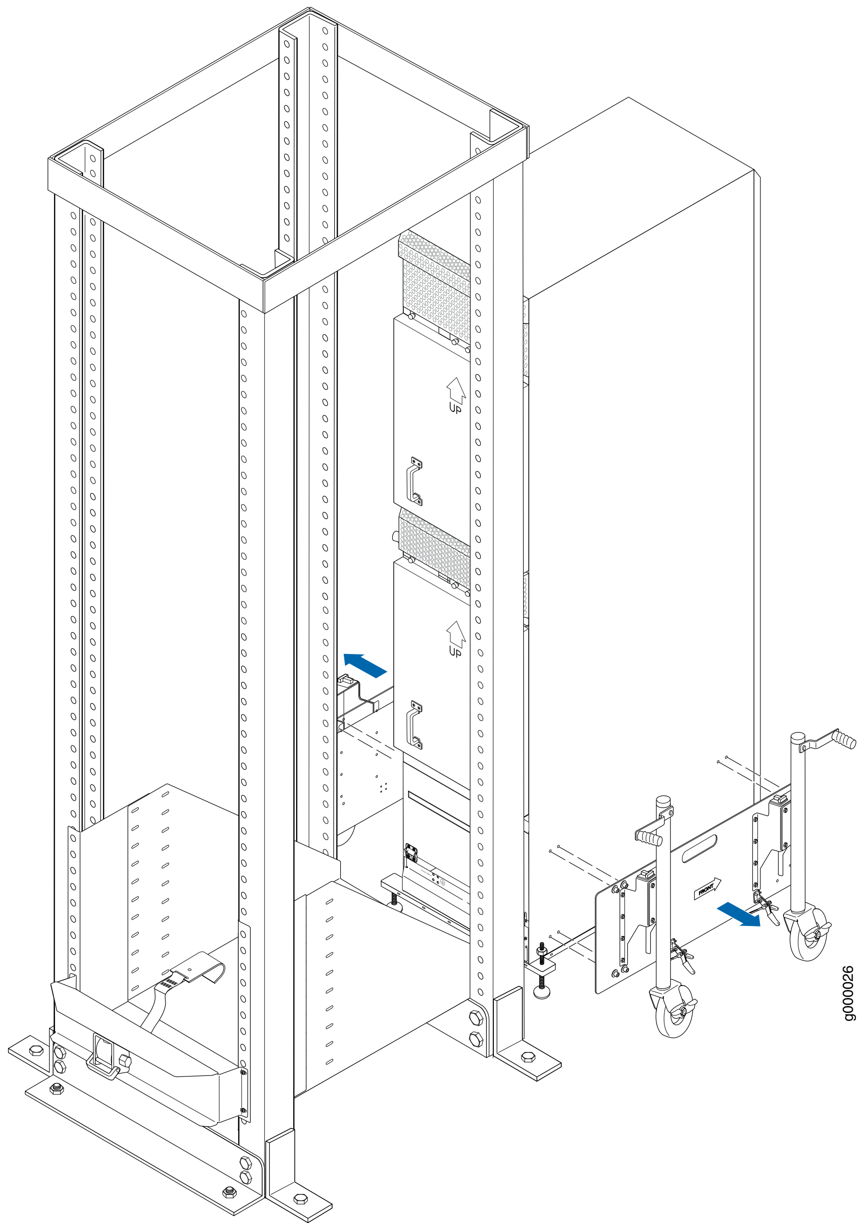


6. Unlock the four toggle latches that secure the router transport platform to the router transport mounting plates and wheel assembly.

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

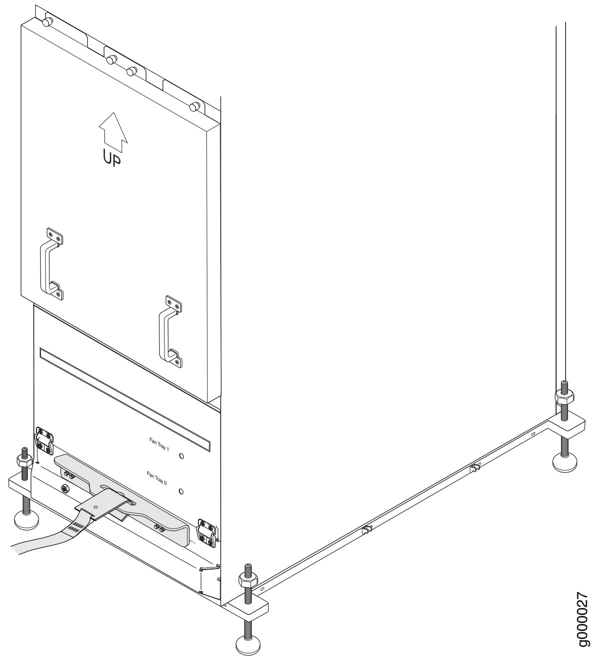
8. Using a number 3 Phillips screwdriver, loosen the captive screws that secure the router transport mounting plate and wheel assembly to the chassis, and set them aside (see Figure 104 on page 233).

Figure 104: Remove Router Transport Mounting Plate and Wheel Assembly



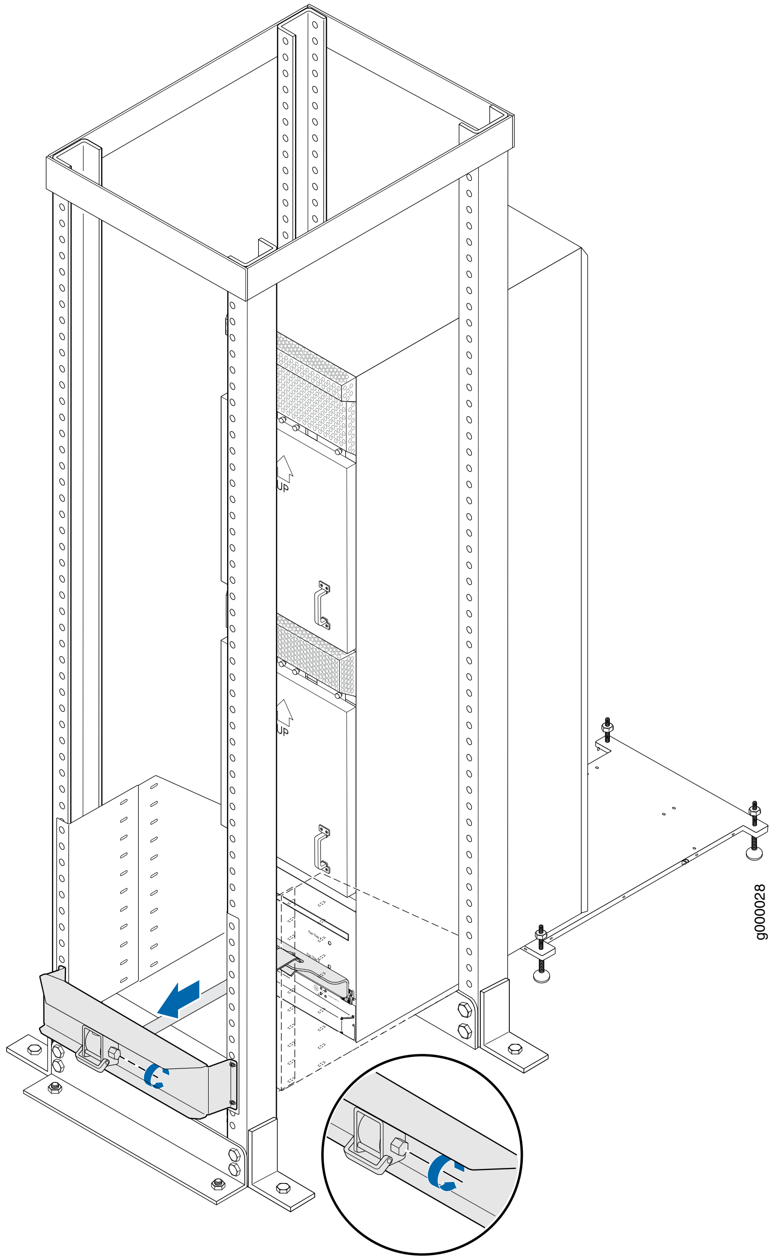
9. Attach the winch strap to the winch strap plate at the rear of the router (see Figure 105 on page 234).

Figure 105: 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 106 on page 235).

Figure 106: 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 on page 103
- Tools Required to Install the MX2020 Router Using a Router Transport Kit on page 191
- Installing the Router Transport Kit on the MX2020 Router on page 224
- MX2020 Moving Requirements and Guidelines Using a Router Transport Kit on page 113
- Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
- Reinstalling Components in the MX2020 Chassis After Installing It In a Rack on page 236

Reinstalling Components in the MX2020 Chassis After Installing It In a Rack

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:

1. Reinstalling the Power Distribution Modules After Installing the MX2020 In a Rack on page 237
2. Reinstalling the Power Supply Modules After Installing the MX2020 In a Rack on page 239
3. Reinstalling the Fan Trays After Installing the MX2020 In a Rack on page 240
4. Reinstalling the SFBs After Installing the MX2020 In a Rack on page 241
5. Reinstalling the Adapter Card After Installing the MX2020 In a Rack on page 242

Reinstalling the Power Distribution Modules After Installing the MX2020 In a Rack

To reinstall the AC or DC PDMs, follow this procedure for each PDM (see Figure 107 on page 238 and Figure 108 on page 238):

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. 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.

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

Figure 107: Reinstalling an AC Power Distribution Module

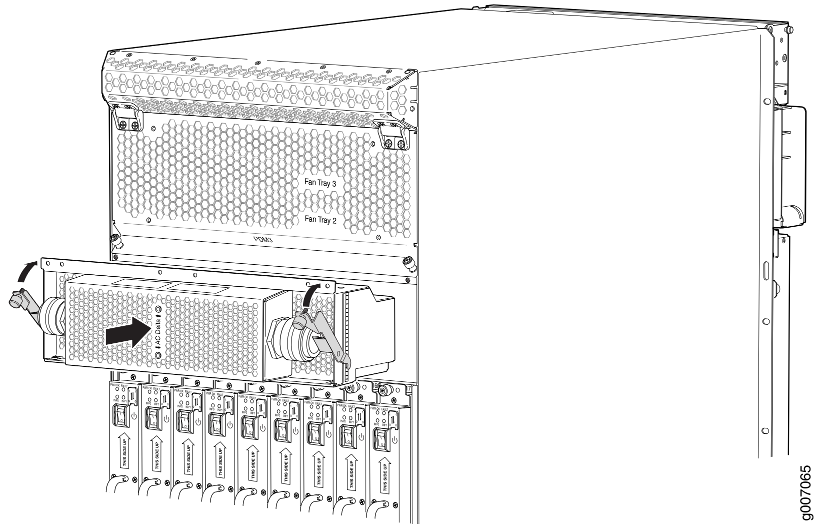
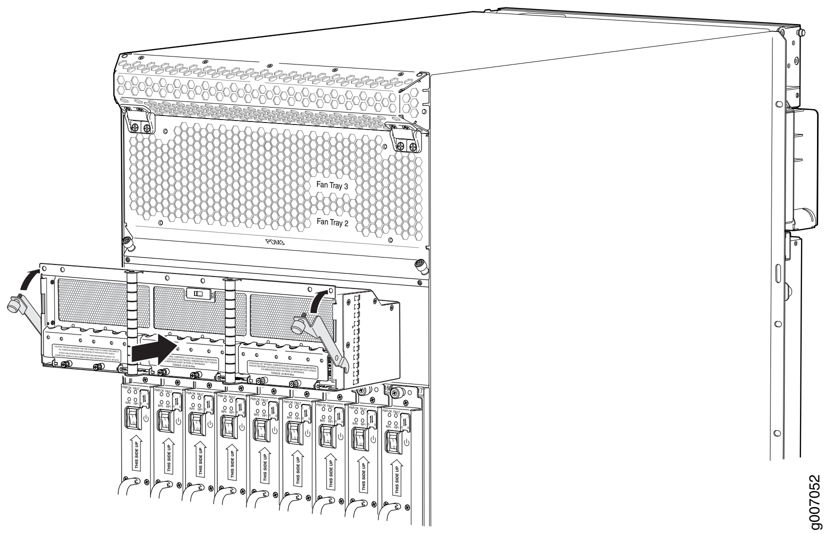


Figure 108: Reinstalling a DC Power Distribution Module



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.

Reinstalling the Power Supply Modules After Installing the MX2020 In a Rack

To reinstall the AC or DC PSMs, follow this procedure for each PSM (see Figure 109 on page 239 and Figure 110 on page 240): 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 109: Reinstalling an AC Power Supply Module

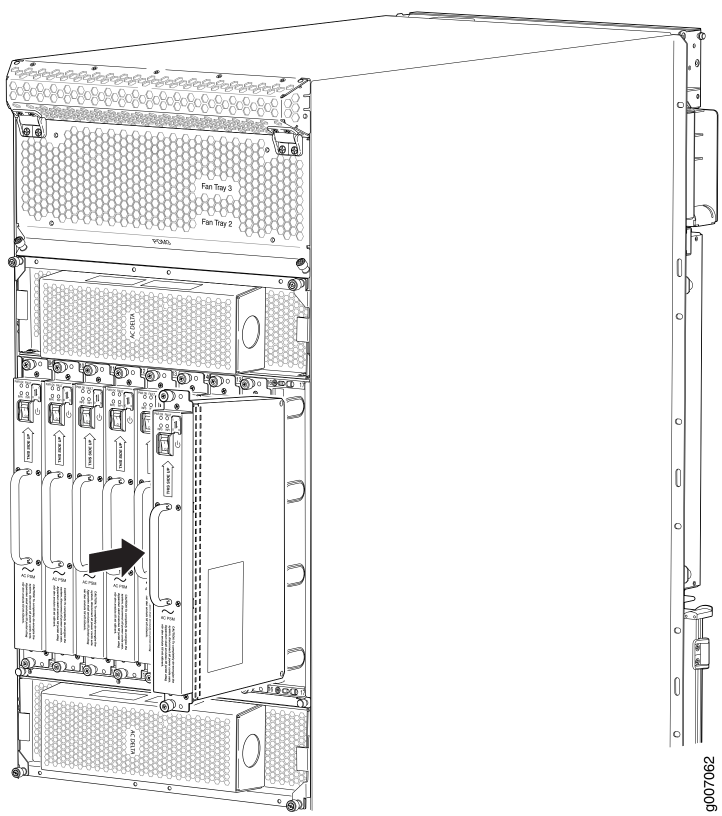
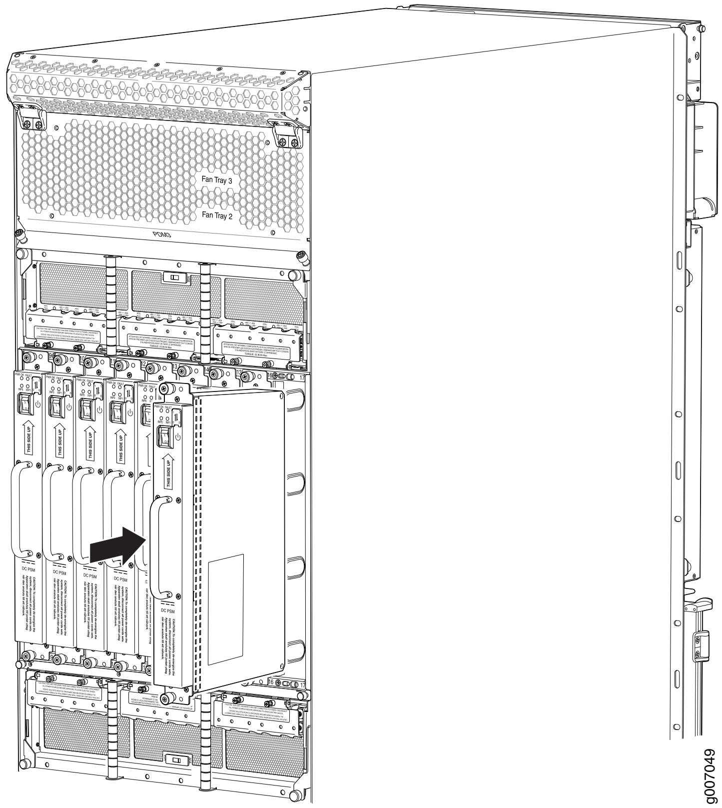


Figure 110: Reinstalling a DC Power Supply Module



Reinstalling the Fan Trays After Installing the MX2020 In a Rack

To reinstall the upper or lower fan trays (see Figure 111 on page 241 and Figure 112 on page 241):

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 111: Installing Upper Fan Trays

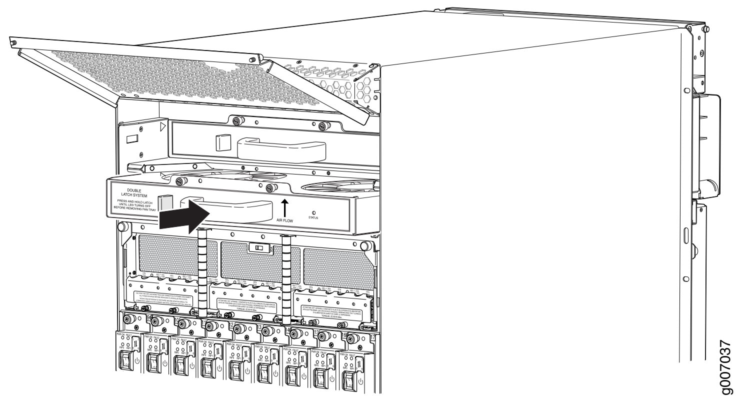
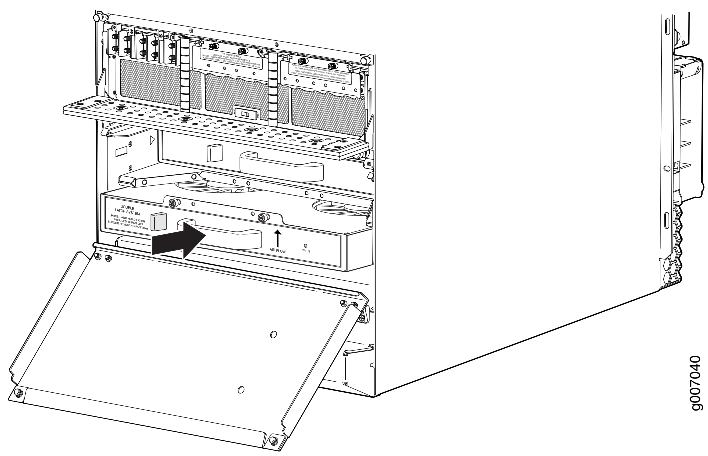


Figure 112: Installing Lower Fan Trays



Reinstalling the SFBs After Installing the MX2020 In a Rack

To reinstall an SFB (see Figure 113 on page 242):

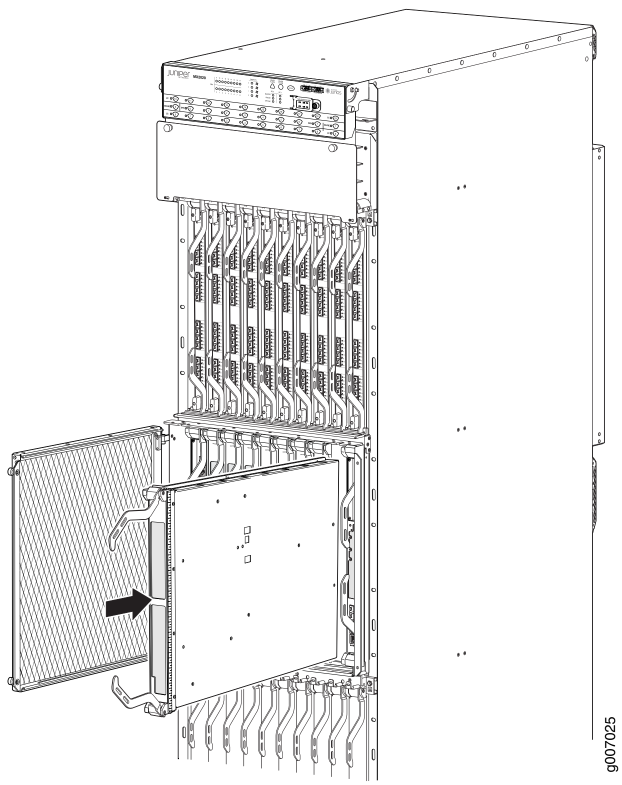
CAUTION: Before removing or replacing an SFB, ensure that the ejector handles are stored horizontally and pressed toward the center of the SFB.

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 113: Reinstalling an SFB



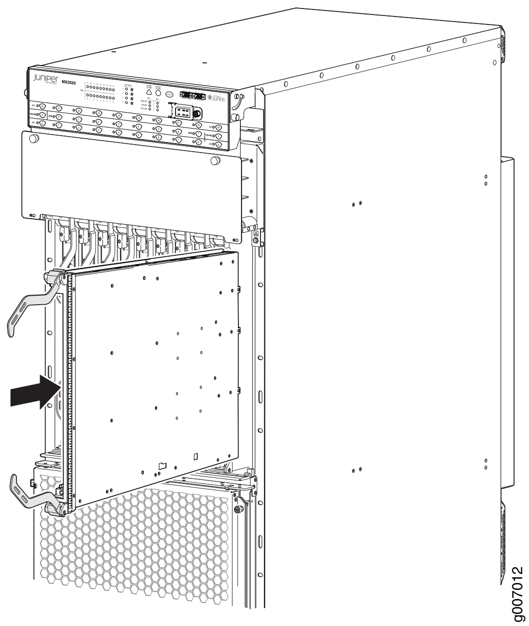
Reinstalling the Adapter Card After Installing the MX2020 In a Rack

To reinstall an ADC (see Figure 114 on page 243):

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 114: Reinstalling an ADC



Reinstalling the MPCs After Installing the MX2020 In a Rack

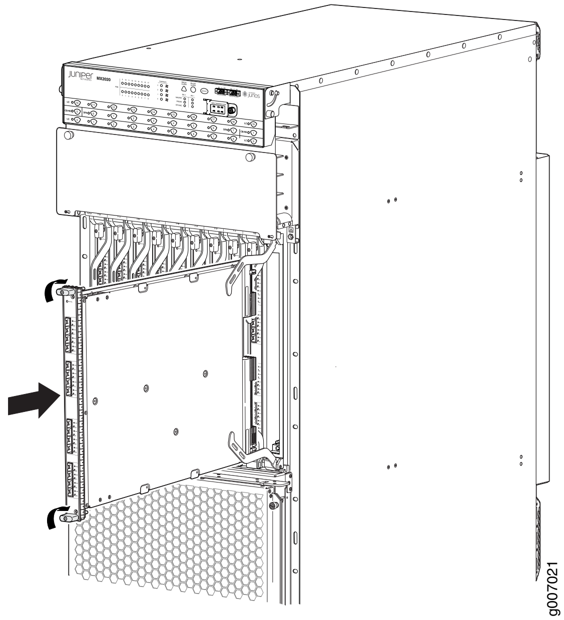
To reinstall an MPC (see Figure 115 on page 244):

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 115: Reinstalling an MPC

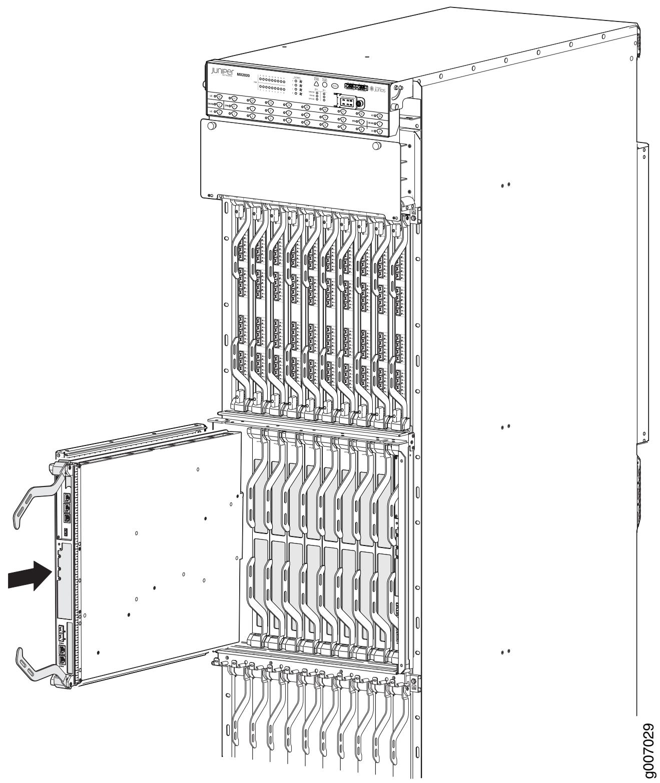


Reinstalling the CB-REs After Installing the MX2020 In a Rack

To reinstall a CB-RE (see Figure 116 on page 245):

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 116: Reinstalling a CB-RE



Related Documentation

- Overview of Preparing the Site for the MX2020 Router on page 103
- Tools Required to Install the MX2020 Router Using a Pallet Jack on page 191
- Removing Components from the MX2020 Router Chassis Before Installing It In a Rack on page 209
- Installing the MX2020 Router Using a Pallet Jack with Attachment on page 220

CHAPTER 19

Connecting the Router to Power

Grounding the MX2020 Router

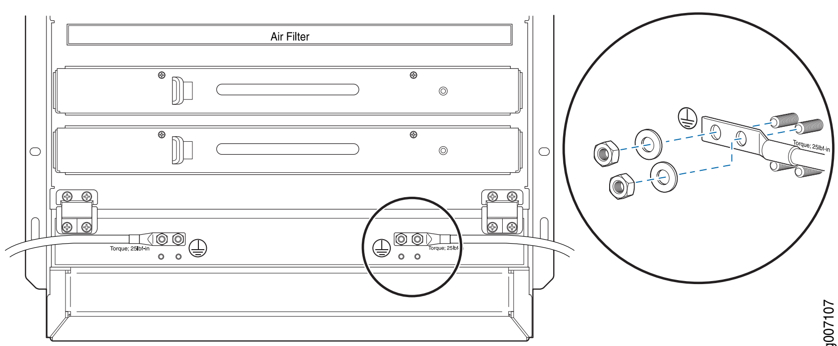
To ground the router, you need the following tools:

- 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 6-AWG for 60-A input
- Grounding cable, minimum 10 AWG wire (not provided)

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points using two screws. You must provide the grounding cables (the cable lugs are supplied with the router). To connect the grounding cable (see Figure 117 on page 248):

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 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, 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 117: Connecting the Grounding Cable



Related Documentation

- MX2020 Router Grounding Specifications on page 117
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- Connecting Power to a DC-Powered MX2020 Router with Power Distribution Modules on page 262

Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules

CAUTION: Do not mix AC and DC power modules within the same router.

WARNING: Power connections must be performed by a licensed electrician only.

You connect AC power to the router with three-phase delta AC 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. Switch the power switches on all the 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 the 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. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
10. Put the wires of the AC power cord through the hole of the metal wiring compartment.
11. Connect the wires to the AC terminal block on the three-phase delta AC PDM (see Figure 118 on page 250). Loosen the input terminal or grounding point screw, insert each wire into the grounding point input terminal, and tighten the screw (see Table 78 on page 251 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:

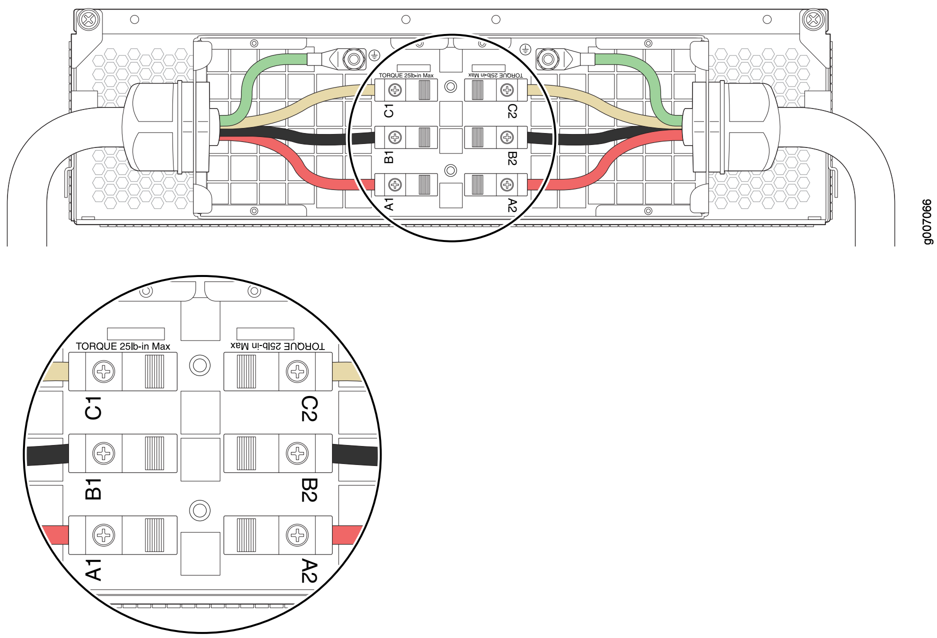
a. Insert the grounding wire into the grounding point labeled **GND**.

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 118: 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 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 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: 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 78: 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.

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 is not touching or blocking 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 delta AC PDMs.

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs on page 91
- Powering On the AC-Powered MX2020 Router on page 260
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules

CAUTION: **Do not mix AC and DC power modules within the same 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. Switch the power switches on all the 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.**

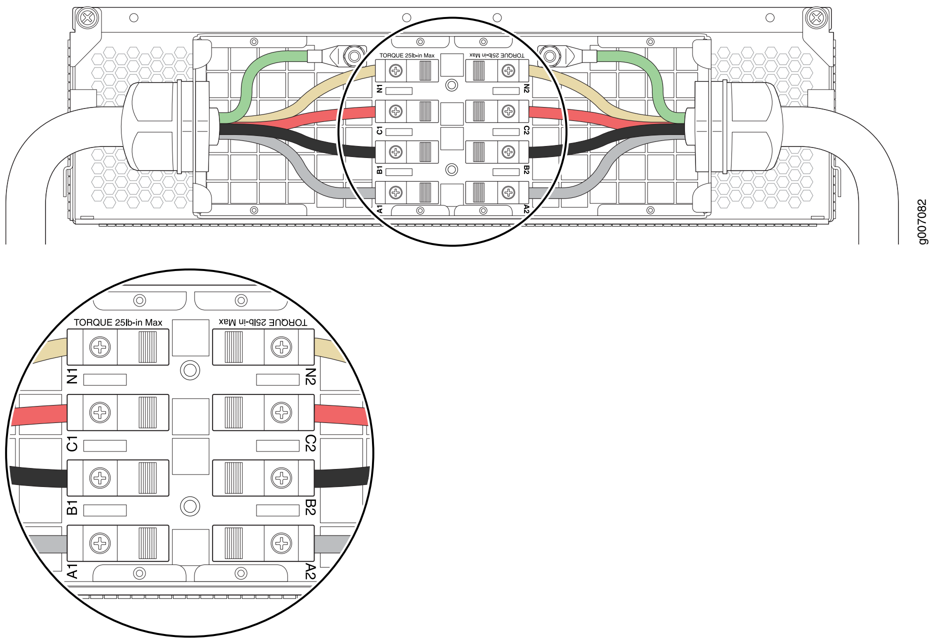
6. Using a number 2 Phillips (+) screwdriver, unscrew the four captive screws located on the either side of the metal AC wiring compartment (four screws total on each PDM).
7. Remove the metal cover of the metal AC wiring compartment.
8. Unscrew the retaining nut from the AC power cord.
9. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
10. Put 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 119 on page 254). Loosen the input terminal or grounding point screw, insert each wire into the grounding point or input terminal, and tighten the screw (see Table 79 on page 255 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 119: 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 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 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 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-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye 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 wye AC wire assembly kits can be purchased from Juniper Networks.

Table 79: 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.

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 is not touching or blocking 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

- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs on page 91

- Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on the MX2020 Router on page 168
- Powering On the AC-Powered MX2020 Router on page 260
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on the MX2020 Router

You connect AC power to the router with AC PDMs by connecting two AC power cords to each PDM. One feed maps to six PSMs and the other maps to three PSMs (see Figure 74 on page 169). The arrangement matches the internal components of the PDM. Table 64 on page 169 shows the AC PDM input mapping to AC **PDM0/Input0** and **PDM1/Input1**. Table 65 on page 170 shows the AC PDM input mapping to AC **PDM2/Input0** and **PDM3/Input1**.

Figure 120: Mapping AC Power Distribution Modules Input to AC Power Supply Modules

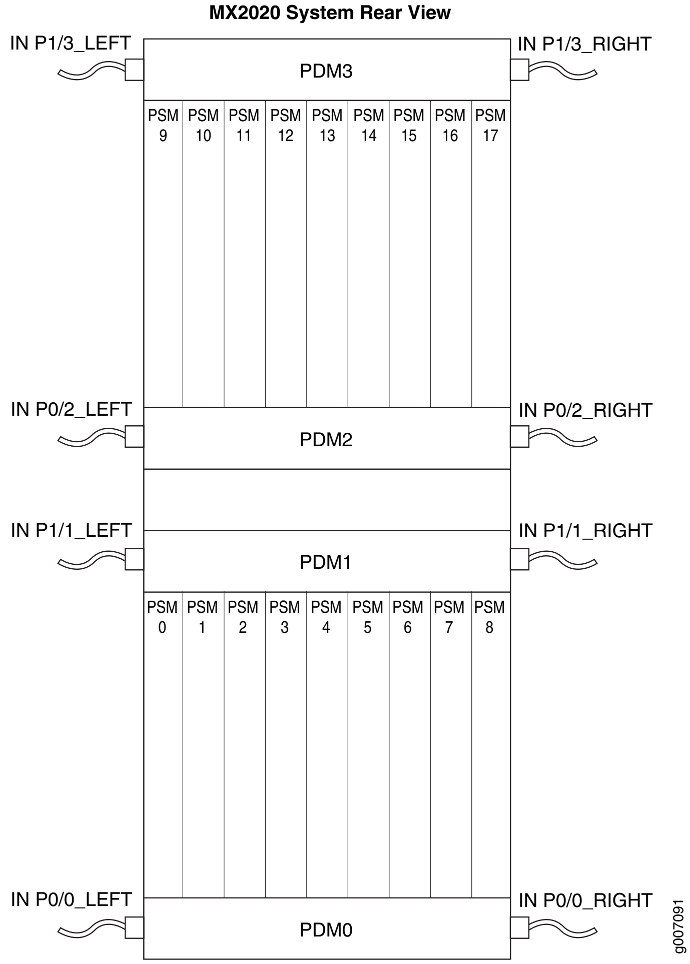


Table 80: Input AC Power Mapping for PDM0 and PDM1

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 81: 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	–

Related Documentation

- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252
- Powering On the AC-Powered MX2020 Router on page 260
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- MX2020 AC Power Cord Specifications on page 154
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Installing MX2020 AC Power Supply Modules

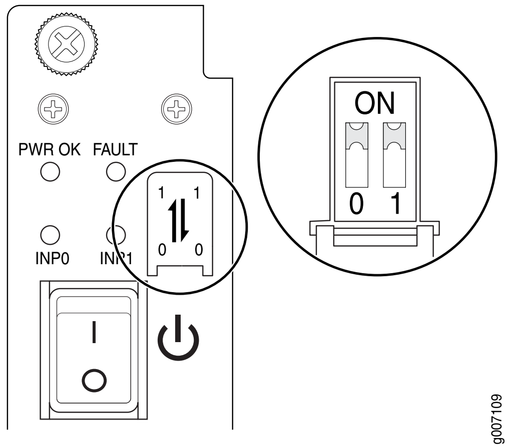
To install an MX2020 AC PSM:

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 121 on page 259).

   In addition, a PSM failure triggers the alarm LED on the craft interface.

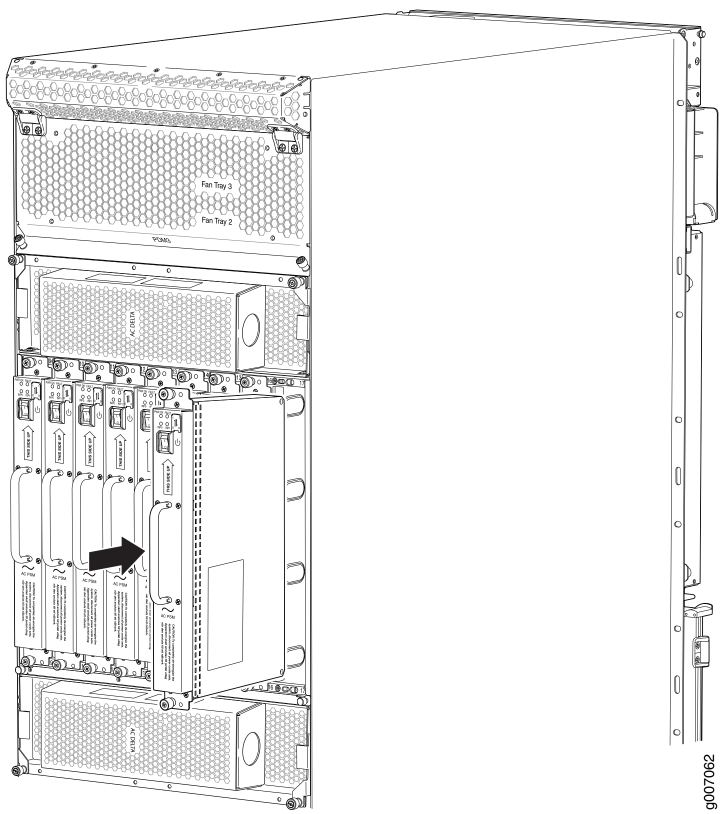
   NOTE: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed 0. Power will be drawn from feed 1 only if feed 0 fails.

Figure 121: 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 122 on page 259). 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 122: MX2020 Router with AC Power Supply Modules Installed

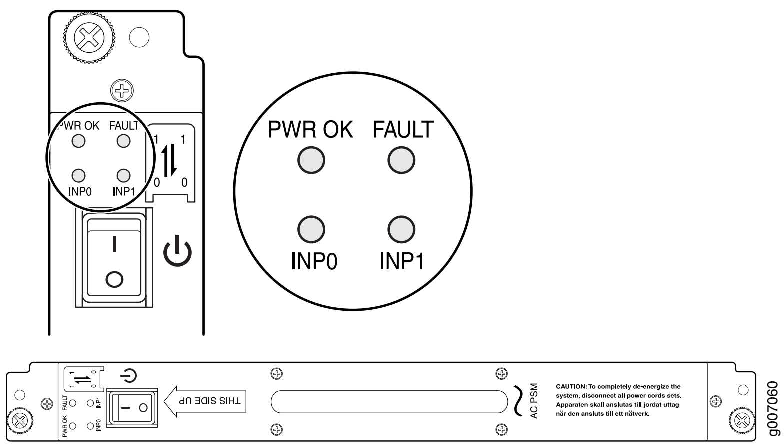


4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 123 on page 260).

   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 93 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 123: 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 on page 558
- Powering On the AC-Powered MX2020 Router on page 260

Powering On the AC-Powered MX2020 Router

You can use this procedure for a router with either a three-phase delta AC PDM or a three-phase wye AC PDM. To power on the AC-powered router:

1. Verify that the PSMs are fully inserted in the chassis and that the captive screws on their faceplates are tightened.
2. Verify that each AC power cord is connected correctly.

3. 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 will not be functional until you have completed the initial configuration.

4. Turn on the power to the external management device.
5. Switch on the dedicated customer site circuit breakers to provide power to the AC power cables. Follow your site's procedures.
6. 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.

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. Switch 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 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.

9. 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.
10. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.
11. Verify the MX2020 router power up, system initialization, and status. See "Initially Configuring the MX2020 Router" on page 287, and "Maintaining and Verifying the Status of the MX2020 Router Components" on page 340.

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Connecting the MX2020 Router to a Console or Auxiliary Device on page 276
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Mapping Input Power from AC Power Distribution Modules to AC Power Supply Modules on the MX2020 Router on page 168
- Powering Off the AC-Powered MX2020 Router on page 527
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

- Replacing an MX2020 AC Power Supply Module on page 428
- Replacing an MX2020 Three-Phase Delta AC Power Distribution Module on page 510

Connecting Power to a DC-Powered MX2020 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.

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) 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. Remove the 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.)
8. 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 124 on page 265). 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.)

   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.**

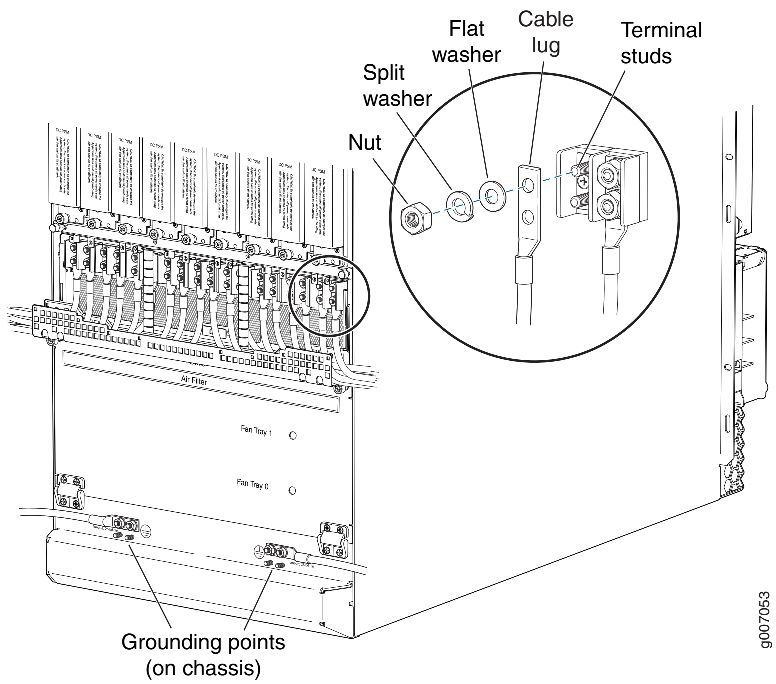
NOTE: The DC PDMs in slots **PDM0/Input0**, **PDM2/Input0**, **PDM1/Input1**, and **PDM3/Input1** can be powered by dedicated power feeds derived from feed **A**, or feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system to balance the power draw.

9. Close the plastic cable restraint cover over the terminal studs on the faceplate.
10. Route the positive and negative DC power cables through the left and right sides of the cable restraint.
11. 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.**

12. 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.
13. Repeat Steps 3 through 12 for the remaining PDMs.

Figure 124: Connecting DC Power to the MX2020 Router



Related Documentation

- DC Power Cable Specifications for the MX2020 Router on page 184
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Powering On the DC-Powered MX2020 Router on page 273

Installing MX2020 DC Power Supply Modules

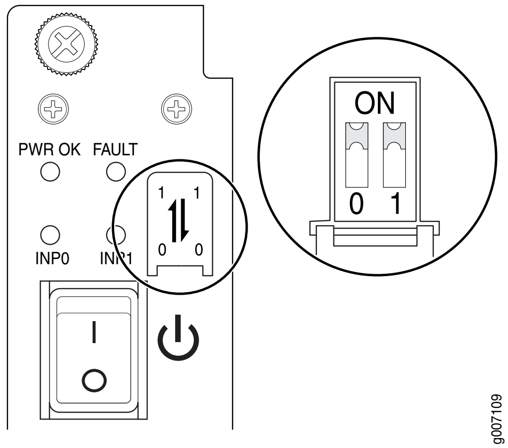
To install an MX2020 DC PSM:

1. Verify that the power switches on all PSMs are in the off (**O**) position.
2. On the PSM, slide the plastic cover away from the input mode switch to expose the dual DIP switches. Move the input mode DIP switch **0** (left switch) to the **ON** position for the bottom feed **INP0** (expected to be connected), and DIP switch **1** (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 125 on page 266).

   In addition, a PSM failure triggers the alarm LED on the craft interface.

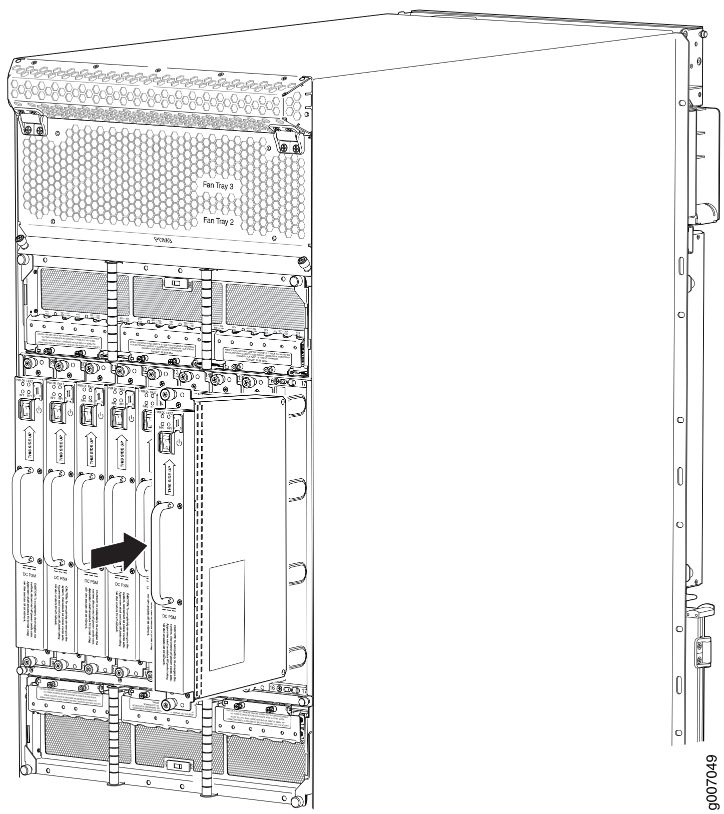
   NOTE: The DIP switches are only used to indicate presence of a feed. If both feeds are present, power is always drawn from feed 0. Power will be drawn from feed 1 only if feed 0 fails.

Figure 125: 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 126 on page 266). 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 126: MX2020 Router with DC Power Supply Modules Installed

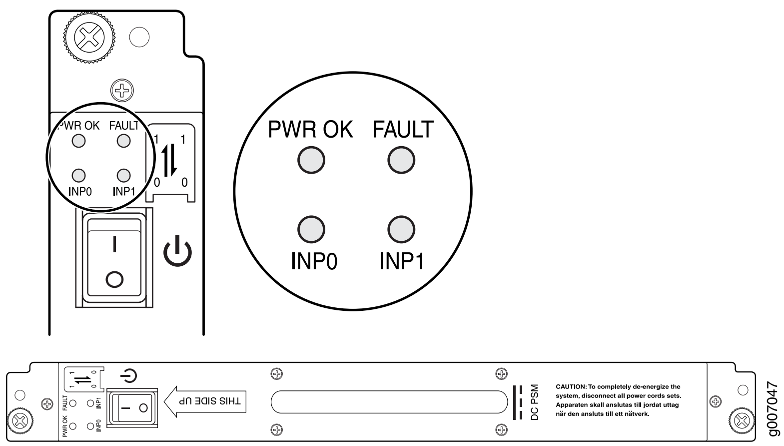


4. Verify that the **INP0** and/or **INP1** LEDs on the PSM are lit green steadily (see Figure 127 on page 267).

   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 98 for information on MX2020 DC PSM LEDs.
8. Repeat Steps 1 through 7 for installing PSMs in slots **0**, **1**, and **2**, where required.

Figure 127: MX2020 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

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Powering On the DC-Powered MX2020 Router on page 273

Connecting 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.

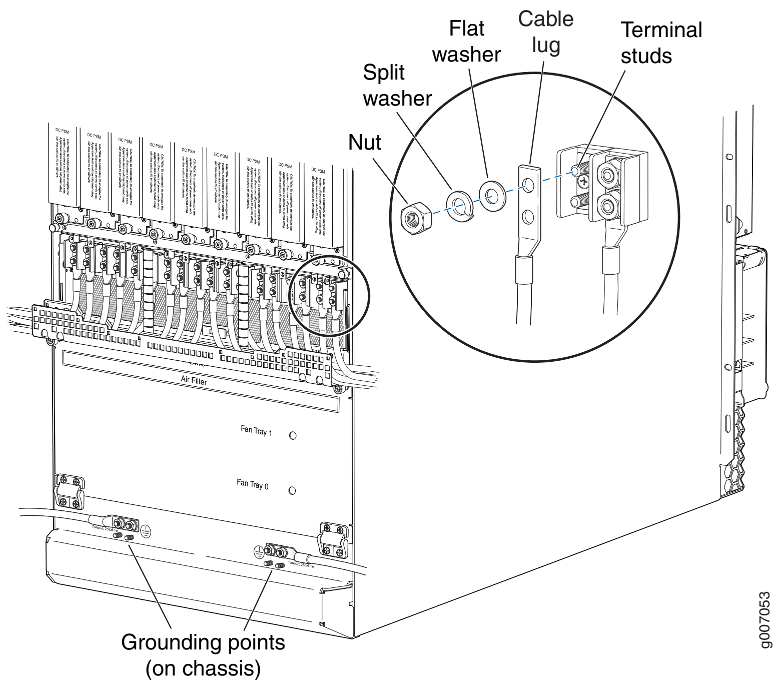
To connect a power cable for a DC PDM:

1. Locate a replacement power cable that meets the specifications defined in "MX2020 DC Power Subsystem Electrical Specifications" on page 179.
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 first with the flat washer, then the split washer, and then 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 128 on page 269). Do not overtighten the nut. (Use a 7/16-in. [11 mm)] torque-controlled driver or socket wrench.)

   CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when the nut is improperly threaded 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.

Figure 128: Connecting Power Cables to the DC Power Distribution Module



5. Route the positive and negative DC power cables through the plastic cable restraint cover. Make sure that the cable does not touch or obstruct any router components.
6. Verify that the DC power cable is connected correctly, that it does not touch or block access to router components, and that it does not drape where people could trip on it.
7. Attach the power cable to the DC power source.
8. Turn on the dedicated customer site circuit breaker to the PDM.
9. Verify that the **–48V** LED on the PDM is lit steadily.
10. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

NOTE: The circuit breaker may bounce back to the **OFF** position if you move the breaker too quickly.

Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the **–48V** LEDs light green steadily.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 DC Power Distribution Module Description on page 94
- DC Power Cable Specifications for the MX2020 Router on page 184

- MX2020 DC Power Electrical Safety Guidelines on page 585

Connect Power to a Single-Phase Seven-Feed AC Power Distribution Module

CAUTION: **Do not mix AC and DC power modules within the same router.**

To connect an AC power cord to an seven-feed single-phase AC 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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.
5. Move the safety retention bar downwards and tight the captive retention screws.
6. Connect the powers cords to the AC PDM.
7. Verify that the power cords are not touching or blocking access to router components, and that it does not drape where people could trip on it.

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

Connect Power to a Single-Phase Seven-Feed AC Power Distribution Module

CAUTION: **Do not mix AC and DC power modules within the same router.**

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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.

5. Move the safety retention bar downwards and tight the captive retention screws.
6. Connect the powers cords to the AC PDM.
7. Verify that the power cords are not touching or blocking access to router components, and that it does not drape where people could trip on it.

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

Connect Power to a Seven-Feed DC Power Distribution Module

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. For more information about ESD, see the *MX2010 3D Universal Edge Router Hardware Guide*.

   NOTE: **If the DC PSMs are installed in the router, make sure the power switch is turned to the off (O) position.**

2. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
3. Remove the DC PDM from the electrostatic bag.
4. Using both hands, slide the PDM part way into the chassis.
5. Open the two locking levers on either side of the PDM, and align them with the openings in the chassis.
6. Using both hands, push firmly on both spring loaded levers until the PDM is fully seated in the chassis slot. The PDM faceplate should be flush. Tighten both captive screws.

   NOTE: **Make sure the DC circuit feed switch on the PDM faceplate matches the current rating amperage, (60A) or (80A). This switch applies to all inputs of this PDM, and that selecting 60A reduces the available power output capacity of the PSMs supplied by this PDM.**

7. Loosen the captive screws on the clear plastic cable restraint protecting the terminal studs on the faceplate of the PDM.
8. Secure the power cable lugs to the terminal studs, first with the split washer, then with the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) torque to each nut (see Figure 129 on page 272). Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.).

   Table 67 on page 179 describes the DC operating range specifications.

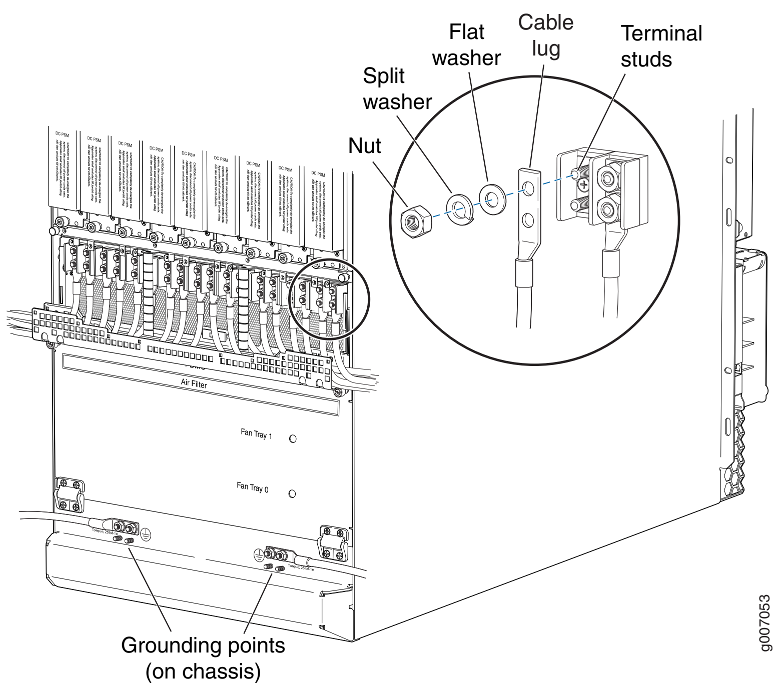
   a. Attach the positive (+) DC source power cable lug to the **RTN** (return) terminal.

   b. Attach the negative (–) DC source power cable lug to the **–48V** (input) terminal.

Table 82: MX2010 DC Power System Input Voltage

Item	Specification
DC input voltage	Operating range: –40 to –72 VDC

Figure 129: Connecting Ground and DC Power Cables



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: For information about connecting to DC power sources, see the *MX2010 3D Universal Edge Router Hardware Guide*.

9. Connect each DC power cable to the appropriate external DC power source.

NOTE: For information about connecting to external DC power sources, see the *MX2010 3D Universal Edge Router Hardware Guide*.

10. Switch on the external circuit breakers to provide voltage to the DC power source cable leads.

NOTE: Each PDM must be connected to a dedicated 60A or 80A DC circuit breaker for the DC power source. The PDM has a switch to accommodate DC circuit breaker amperage.

11. 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.
12. Close the cable restraint cover over the terminal studs, and tighten the captive screws.

Powering On the DC-Powered 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" on page 528.

13. Verify the MX2020 router power up, system initialization, and status, see "Initially Configuring the MX2020 Router" on page 287.

Related Documentation

- Connecting the MX2020 Router to Management and Alarm Devices on page 275
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Replacing an MX2020 DC Power Supply Module on page 454
- Replacing an MX2020 DC Power Distribution Module on page 457

CHAPTER 20

Connecting the Router to the Network

Connecting the MX2020 Router to Management and Alarm Devices

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. One Ethernet cable is provided with the router. 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 131 on page 276 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 130 on page 275 shows the port. Table 83 on page 276 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 130: Out-of-Band Management Port

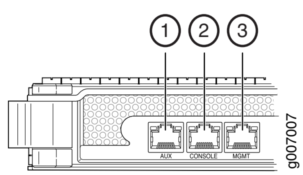


Figure 131: Out-of-Band Management Cable Connector

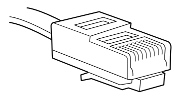


Table 83: Out-of-Band Management Port on the MX2020 CB-RE

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.

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. One serial cable with an RJ-45 connector and a DB-9 connector is provided with the router. To connect a device to the **CONSOLE** port and another device to the **AUX** port, you must supply an additional cable.

WARNING: The MX2020 router must be adequately grounded before powering on the console or auxiliary devices, (see "MX2020 Router Grounding Specifications" on page 117).

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 133 on page 277) into the **AUX** port or **CONSOLE** port on the CB-RE interface. Figure 132 on page 277 shows the ports. Table 84 on page 277 describes the auxiliary and console ports.
3. Plug the female DB-9 end into the device's serial port.

NOTE:
For console devices, configure the serial port to the following values:

- Baud rate—9600
- Parity—N
- Data bits—8
- Stop bits—1
- Flow control—none

Figure 132: Console and Auxiliary Ports

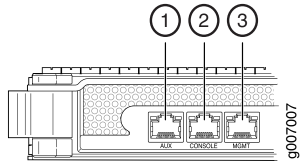


Figure 133: Console and Auxiliary Cable Connector

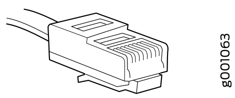


Table 84: Console and Auxiliary Ports on the MX2020 CB-RE

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.

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 134 on page 278). 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 85 on page 278). 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 134 on page 278).

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 134: Alarm Relay Contacts

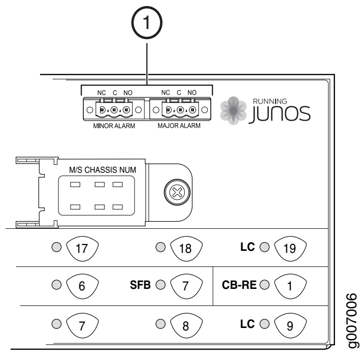


Table 85: Alarm Relay Contacts

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

- Tools and Parts Required for MX2020 Router Connections on page 193
- Connecting MPC or MIC Cables to the MX2020 Router on page 284
- CB-RE Interface Cable and Wire Specifications for MX Series Routers on page 130

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. One Ethernet cable is provided with the router. 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 131 on page 276 shows the connector) into the **MGMT** port on the CB-RE interface. Figure 130 on page 275 shows the port. Table 83 on page 276 describes the Ethernet ports.
3. Plug the other end of the cable into the network device.

Figure 135: Out-of-Band Management Port

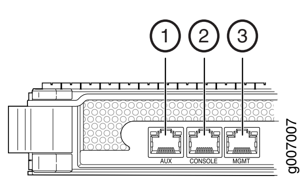


Figure 136: Out-of-Band Management Cable Connector

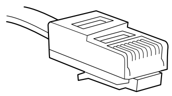


Table 86: Out-of-Band Management Port on the MX2020 CB-RE

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 on page 276
- Connecting an MX2020 Router to an External Alarm-Reporting Device on page 277

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. One serial cable with an RJ-45 connector and a DB-9 connector is provided with the router. To connect a device to the **CONSOLE** port and another device to the **AUX** port, you must supply an additional cable.

WARNING: The MX2020 router must be adequately grounded before powering on the console or auxiliary devices, (see “MX2020 Router Grounding Specifications” on page 117).

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 133 on page 277) into the **AUX** port or **CONSOLE** port on the CB-RE interface. Figure 132 on page 277 shows the ports. Table 84 on page 277 describes the auxiliary and console ports.
3. Plug the female DB-9 end into the device's serial port.

NOTE:
For console devices, configure the serial port to the following values:

- Baud rate—9600
- Parity—N
- Data bits—8
- Stop bits—1
- Flow control—none

Figure 137: Console and Auxiliary Ports

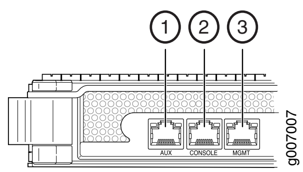


Figure 138: Console and Auxiliary Cable Connector

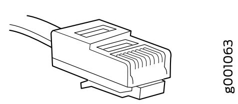


Table 87: Console and Auxiliary Ports on the MX2020 CB-RE

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 on page 275
- Connecting an MX2020 Router to an External Alarm-Reporting Device on page 277

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 134 on page 278). 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 85 on page 278). 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 134 on page 278).

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 139: Alarm Relay Contacts

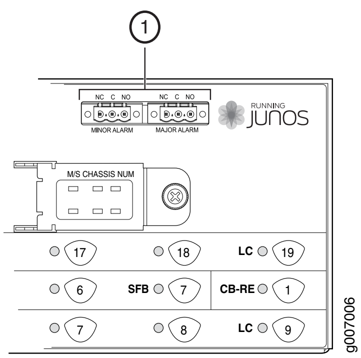


Table 88: Alarm Relay Contacts

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 on page 276
- Connecting the MX2020 Router to a Network for Out-of-Band Management on page 275

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 140 on page 282):

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 89 on page 282). 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 140: Alarm Relay Contacts

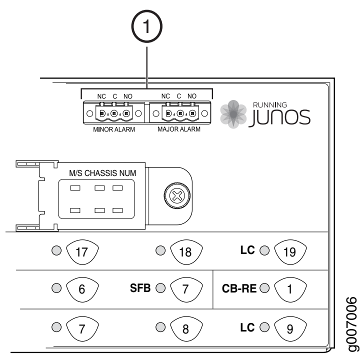


Table 89: Connecting Alarm Relay Contacts

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 on page 299
- Removing the MX2020 Craft Interface on page 451
- Maintaining and Verifying the Status of the MX2020 Craft Interface on page 399

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 141 on page 283):

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 90 on page 283).

Figure 141: Alarm Relay Contacts

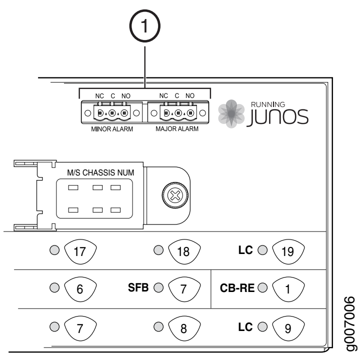


Table 90: Alarm Relay Contacts on the Craft Interface

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 on page 299
- Removing the MX2020 Craft Interface on page 451
- Maintaining and Verifying the Status of the MX2020 Craft Interface on page 399

Connecting MPC or MIC Cables to the MX2020 Router

To connect the MPCs or MICs to the network (see Figure 142 on page 285 and Figure 143 on page 285):

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.

   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 142: Attaching a Cable to a MPC

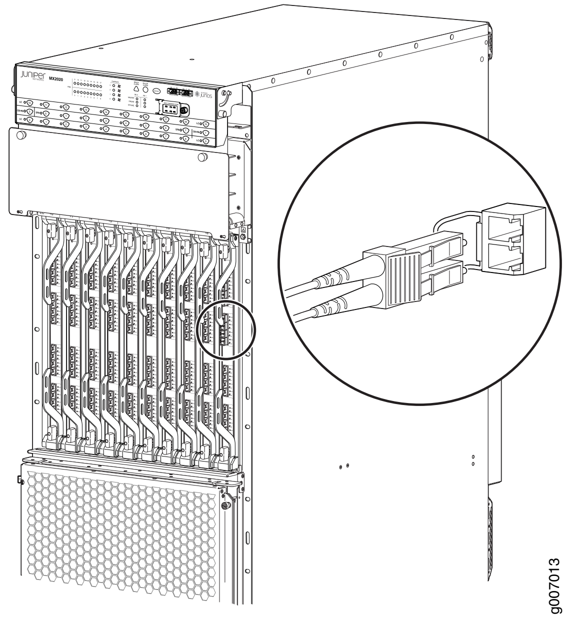
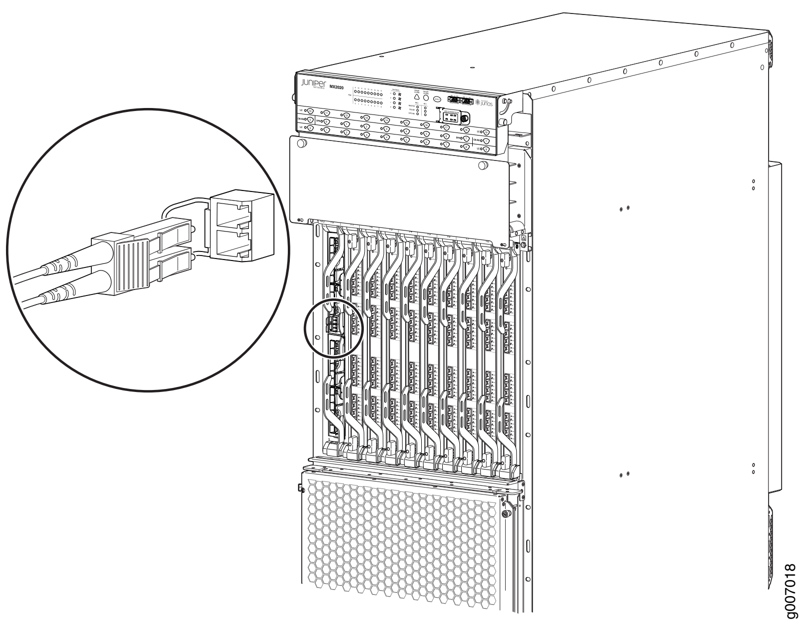


Figure 143: Attaching a Cable to a MIC



Related Documentation

- Connecting the MX2020 Router to Management and Alarm Devices on page 275
- Tools and Parts Required for MX2020 Router Connections on page 193
- Grounding the MX2020 Router on page 247

CHAPTER 21

Initially Configuring the Router

Initially Configuring the MX2020 Router

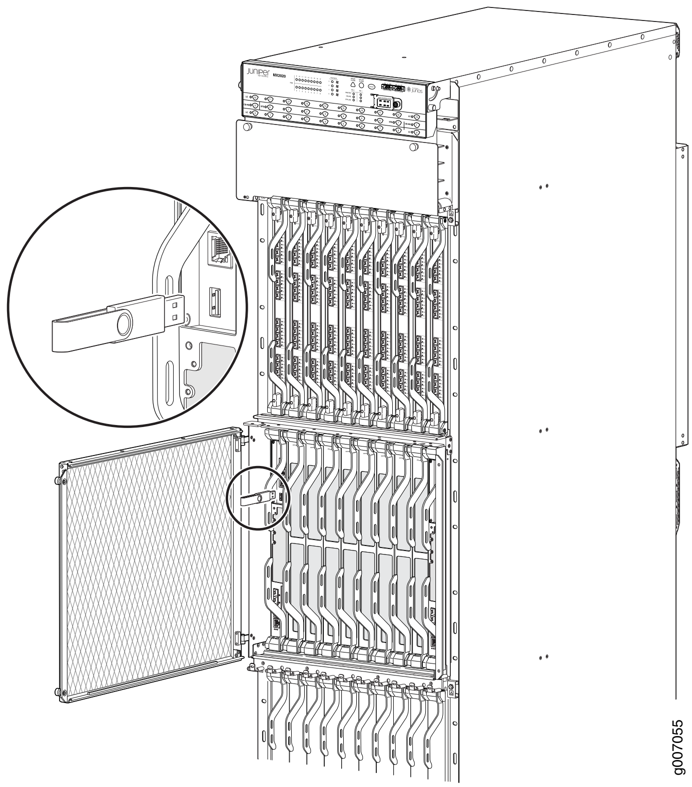
The MX2020 router is shipped with the Junos OS preinstalled and ready to be configured when the MX2020 router is powered on. There are three copies of the software: one on a CompactFlash card in the CB-RE, one on a solid state drive (SSD) in the CB-RE, and one on a USB flash drive that can be inserted into the slot in the CB-RE faceplate (see Figure 144 on page 288).

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 144: 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 on page 260
- Powering On the DC-Powered MX2020 Router on page 273
- Grounding the MX2020 Router on page 247
- Routine Maintenance Procedures for the MX2020 Router on page 407

CHAPTER 22

Installing and Replacing Components

Installing an MX2020 AC Power Supply Module

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.

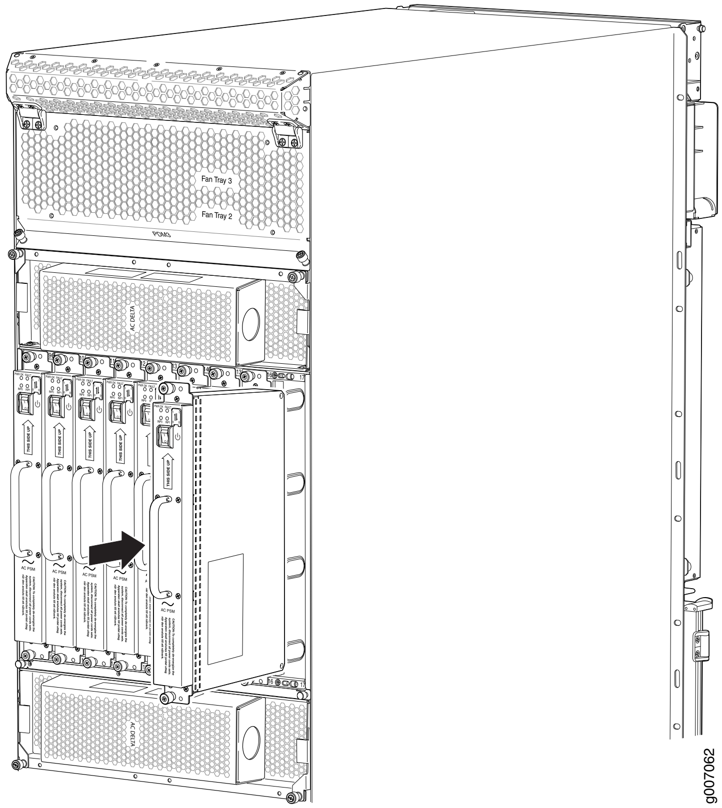
To install an AC PSM (see Figure 145 on page 295):

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 145: Installing an AC Power Supply Module



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 AC Power Supply Module Description on page 158
- MX2020 AC Power Subsystem Electrical Specifications on page 158
- Removing an MX2020 AC Power Supply Module on page 428

Installing an MX2020 Adapter Card

An ADC weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To install an ADC (see Figure 146 on page 296):

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 ADC from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Orient the ADC so that the faceplate faces you vertically.
5. Lift the ADC into place, and carefully align the sides of the ADC with the guides inside the card cage.

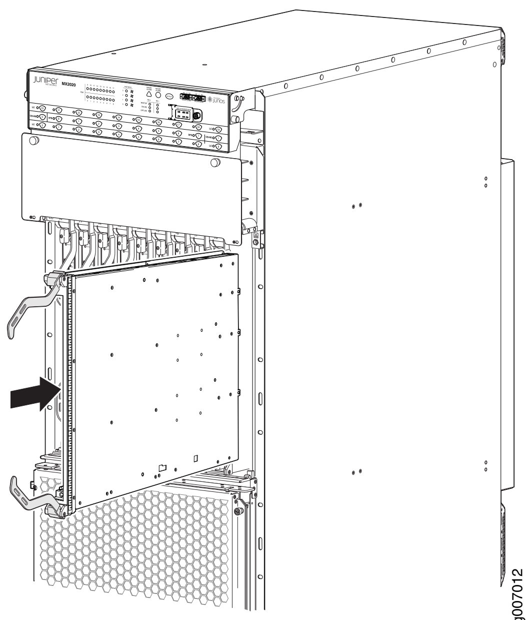
6. Slide the ADC all the way into the card cage until you feel resistance.
7. Grasp both ejector handles, and gently close them inward simultaneously until the ADC is fully seated.
8. Issue the following CLI command to bring the ADC online:

   `user@host>`**request chassis fdc 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 fdc online** command, the FRU will gain power, and the system total power will decrease.

Figure 146: Installing an ADC



Related Documentation

- MX2020 Adapter Card (ADC) Description on page 67
- Maintaining the MX2020 Adapter Cards on page 338
- Removing an MX2020 Adapter Card on page 489

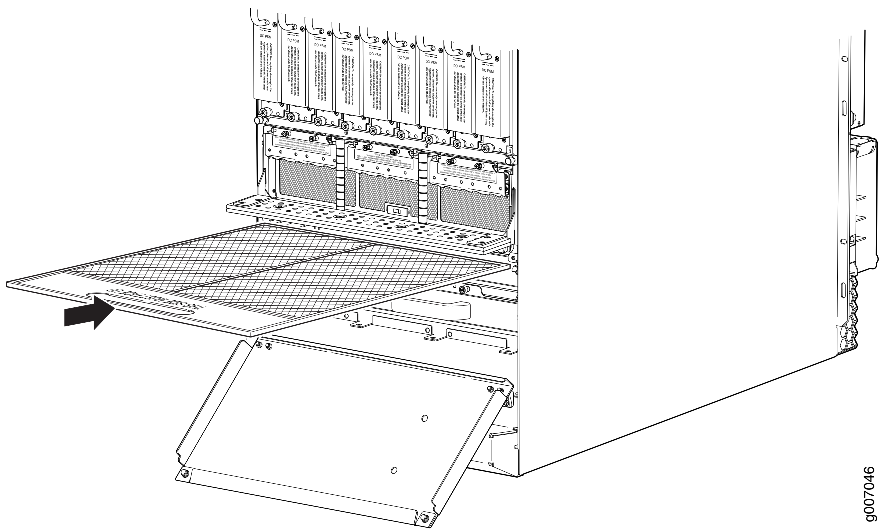
Installing the MX2020 Air Filter

To install the lower air filter—MX2020-FLTR-KIT-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the air filter is right side up.

3. Open the fan tray and air filter access door, located at the bottom of the chassis.
4. Grasp the handle on the air filter and insert into the chassis until it stops, (see Figure 147 on page 297).
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 147: Installing the Air Filter



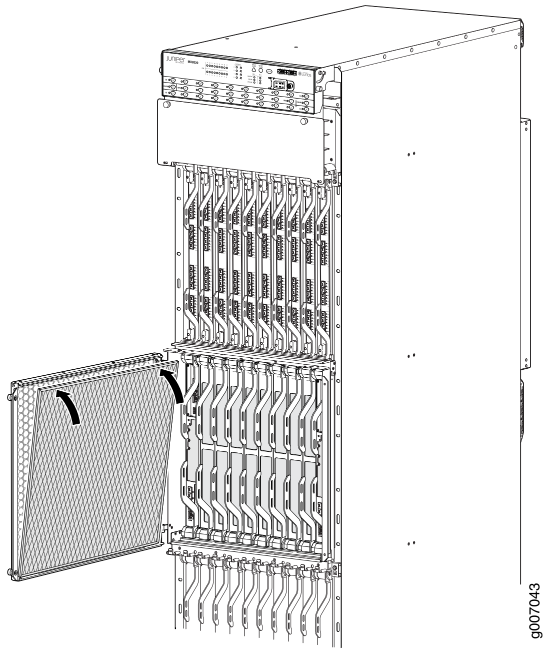
To install the middle card cage cable manager air filter—MX2020-MID-FLTR-PNL-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the 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 148 on page 298).

Figure 148: Installing the Middle Card Cage Cable Manager Air Filter



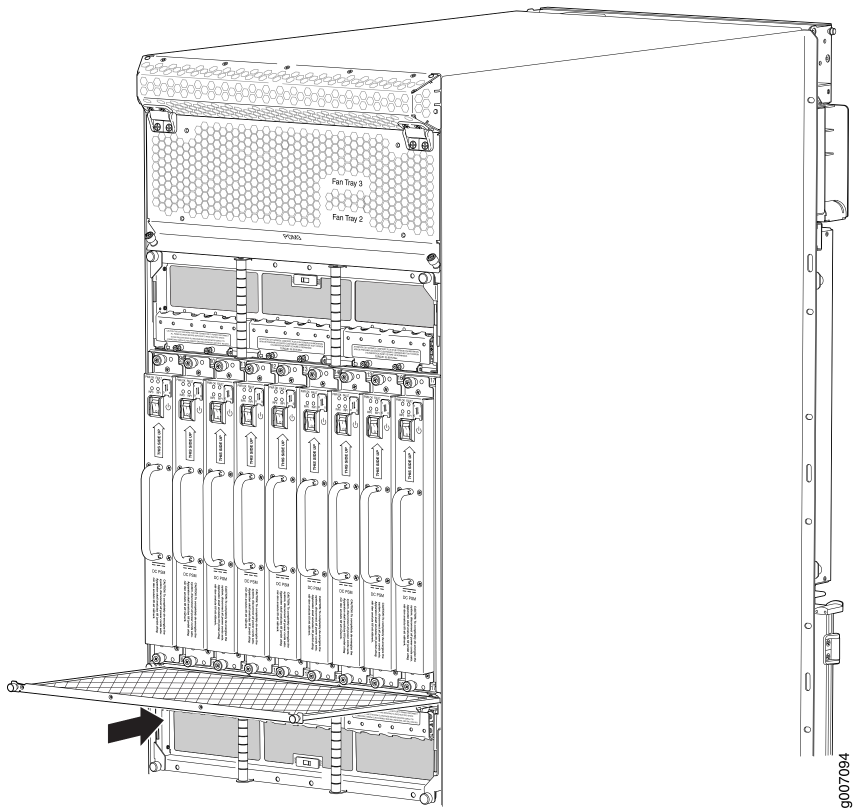
5. Push the air filter in place, close the door, and tighten the two captive screws.
6. Replace the cables in the middle card cage cable manager, if necessary.

To install the PSM air filter—MX2000-FLTR-PWR:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the air filter is right side up.
3. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 149 on page 299).
4. Tighten the two captive screws to secure.

NOTE: The AC-powered MX2020 router has the same air filter.

Figure 149: Installing the PSM Air Filter



Related Documentation

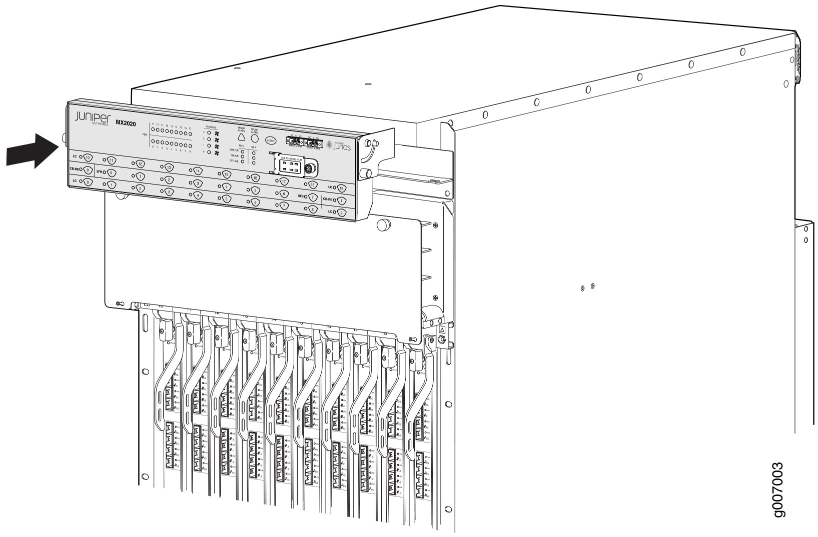
- Maintaining the MX2020 Air Filter on page 341
- Removing the MX2020 Air Filter on page 431

Installing the MX2020 Craft Interface

To install the craft interface (see Figure 150 on page 300):

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 150: Installing the Craft Interface



Related Documentation

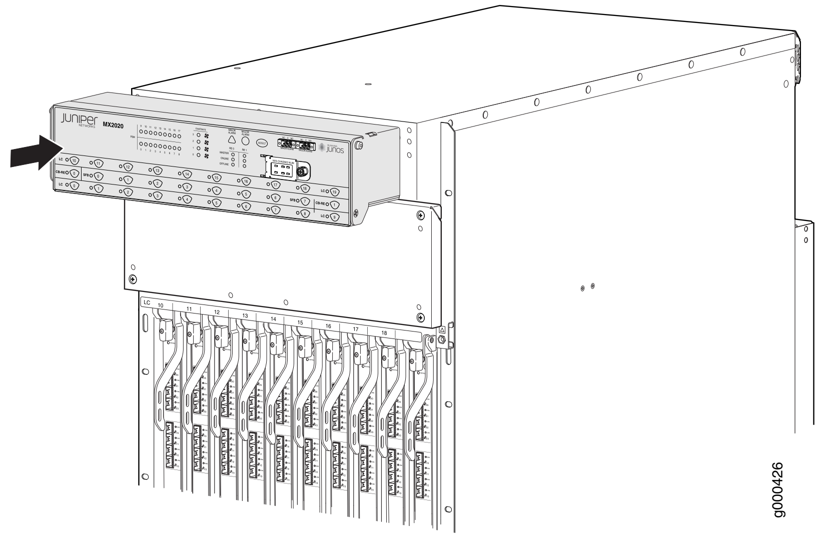
- MX2020 Craft Interface Description on page 37
- Maintaining and Verifying the Status of the MX2020 Craft Interface on page 399
- Removing the MX2020 Craft Interface on page 451

Installing an MX2020 Extended Craft Interface

To install the extended craft interface (see Figure 151 on page 301):

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 151: Installing the Extended Craft Interface



Related Documentation

- MX2020 Craft Interface Description on page 37
- Maintaining and Verifying the Status of the MX2020 Craft Interface on page 399

Installing an MX2020 CB-RE

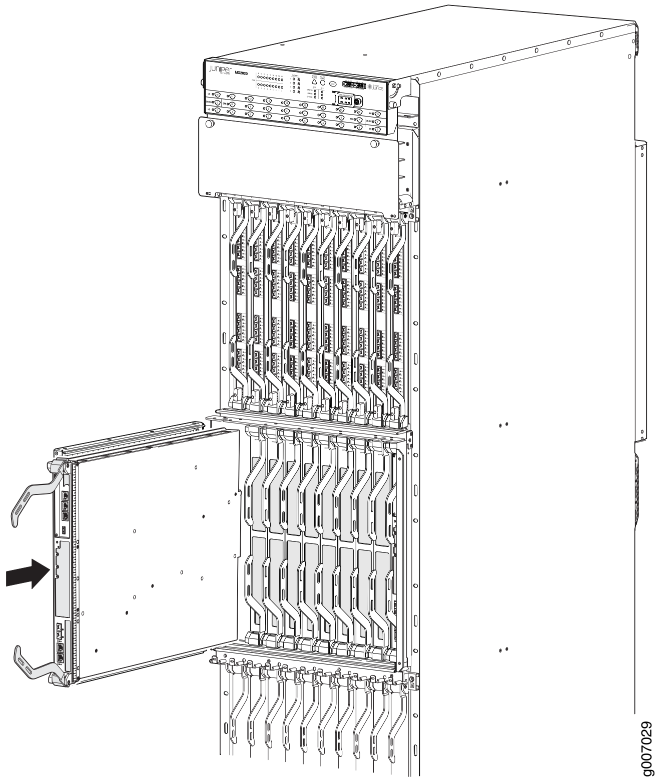
To install a CB-RE (see Figure 152 on page 303):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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 “Contacting Customer Support” on page 549.
7. 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
```


Figure 152: Installing a CB-RE



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Effect of Taking the MX2020 Host Subsystem Offline on page 402
- Taking an MX2020 Host Subsystem Offline on page 401
- Removing an MX2020 CB-RE on page 419

Installing the MX2020 DC Cable Manager

NOTE: To accommodate additional clearance, you may order an extended DC cable manager from Juniper Networks.

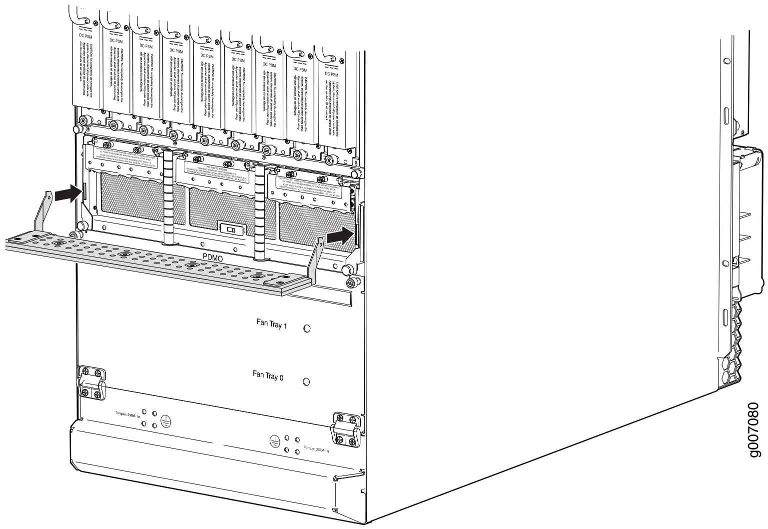
To install the DC cable manager (see Figure 153 on page 304):

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 153: Installing the Standard DC Cable Manager



Related Documentation

- Removing the MX2020 DC Cable Manager on page 439

Installing an MX2020 DC Power Supply Module

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.

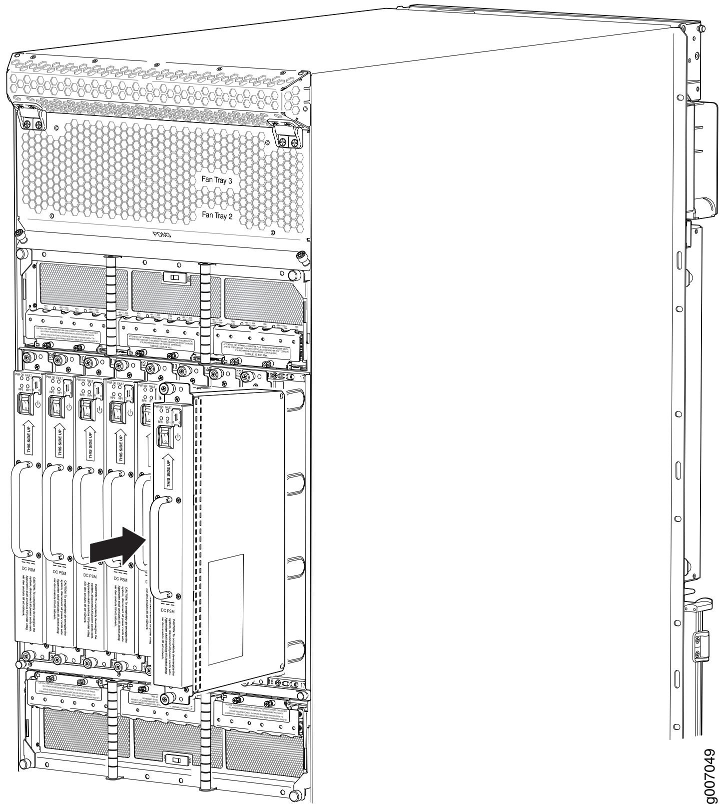
To install a DC PSM (see Figure 154 on page 306):

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 154: Installing a DC Power Supply Module



Related Documentation

- MX2020 DC Power Supply Module Description on page 96
- Removing an MX2020 DC Power Supply Module on page 454

Installing an MX2020 Dual-Wide MIC

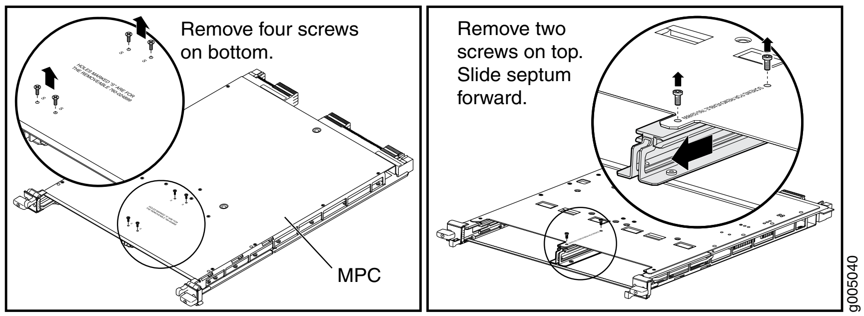
To install a dual-wide MIC:

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 155 on page 307):
   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 487.
   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 492.

Figure 155: 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.

> 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 374.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Removing an MX2020 MIC on page 477
- Installing an MX2020 MIC on page 315

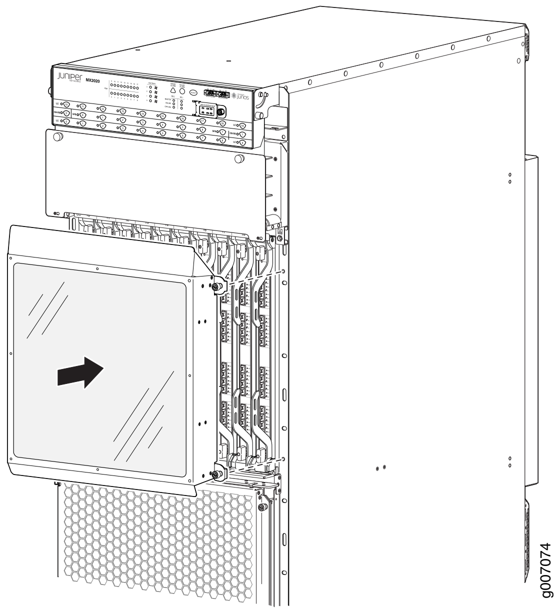
Installing the MX2020 Standard EMI Covers

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 156 on page 309).

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 156: Installing the Standard EMI Card Cage Cover



Related Documentation

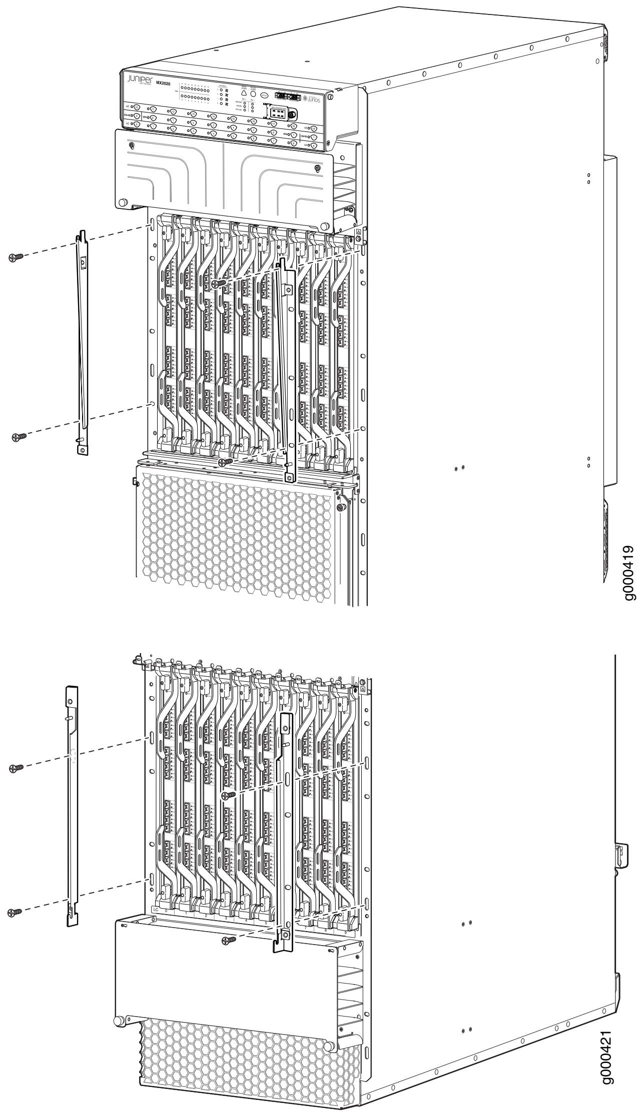
- Removing the MX2020 Standard EMI Covers on page 465

Installing the MX2020 Extended EMI Cover

Two extended electromagnetic interference (EMI) covers attach to the router over the upper and lower card cages.

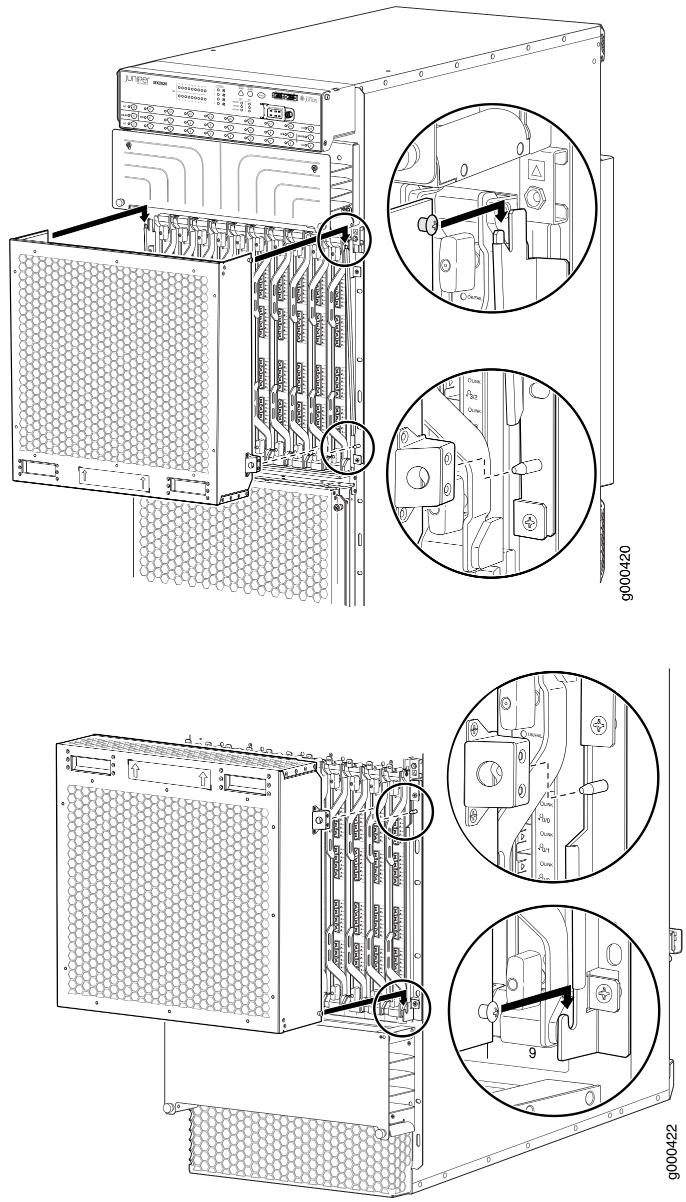
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. On each side of the upper and lower card cage, orient the extended EMI cover mounting brackets so that they line up with the mounting holes.
   - For the upper 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 157 on page 310).

Figure 157: 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 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 158: Installing the Extended EMI Card Cage Cover



Related Documentation

- Replacing the MX2020 Standard EMI Covers on page 465

Installing an MX2020 Fan Tray

This topic describes how to install the upper or lower fan trays in a MX2010. This procedure applies to both the standard fan tray and the optimized power fan tray.To install the upper or lower fan tray (see Figure 159 on page 313 and Figure 160 on page 313):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Reposition the DC cable manager, if necessary, before installing the upper or lower fan tray:
   - Unwrap any cables on the DC cable manager and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable manager, and tray and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
3. Loosen the two captive screws on the access panel and then swing the panel open.
4. Remove the fan tray from the antistatic mat or ESD bag.
5. Grasp the fan tray by the handle, and place one hand under the fan tray for support. Insert the fan tray partially into the chassis while pressing the latch.

   NOTE: When inserting the fan tray observe the correct orientation by the "this side up" label on the fan tray.

6. Press and hold the latch again while carefully pushing the fan tray into the chassis.

   NOTE: The fan tray has a double locking safety mechanism that allows you to safely install the fan tray in a two-stage process.

7. Tighten the two captive screws on the fan tray faceplate. 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. Close the access panel and secure the two captive screws on either side of the access panel. 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. Reinstall the DC cable manager back into position, if necessary.

Figure 159: Installing Upper Fan Trays

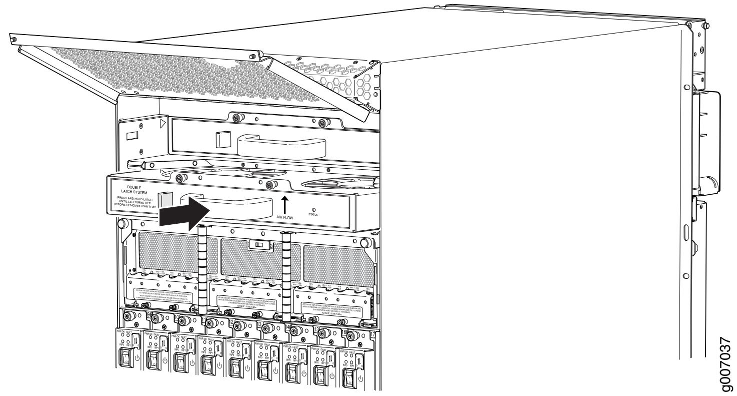
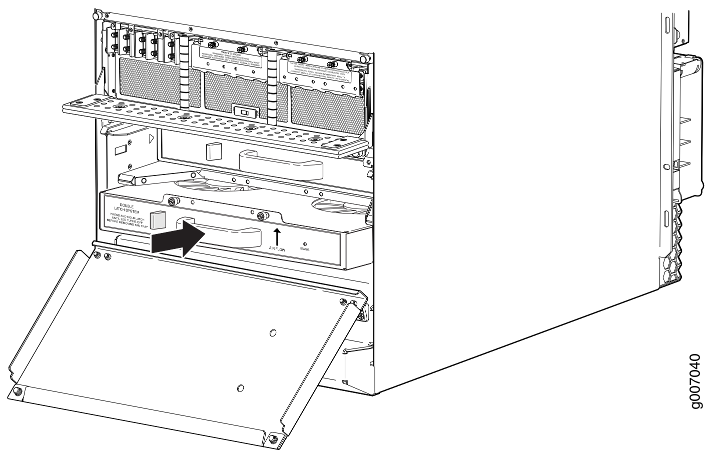


Figure 160: Installing Lower Fan Trays



Related Documentation

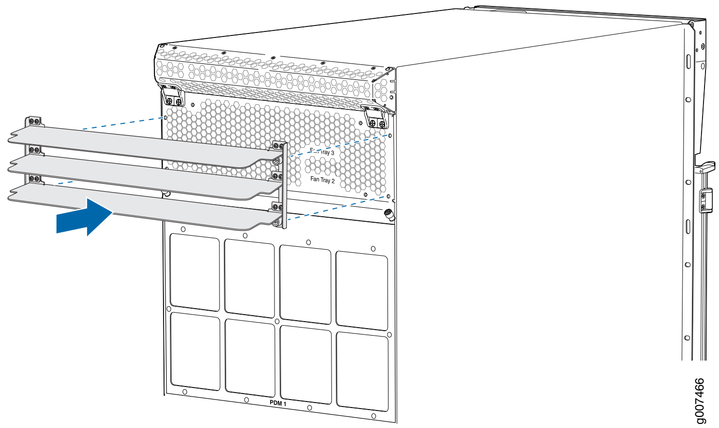
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Maintaining the MX2020 Fan Trays on page 345
- Removing an MX2020 Fan Tray on page 472

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 161 on page 314).
4. Tighten the four captive screws to secure the air baffle to the upper fan tray access door.

Figure 161: Installing the Air Baffle



Related Documentation

- Maintaining the MX2020 Air Baffle on page 344
- Removing the MX2020 Air Baffle on page 475

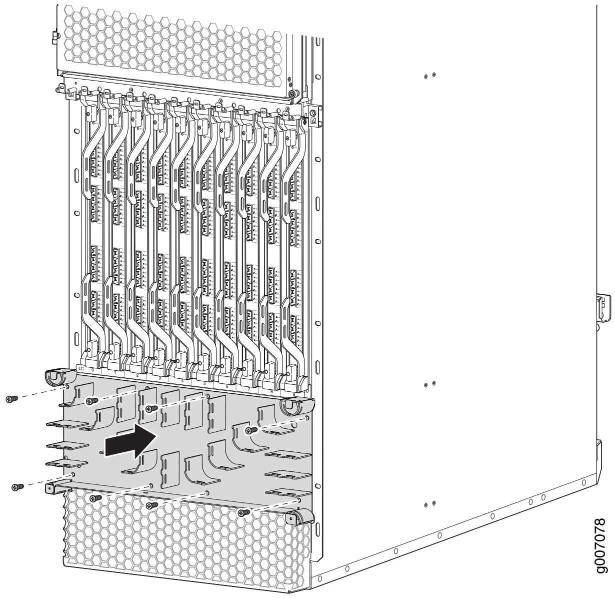
Installing the MX2020 Lower Cable Manager

NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To install the lower cable manager (see Figure 162 on page 315):

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 162: Installing the Standard Lower Cable Manager



Related Documentation

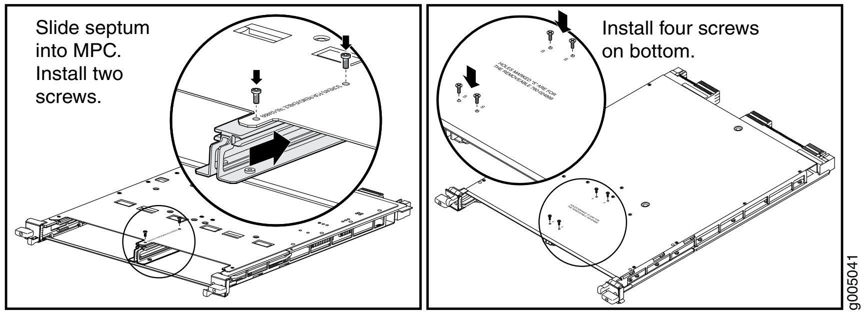
- Removing the MX2020 Lower Cable Manager on page 438

Installing an MX2020 MIC

To install a MIC (see Figure 164 on page 317):

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 163 on page 316):
   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 487.
   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 492.

Figure 163: 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.

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.

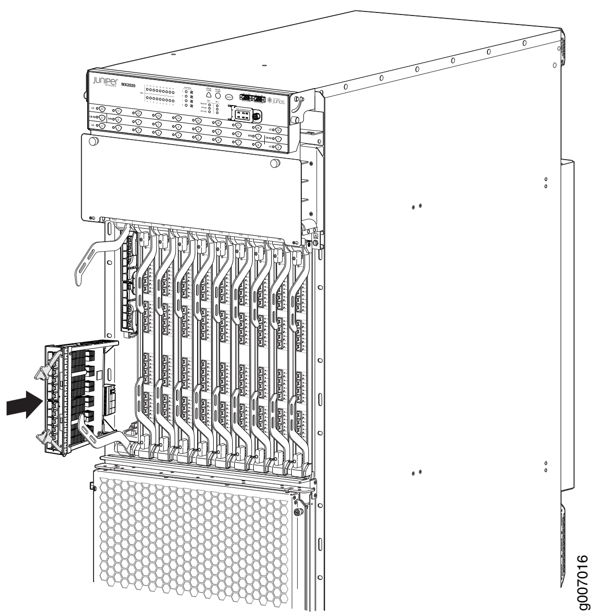
11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

      `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 374.

Figure 164: Installing a MIC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Removing an MX2020 MIC on page 477
- Installing an MX2020 Dual-Wide MIC on page 306

Installing an MX2020 SFB

To install an SFB (see Figure 165 on page 323):

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 SFB from the electrostatic bag.
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. 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 "Contacting Customer Support" on page 549.
7. Check the status of the SFB 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
```

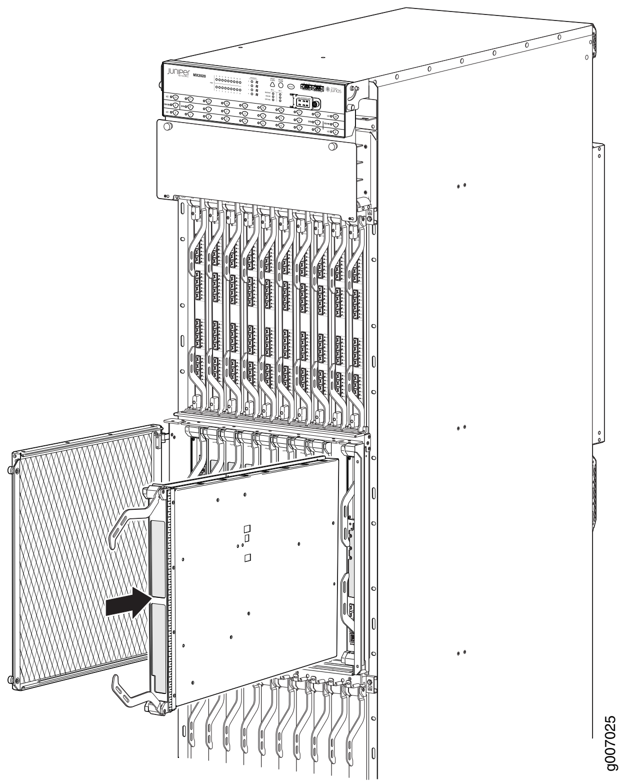
```
    LTC3880-XF0-1.0v-CH1      1032 mV
    LTC3880-3.3v-RAIL         3299 mV
    LTC3880-3.3v-CH0          3299 mV
    LTC3880-3.3v-CH1          3299 mV
SFB 3 status:
  State                      Online
  Intake-Zone0 Temperature   44 degrees C / 111 degrees F
  Exhaust-Zone1 Temperature  40 degrees 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
```

Figure 165: Installing an SFB



Related Documentation

- Maintaining the MX2020 SFB on page 397
- Removing an MX2020 SFB on page 495

Installing an MX2020 Three-Phase Delta AC Power Distribution Module

Before you install 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.

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 PDU (AC or DC) to another while the system is on.

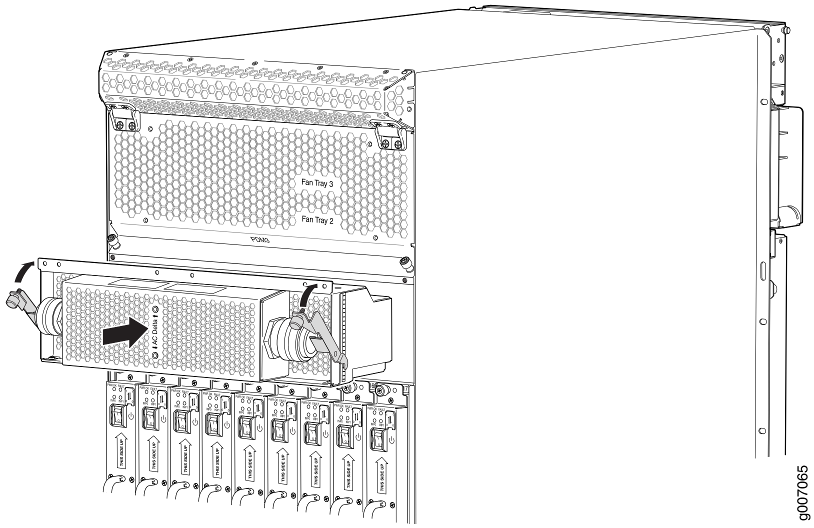
Each three-phase delta AC PDM weighs approximately 12 lb (5.44 kg). To install a three-phase delta AC PDM:

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. Switch off (**O**) the PSMs 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.

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 166 on page 325).
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. 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 166: Installing a Three-Phase Delta AC Power Distribution Module

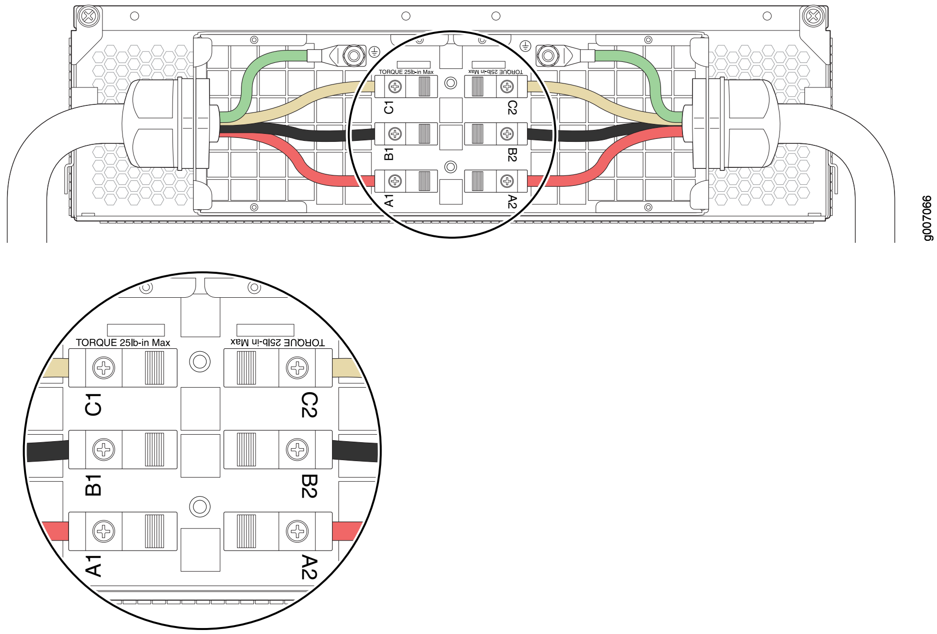


9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Put the wires of the AC power 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 167 on page 326). 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 91 on page 327 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 167: 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 may 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 91: 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 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.
24. Switch the power switch on all the PSMs to the on (|) position to provide power to the router components.

Related Documentation

- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163
- Removing an MX2020 Three-Phase Delta AC Power Distribution Module on page 510

Installing an MX2020 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, 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.

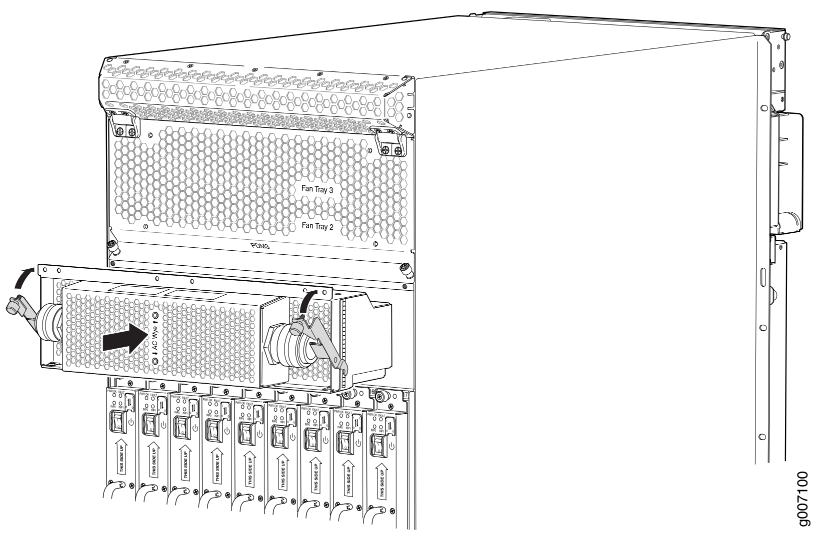
NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker back on.

NOTE: The PDMs are hot swappable in a redundant configuration. However, you cannot switch from one type of PDU (AC or DC) to another 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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.
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 168 on page 329).
6. Push the lock levers completely into 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.

Figure 168: Installing a Three-Phase Wye AC Power Distribution Module



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. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Put 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 169 on page 330). 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 92 on page 331 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**.

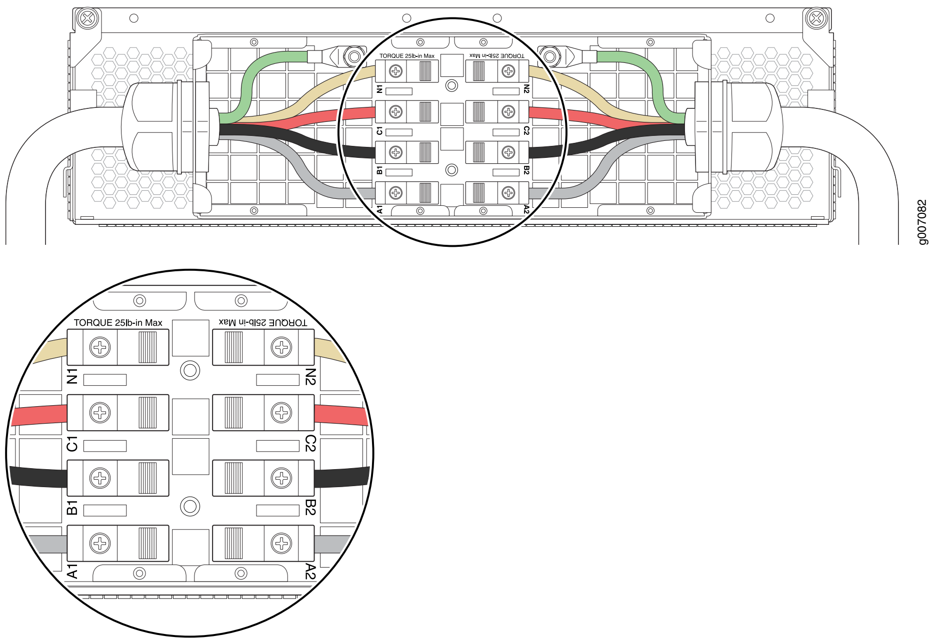
    b. Insert the wire labeled **L1** into the input terminal labeled **A1**.

    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 169: 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 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**.

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 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-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye 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 wye AC wire assembly kits can be purchased from Juniper Networks.

Table 92: 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. 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.
24. Switch the power switches on all the PSMs to the on (|) position to provide power to the router components.

Related Documentation

- MX2020 Three-Phase Wye AC Power Distribution Module Specifications on page 163
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Connecting AC Power to an MX2020 Router with Three-Phase Wye AC Power Distribution Modules on page 252

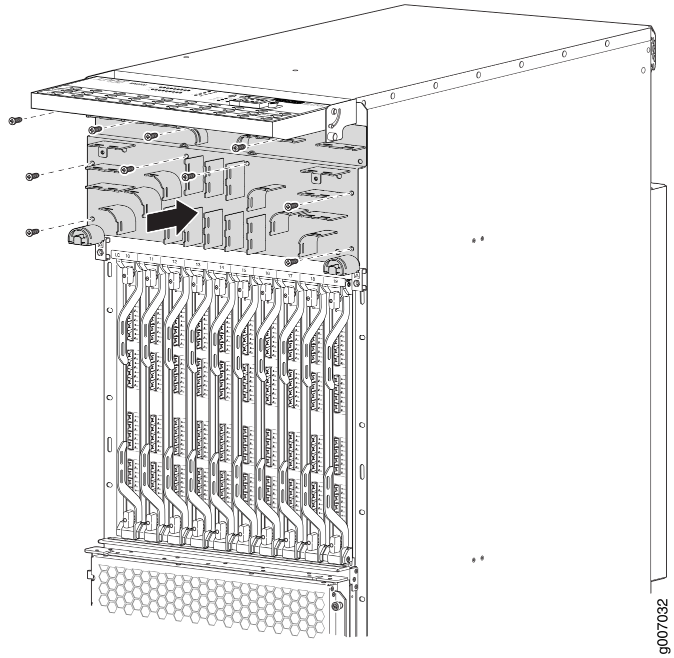
Installing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To install the upper cable manager (see Figure 170 on page 333):

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 170: Installing the Standard Upper Cable Manager



Related Documentation

- Removing the MX2020 Upper Cable Manager on page 438

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.

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 Transceiver from an MX2020 MPC or MIC on page 502

PART 4

Maintaining the Chassis and Components

CHAPTER 23

Maintaining Components

Maintaining the MX2020 Adapter Cards

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 on page 5
- Installing an MX2020 MPC into an Adapter Card on page 492
- Connecting MPC or MIC Cables to the MX2020 Router on page 284
- Installing a Cable on an MX2020 MPC or MIC on page 425

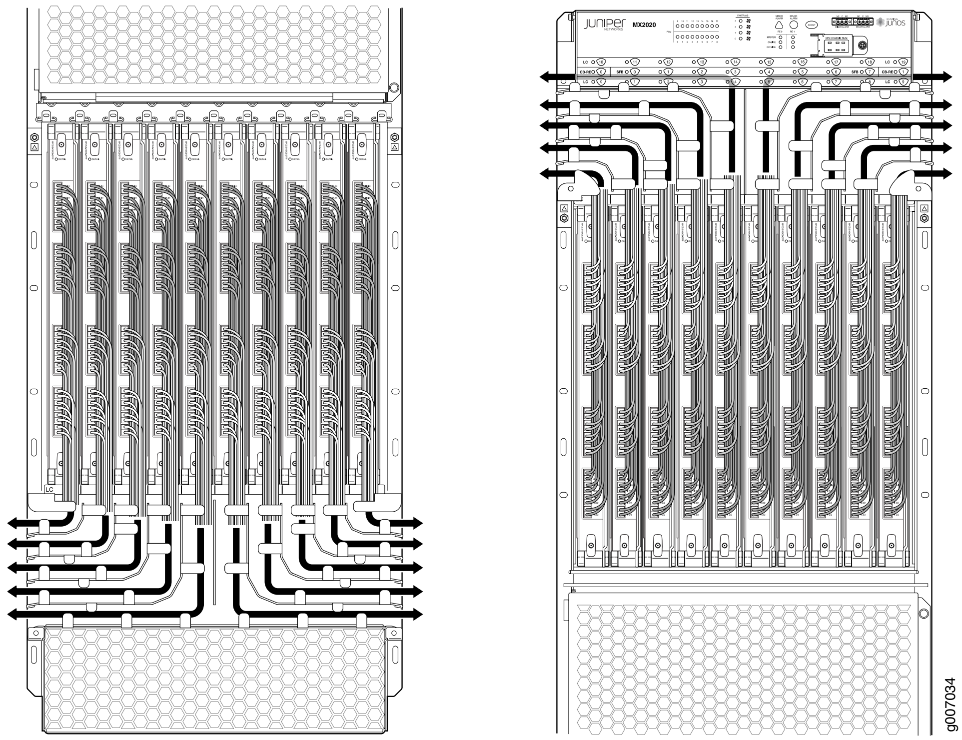
Maintaining Cables That Connect to MX2020 MPCs or MICs

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 171 on page 339) to support cables and prevent cables from dislodging or developing stress points.

Figure 171: 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 on page 193
- MX2020 Cable Manager Description on page 45
- Maintaining MX2020 MPCs on page 375
- Maintaining MX2020 MICs on page 374

Maintaining and Verifying the Status of the MX2020 Router Components

- Maintaining the MX2020 Power Usage on page 391
- Maintaining the MX2020 Routing Engines on page 370
- Maintaining the MX2020 SFB on page 397
- Maintaining the MX2020 Switch Processor Mezzanine Board on page 398
- Maintaining and Verifying the MX2020 Router Version on page 398
- Maintaining and Verifying the Status of the MX2020 Craft Interface on page 399

Maintaining the MX2020 Air Filter

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.**

- Use spare filters within 1 year of manufacture. Check the date of manufacture printed on the filter. Store spare air filters in a dark, cool, and dry place. Storing air filters at higher temperatures, or where they can be exposed to ultraviolet (UV) radiation, hydrocarbon emissions, or vapors from solvents, can significantly reduce their life.

Related Documentation

- Tools and Parts Required to Maintain the MX2020 Hardware Components on page 193
- MX2020 Cooling System Description on page 53
- Replacing the MX2020 Air Filters on page 431

Maintaining the MX2020 Air Vents

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 on page 121
- MX2020 Cooling System Description on page 53

Maintaining the MX2020 Chassis FRU Power On Sequence

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 on page 83
- Maintaining the MX2020 Power Usage on page 391
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Troubleshooting the MX2020 Power Subsystem on page 541

Maintaining the MX2020 Control Boards

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 "MX2020 Craft Interface Description" on page 37.

  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 Cooling System Components

Maintaining the MX2020 Air Vents

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.

Maintaining the MX2020 Air Filter

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.**

- Use spare filters within 1 year of manufacture. Check the date of manufacture printed on the filter. Store spare air filters in a dark, cool, and dry place. Storing air filters at higher temperatures, or where they can be exposed to ultraviolet (UV) radiation, hydrocarbon emissions, or vapors from solvents, can significantly reduce their life.

Maintaining the MX2020 Air Baffle

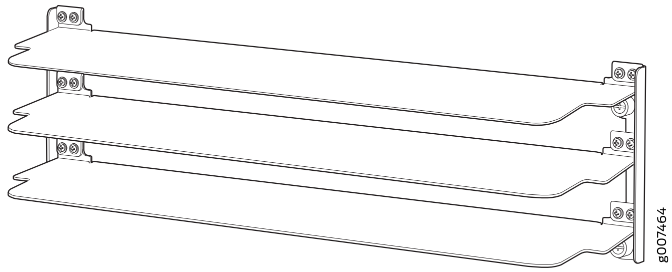
Purpose For optimum cooling, verify the condition of the air baffle. To direct exhaust air away from the router, the louvers on the air baffle must be set to a 90-degree angle see (Figure 172 on page 345).

NOTE: **The air baffle is optional.**

Action

- On a regular basis, check the air baffle louvers are set to a 90-degree angle.

Figure 172: Air Baffle



Maintaining the MX2020 Fan Trays

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
```

NOTE: The fan numbers are stamped into the fan tray sheet metal next to each fan.

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.

Maintaining the MX2020 Cooling System Zones

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 on page 53

Maintaining the MX2020 Cooling System Zones

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 on page 53

Maintaining the MX2020 Ethernet Switch

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

- MX2020 Host Subsystem Description on page 57
- Troubleshooting the MX2020 Host Subsystems on page 536

Maintaining the MX2020 Fan Trays

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
```


NOTE: The fan numbers are stamped into the fan tray sheet metal next to each fan.

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 on page 53
- Troubleshooting the MX2020 Cooling System on page 534
- MX2020 Component LEDs on the Craft Interface on page 39
- Replacing an MX2020 Fan Tray on page 471

Maintaining the MX2020 Air Baffle

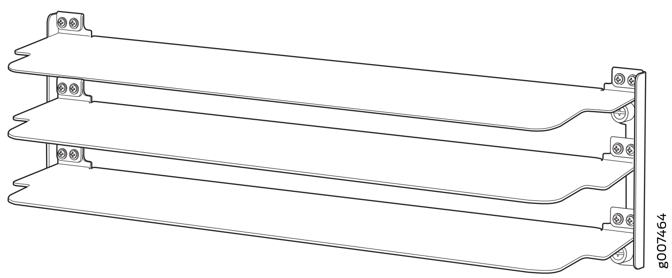
Purpose For optimum cooling, verify the condition of the air baffle. To direct exhaust air away from the router, the louvers on the air baffle must be set to a 90-degree angle see (Figure 172 on page 345).

NOTE: The air baffle is optional.

Action

- On a regular basis, check the air baffle louvers are set to a 90-degree angle.

Figure 173: Air Baffle



Related Documentation

- Tools and Parts Required to Maintain the MX2020 Hardware Components on page 193
- MX2020 Cooling System Description on page 53

Maintaining the MX2020 Host Subsystem

- Maintaining the MX2020 Routing Engines on page 370
- Maintaining the MX2020 Control Boards on page 373

Maintaining the MX2020 Routing Engines

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 37.

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 37. 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*.

Maintaining the MX2020 Control Boards

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 "MX2020 Craft Interface Description" on page 37.

  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

- MX2020 Host Subsystem Description on page 57
- MX2020 Component LEDs on the Craft Interface on page 39
- Troubleshooting the MX2020 Host Subsystems on page 536

Maintaining MX2020 MICs

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 on page 193
- MX2020 Modular Interface Card Description on page 73
- Maintaining the MX2020 Ethernet Switch on page 357
- MX2020 Modular Interface Card LEDs on page 78
- Troubleshooting the MX2020 MICs on page 537
- Replacing an MX2020 MIC on page 477

Maintaining MX2020 MPCs

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 on page 193
- MX2020 Chassis Description on page 5
- MX2020 Modular Port Concentrator Description on page 68
- MX2020 Component LEDs on the Craft Interface on page 39
- Troubleshooting the MX2020 MPCs on page 538
- Replacing an MX2020 MPC on page 485

Maintaining MX2020 Packet Forwarding Engine Components

Maintaining MX2020 MPCs

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*.

Maintaining MX2020 MICs

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*.

Maintaining the MX2020 Ethernet Switch

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*.

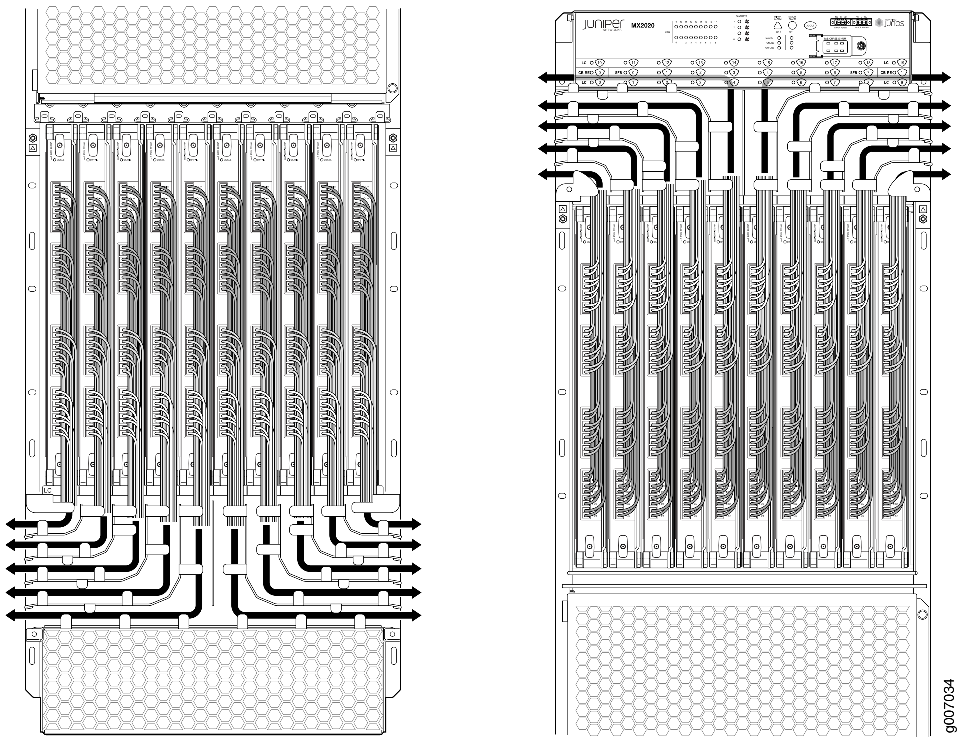
Maintaining Cables That Connect to MX2020 MPCs or MICs

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 171 on page 339) to support cables and prevent cables from dislodging or developing stress points.

Figure 174: 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.

Maintaining the MX2020 Power Supply Modules

Purpose For optimum router performance, verify the condition of the PSMs.

Action On a regular basis:

- Check the status of the PSMs by issuing the **show chassis environment psm** command.

  The output displays the chassis AC PSM status:

  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(%)
```



```
                              51.75      3.25       168.19     8.01
  Hours Used                6862
PSM 1 status:
  State                     Online
  Temperature               OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         226.25      1.40       316.75
                            INP1         2.50        0.00       0.00
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              51.75      4.00       207.00     9.86
  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      4.50       234.00     11.14
  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
PSM 4 status:
  State                     Online
  Temperature               OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         226.25      1.30       294.12
                            INP1         0.00        0.00       0.00
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              51.75      4.50       232.88     11.09
  Hours Used                7438
PSM 5 status:
  State                     Online
  Temperature               OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         225.00      1.30       292.50
                            INP1         5.00        0.00       0.00
  DC Output                 Voltage(V) Current(A)  Power(W)   Load(%)
                              52.00      4.25       221.00     10.52
  Hours Used                7462
PSM 6 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      5.25       273.00     13.00
  Hours Used                7462
PSM 7 status:
  State                     Online
  Temperature               OK
  AC Input                  Feed       Voltage(V)  Current(A) Power(W)
                            INP0         226.25      1.20       271.50
```

```
                        INP1        3.75        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      4.00       208.00     9.90
  Hours Used            7462
PSM 8 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        226.25      1.30       294.12
                        INP1        3.75        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      3.75       195.00     9.29
  Hours Used            7462
PSM 9 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        223.75      2.40       537.00
                        INP1        5.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      8.75       455.00     21.67
  Hours Used            6862
PSM 10 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        225.00      2.20       495.00
                        INP1        3.75        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      8.50       442.00     21.05
  Hours Used            6862
PSM 11 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        225.00      2.10       472.50
                        INP1        0.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      8.00       416.00     19.81
  Hours Used            7438
PSM 12 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        223.75      2.20       492.25
                        INP1        0.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      8.25       429.00     20.43
  Hours Used            6838
PSM 13 status:
  State                 Online
  Temperature           OK
  AC Input              Feed        Voltage(V)  Current(A) Power(W)
                        INP0        225.00      2.30       517.50
                        INP1        0.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      8.50       442.00     21.05
  Hours Used            7438
PSM 14 status:
  State                 Online
  Temperature           OK
```



```
  AC Input                   Feed        Voltage(V)  Current(A) Power(W)
                             INP0          225.00      2.20       495.00
                             INP1          0.00        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.75       8.00       414.00     19.71
  Hours Used                 7462
PSM 15 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed        Voltage(V)  Current(A) Power(W)
                             INP0          223.75      2.20       492.25
                             INP1          0.00        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00       8.00       416.00     19.81
  Hours Used                 6837
PSM 16 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed        Voltage(V)  Current(A) Power(W)
                             INP0          226.25      2.20       497.75
                             INP1          5.00        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               52.00       8.25       429.00     20.43
  Hours Used                 7462
PSM 17 status:
  State                      Online
  Temperature                OK
  AC Input                   Feed        Voltage(V)  Current(A) Power(W)
                             INP0          225.00      2.20       495.00
                             INP1          3.75        0.00       0.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                               51.75       8.25       426.94     20.33
  Hours Used                 7462
```

The output displays the chassis DC power supply module (PSM) status:

```
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        52.00       11.20     582.40
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      10.25      525.31     25.01
  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       11.55     595.98
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      10.00      512.50     24.40
  Hours Used                 2970
PSM 13 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
                            INP1         52.00       10.50     546.00
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      9.25       474.06     22.57
  Hours Used                 810
PSM 14 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
                             INP1        50.80       10.50     533.40
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      9.50       486.88     23.18
  Hours Used                 1722
PSM 15 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
                             INP1        50.80       10.15     515.62
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      9.25       474.06     22.57
  Hours Used                 2970
PSM 16 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
                             INP1        51.60       10.15     523.74
  DC Output                  Voltage(V) Current(A)  Power(W)   Load(%)
                              51.25      9.25       474.06     22.57
  Hours Used                 2970
PSM 17 status:
  State                      Online
  Temperature                OK
  DC Input                   Feed       Voltage(V)  Current(A) Power(W)
                             INP0         0.00        0.00       0.00
```



```
                              INP1        51.60       10.15      523.74
 DC Output                    Voltage(V) Current(A)  Power(W)   Load(%)
                                51.25      9.25       474.06     22.57
 Hours Used                   2970
```

- 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 if 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 there is no moisture accumulating near the router.

Related Documentation

- MX2020 Power Subsystem Description on page 83
- MX2020 Troubleshooting Resources on page 531
- Troubleshooting the MX2020 Power Subsystem on page 541
- Overview of Preparing the Site for the MX2020 Router on page 103

Maintaining the MX2020 Power Usage

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
```

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 on page 83
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Troubleshooting the MX2020 Power Subsystem on page 541

Maintaining the MX2020 Routing Engines

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 37.

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 37. 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

- MX2020 Host Subsystem Description on page 57
- MX2020 Component LEDs on the Craft Interface on page 39
- Troubleshooting the MX2020 Host Subsystems on page 536

Maintaining the MX2020 SFB

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

- Replacing an MX2020 SFB on page 494
- Removing an MX2020 SFB on page 495

Maintaining the MX2020 Switch Processor Mezzanine Board

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

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Maintaining and Verifying the MX2020 Router Version

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 on page 193

Maintaining and Verifying the Status of the MX2020 Craft Interface

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 on page 193
- Maintaining the MX2020 Cooling System Components on page 343
- Maintaining the MX2020 Fan Trays on page 345
- Maintaining the MX2020 Control Boards on page 342
- Maintaining the MX2020 Power Supply Modules on page 386

Taking an MX2020 Host Subsystem Offline

Before you take a host subsystem offline, see "Effect of Taking the MX2020 Host Subsystem Offline" on page 402.

To take a host subsystem offline:

1. Determine whether the host subsystem is functioning as the master 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 master.

   - Issue the following command. The master 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             31 degrees C / 87 degrees F
    DRAM                      16351 MB (16384 MB installed)
    Memory utilization           7 percent
    CPU utilization:
      User                       1 percent
      Background                 0 percent
      Kernel                     4 percent
      Interrupt                  1 percent
      Idle                      94 percent
    Model                          RE-S-1800x4
    Serial ID                      9009099715
    Start time                     2012-11-26 16:16:13 PST
    Uptime                         18 hours, 26 minutes, 43 seconds
    Last reboot reason             Router rebooted after a normal shutdown.

    Load averages:                 1 minute   5 minute  15 minute
                                       0.04       0.03       0.00
Routing Engine status:
  Slot 1:
    Current state                  Backup
    Election priority              Backup (default)
    Temperature                 27 degrees C / 80 degrees F
    CPU temperature             26 degrees C / 78 degrees F
    DRAM                      16351
    Memory utilization           7 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                     2012-11-26 16:16:14 PST
    Uptime                         18 hours, 26 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
```

2. If the host subsystem is functioning as the master, switch it to backup by using the command:

   `user@host>` **request chassis routing-engine master switch**

   CAUTION: When you request the host subsystem master to switch to backup, a message appears indicating that the network traffic will be interrupted while the PFE 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** 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 CLI Explorer.

   NOTE: The Routing Engine might continue forwarding traffic for approximately 5 minutes after the **request system halt** command has been issued.

Related Documentation

- MX2020 Host Subsystem Description on page 57
- Maintaining the MX2020 Host Subsystem on page 370

Effect of Taking the MX2020 Host Subsystem Offline

The host subsystem is taken offline and brought online as a unit. Before you replace a Control Board and Routing Engine (CB-RE) , you must take the host subsystem offline. The host subsystem is hot-pluggable.

Normally, if two host subsystems are installed in the router, one CB-RE functions as the master and the other as back-up. You can remove the backup host subsystem (or either of its components) without interrupting the functioning of the router. If you take the master host subsystem offline, the backup host subsystem becomes the master. Depending on the configuration, the individual FRUs may reboot upon switching mastership. If the router has only one host subsystem, taking the host subsystem offline causes the router to shut down. The effect of taking the master host subsystem offline varies depending on your configuration of high availability features.

Table 93 on page 403 explains the effect of taking the host subsystem offline.

Table 93: Effect of Taking the Host Subsystem Offline

Type of Host Subsystem	Effect of Taking the Host Subsystem Offline
Nonredundant host subsystem	The router shuts down.
Backup host subsystem	The functioning of the router is not interrupted. The backup host subsystem is hot-removable and hot-insertable.
Master host subsystem	The backup host subsystem becomes the master. The backup CB-RE assumes routing engine functions. The master host subsystem is hot-pluggable. Removal or failure of the master CB-RE affects forwarding and routing based on the high availability configuration: • Dual CB-RE without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. All kernel and forwarding processes are restarted. When the switchover to the new master CB-RE is complete, routing convergence takes place and traffic is resumed. • Graceful CB-RE switchover is enabled—Graceful CB-RE switchover preserves interface and kernel information. Traffic is not interrupted. However, graceful CB-RE switchover does not preserve the control plane. Neighboring routers detect that the router has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful CB-RE switchover must be combined with nonstop active routing. • Nonstop active routing is enabled (graceful CB-RE switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports CB-RE switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful CB-RE switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both CB-REs. In addition, nonstop active routing preserves TCP connections maintained in the kernel. • Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop.

NOTE: Router performance might change if the backup CB-REs configuration differs from the former master's configuration. For the most predictable performance, configure the two CB-RE identically, except for parameters unique to each Routing Engine.

To configure the Routing Engine on the Control Board (CB-RE)—specific parameters and still use the same configuration on both Routing Engines on the Control Board, include the appropriate configuration statements under the **re0** and **re1** statements at the [**edit groups**] hierarchy level, and use the **apply-groups** statement. For instructions, see the *Junos OS Administration Library for Routing Devices*.

NOTE: For information about configuring graceful Routing Engine on the CB-RE switchover, graceful restart, and nonstop active routing, see the *Junos OS High Availability Library for Routing Devices*.

NOTE: The first supported release for both graceful Routing Engine on the CB-RE switchover and nonstop active routing on the router is Junos OS Release 12.3R2. Graceful restart software requirements depend on the routing protocols configured on the router. For the minimum software requirements for graceful restart, see the *Junos OS High Availability Library for Routing Devices*.

Related Documentation

- MX2020 Host Subsystem Description on page 57
- Taking an MX2020 Host Subsystem Offline on page 401
- Maintaining the MX2020 Host Subsystem on page 370

Holding an MX2020 MPC

When carrying an MPC, you can hold it either vertically or horizontally.

NOTE: A typical MPC can weigh 25 lb (11.34 kg) or more. Be prepared to accept the full weight of the MPC as you lift it.

To hold an MPC vertically:

1. Orient the MPC so that the faceplate faces you. To verify orientation, confirm that the text on the MPC is right-side up and the electromagnetic interference (EMI) strip is on the right-hand side.
2. Place one hand around the MPC faceplate about a quarter of the way down from the top edge. To avoid deforming the EMI shielding strip, do not press hard on it.

3. Place your other hand at the bottom edge of the MPC.

If the MPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge.

To hold an MPC horizontally:

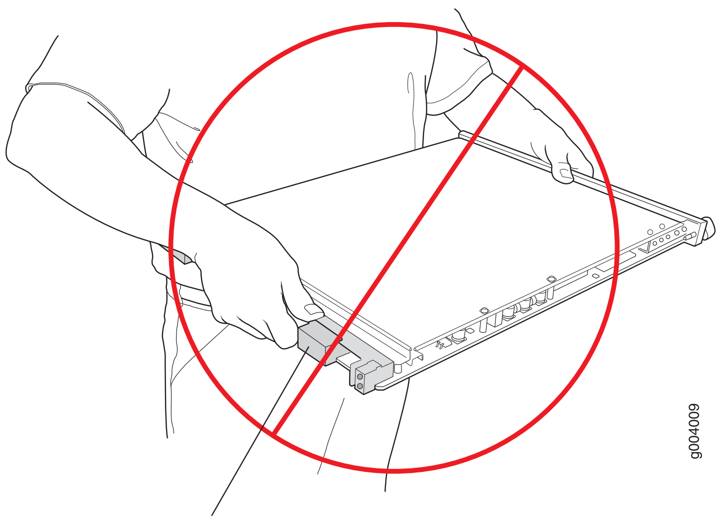
1. Orient the MPC so that the faceplate faces you.
2. Grasp the top edge with your left hand and the bottom edge with your right hand.

You can rest the faceplate of the MPC against your body as you carry it.

As you carry the MPC, do not bump it against anything. MPC components are fragile.

Never hold or grasp the MPC anywhere except places that this document indicates. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet.

Figure 175: Do Not Grasp the Connector Edge

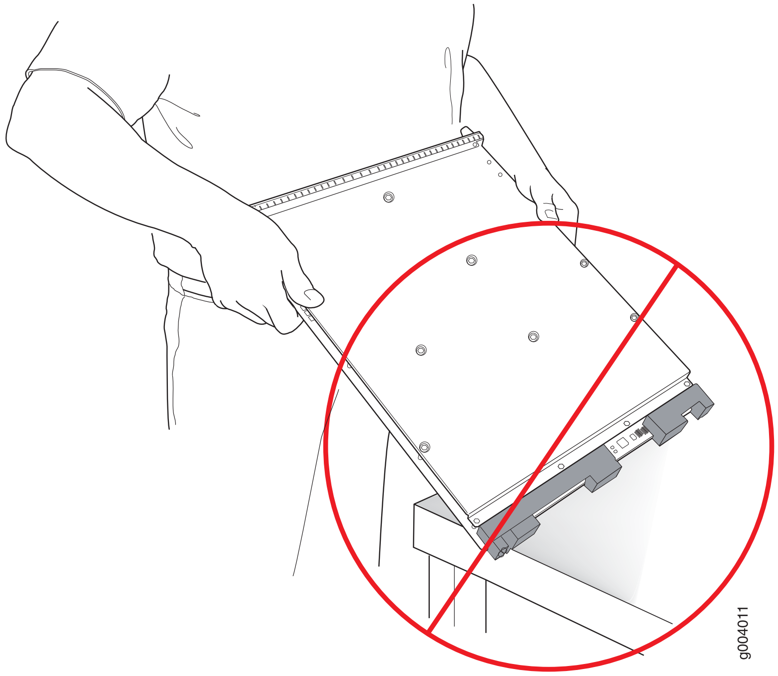


Never carry the MPC by the faceplate with only one hand.

Do not rest any edge of an MPC directly against a hard surface (see Figure 176 on page 406).

Do not stack MPCs.

Figure 176: Do Not Rest the MPC on an Edge



Do not rest connectors on any surface.

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

- MX2020 MPC Terminology on page 73
- Storing an MX2020 MPC on page 406
- Troubleshooting the MX2020 MPCs on page 538
- Replacing an MX2020 MPC on page 485

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

- MX2020 MPC Terminology on page 73
- Holding an MX2020 MPC on page 404
- Maintaining MX2020 MPCs on page 375
- Replacing an MX2020 MPC on page 485
- Troubleshooting the MX2020 MPCs on page 538

Routine Maintenance Procedures for the MX2020 Router

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 on page 193
- Maintaining the MX2020 Air Filter on page 341
- Maintaining the MX2020 Fan Trays on page 345

CHAPTER 24

Packing and Returning Components

Guidelines for Packing Router Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in electrostatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION: **Do not stack any of the router components.**

Related Documentation

- Returning a Hardware Component to Juniper Networks, Inc. on page 412
- Contacting Customer Support on page 549

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 master 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 on page 558
- Powering Off the DC-Powered MX2020 Router on page 528
- Powering Off the AC-Powered MX2020 Router on page 527
- Replacing an MX2020 Three-Phase Delta AC Power Cord on page 504
- *Replacing an MX2020 Three-Phase Wye AC Power Cord*
- Disconnecting an MX2020 DC Power Distribution Module Cable on page 463
- Installing the Router Transport Kit on the MX2020 Router on page 224

Returning a Hardware Component to Juniper Networks, Inc.

If a problem cannot be resolved by the JTAC technician, a Return Materials Authorization (RMA) is issued. 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 Web page at http://www.juniper.net/support/guidelines.html.

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Case Manager link at http://www.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 hardware component:

1. Determine the part number and serial number of the 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.

Related Documentation

- Contacting Customer Support on page 549
- Guidelines for Packing Router Components for Shipment on page 409

CHAPTER 25

Replacing Components

Tools and Parts Required for Replacing MX2020 Hardware Components

To replace hardware components, you need the tools and parts listed in Table 94 on page 416.

Table 94: 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.
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).

Table 94: Tools and Parts Required for Component Replacement *(continued)*

Components	Tool or Part
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
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 on page 16
- Replacing the MX2020 Craft Interface on page 450
- Replacing an MX2020 Fan Tray on page 471
- Replacing the MX2020 Air Filters on page 431

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 on page 409
- Contacting Customer Support on page 549

Replacing an MX2020 CB-RE

- Removing an MX2020 CB-RE on page 419
- Installing an MX2020 CB-RE on page 420

Removing an MX2020 CB-RE

To remove a CB-RE (see Figure 177 on page 420):

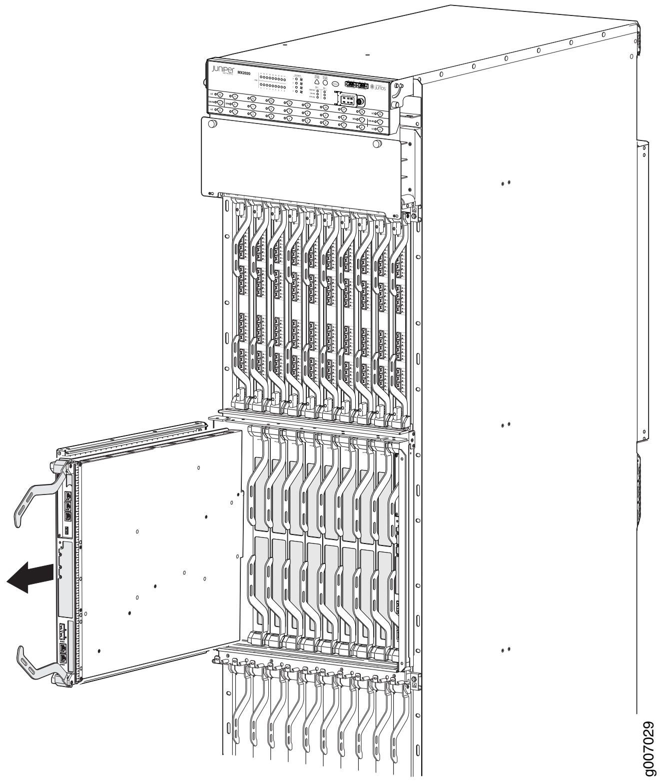
NOTE: You can remove the CB-RE as a unit.

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 177: Removing a CB-RE



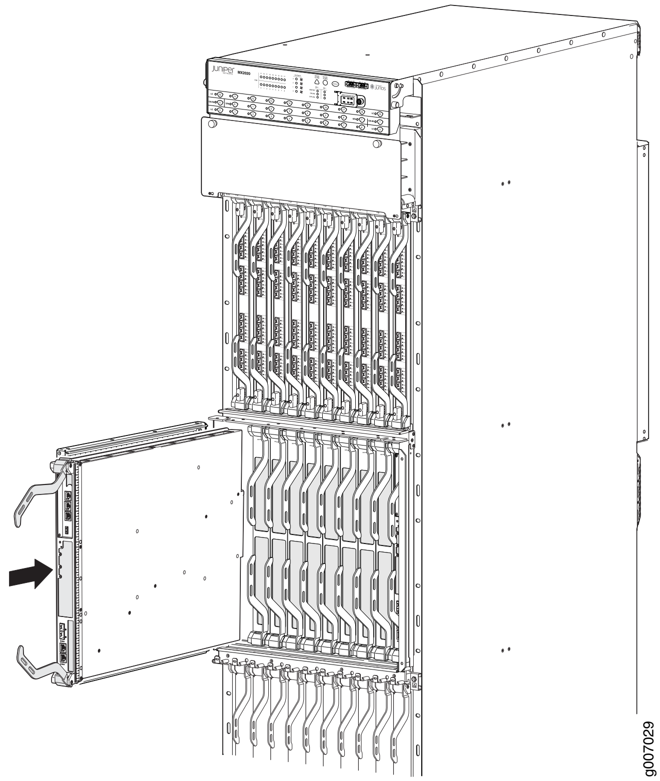
Installing an MX2020 CB-RE

To install a CB-RE (see Figure 152 on page 303):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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 “Contacting Customer Support” on page 549.
7. 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
```

Figure 178: Installing a CB-RE



Related Documentation

- MX2020 CB-RE Description on page 59
- MX2020 CB-RE LEDs on page 62
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Replacing the Alarm Relay Wires from the MX2020 Craft Interface

1. Disconnecting the Alarm Relay Wires from the MX2020 Craft Interface on page 422
2. Connecting the Alarm Relay Wires to the MX2020 Craft Interface on page 423

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 141 on page 283):

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 90 on page 283).

Figure 179: Alarm Relay Contacts

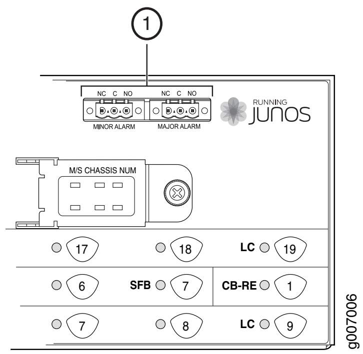


Table 95: Alarm Relay Contacts on the Craft Interface

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

Connecting 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 140 on page 282):

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 89 on page 282). 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 180: Alarm Relay Contacts

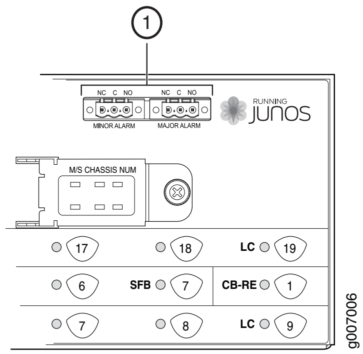


Table 96: Connecting Alarm Relay Contacts

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.

Replacing a Cable on an MX2020 MPC or MIC

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.

   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.

Installing a Cable on an MX2020 MPC or MIC

To install a MIC or an MPC cable (see Figure 181 on page 426 and Figure 182 on page 426):

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.

   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 181: Installing a MIC Cable

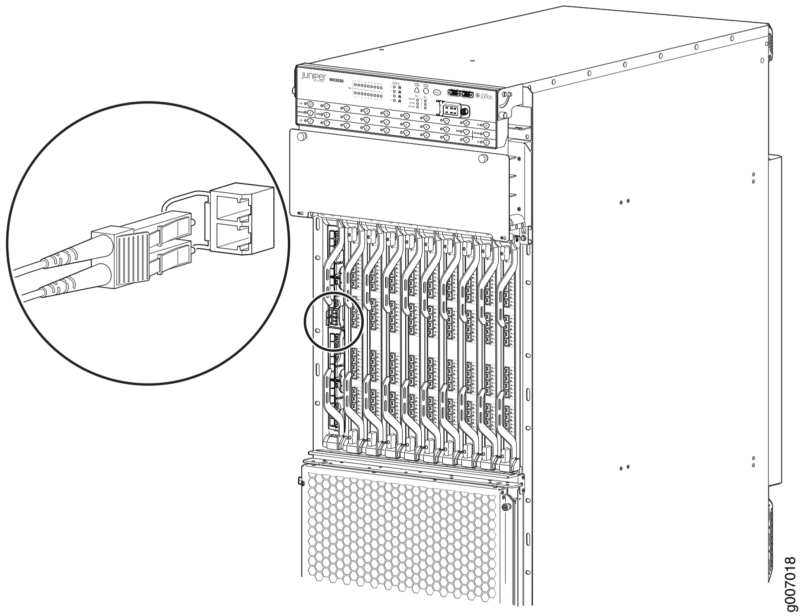
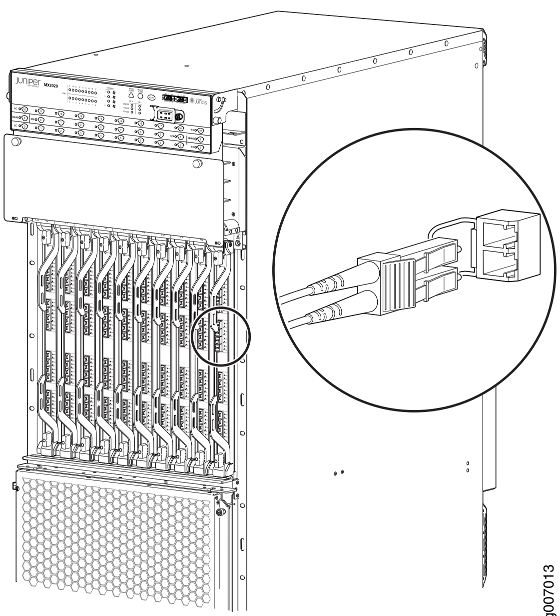


Figure 182: Installing an MPC Cable



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.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Replacing an MX2020 MIC on page 477
- Replacing an MX2020 MPC on page 485
- Replacing an SFP or XFP Transceiver on an MX2020 MPC or MIC on page 502

- Maintaining Cables That Connect to MX2020 MPCs or MICs on page 338

Replacing an MX2020 AC Power Supply Module

Removing an MX2020 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 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 an AC PSM (see Figure 183 on page 429):

NOTE: The minimum number of AC PSMs changes based on the configuration.

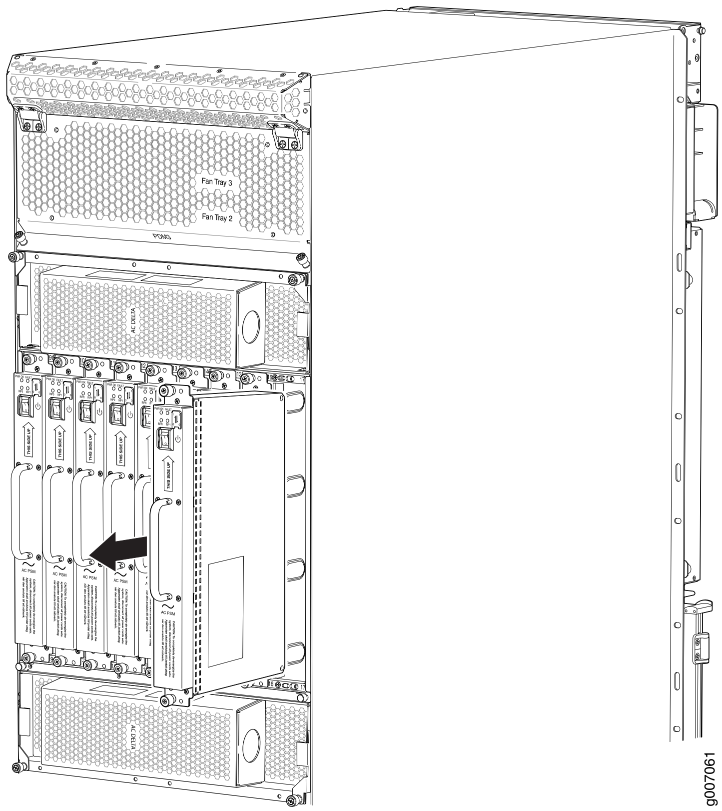
1. With one PSM installed and operational, remove any additional PSM by turning the power switch to the off (**O**) position.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Loosen the two captive screws on the PSM faceplate.
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 in back of the PSM. It 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 183: Removing an AC Power Supply Module from the MX2020 Router



Installing an MX2020 AC Power Supply Module

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.

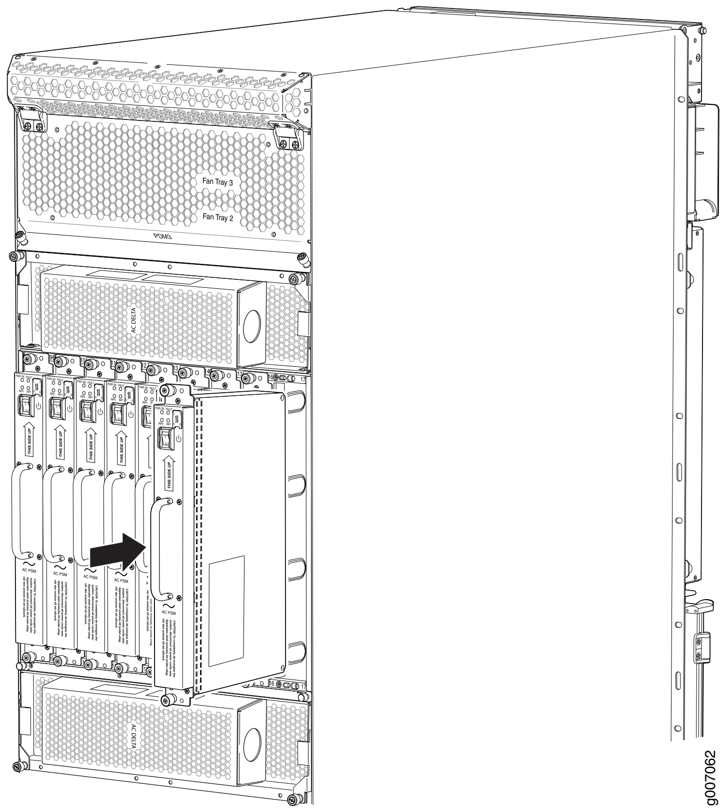
To install an AC PSM (see Figure 145 on page 295):

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 184: Installing an AC Power Supply Module



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 AC Power Supply Module Description on page 158
- MX2020 AC Power Subsystem Electrical Specifications on page 158

Replacing the MX2020 Air Filters

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—MX2020-FLTR-KIT-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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.

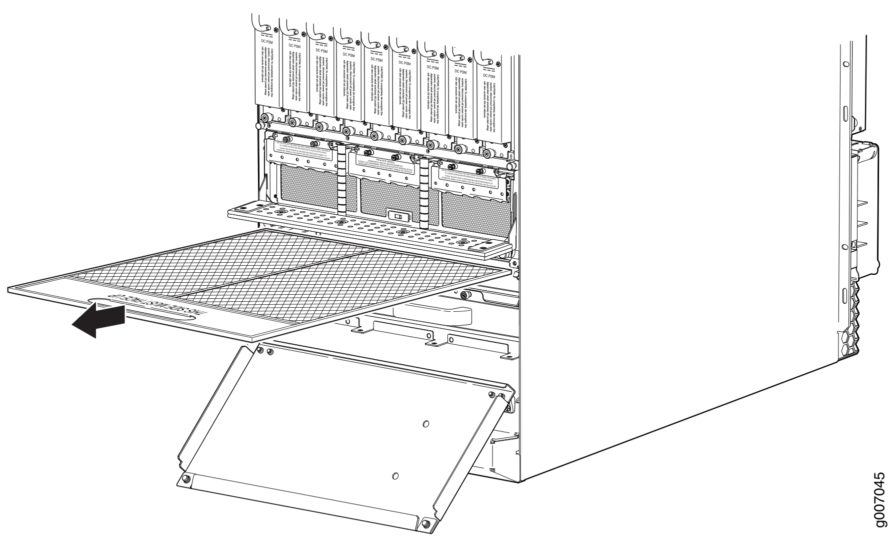
   CAUTION: Do not run the router for more than 2 minutes without the air filter in place.

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 185 on page 432.

Figure 185: Removing the Lower Air Filter from the Chassis



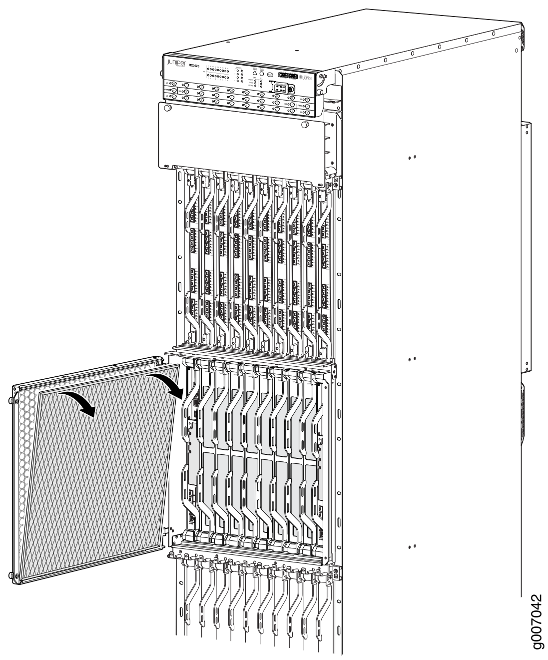
To remove the middle card cage cable manager air filter—MX2020-MID-FLTR-PNL-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the 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 186 on page 433).

Figure 186: Removing the Middle Card Cage Cable Manager Air Filter



To remove the PSM air filter—MX2000-FLTR-PWR:

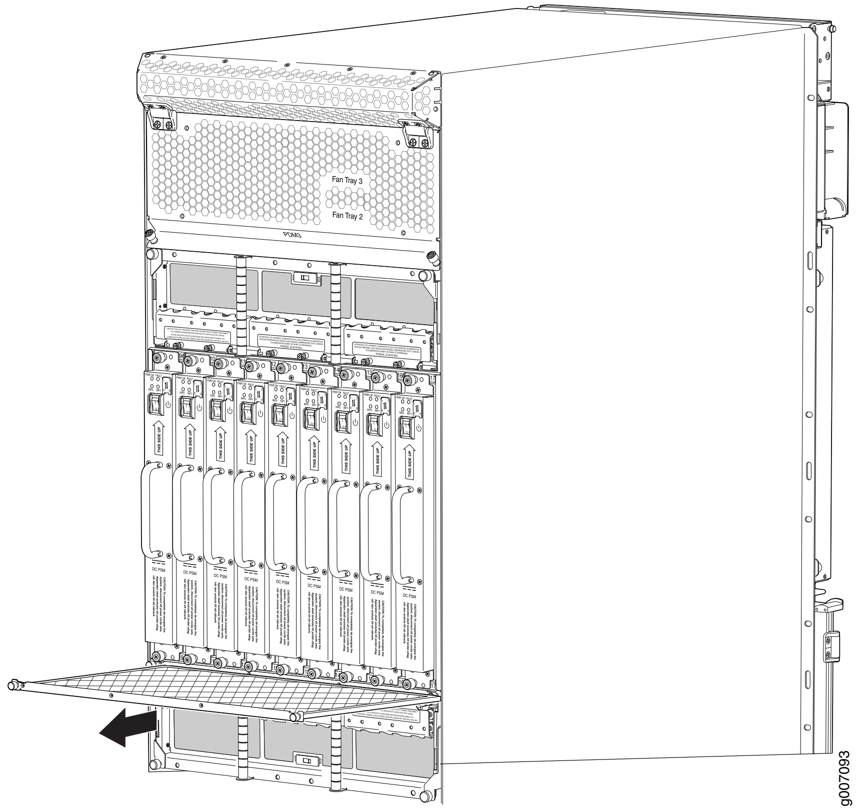
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Loosen the two captive screws located on either side of the air filter and pull slightly out of the chassis.

CAUTION: Do not run the router for more than 2 minutes without the air filter in place.

3. Grasp the PSM air filter, and pull the air filter straight out from the chassis.
4. Slide the air filter out of the chassis as shown in Figure 187 on page 434.

NOTE: The AC–powered MX2020 router has the same air filter.

Figure 187: Removing the PSM Air Filter from the Chassis

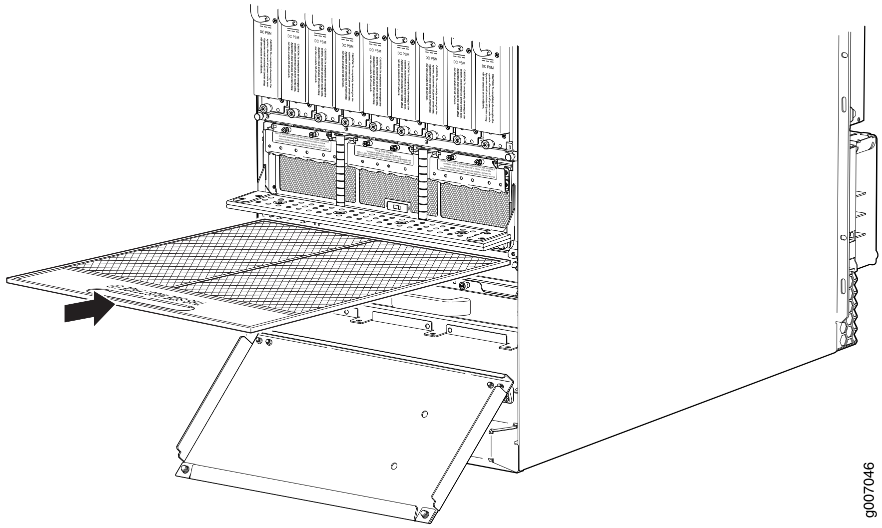


Installing the MX2020 Air Filter

To install the lower air filter—MX2020-FLTR-KIT-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the air filter is right side up.
3. Open the fan tray and air filter access door, located at the bottom of the chassis.
4. Grasp the handle on the air filter and insert into the chassis until it stops, (see Figure 147 on page 297).
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 188: Installing the Air Filter



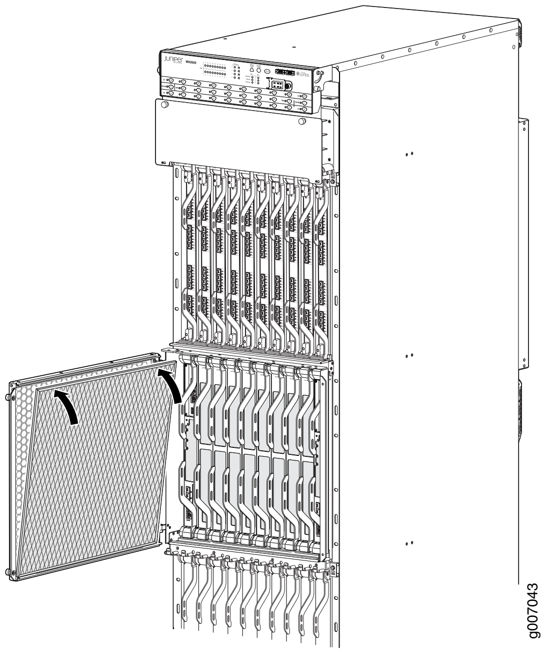
To install the middle card cage cable manager air filter—MX2020-MID-FLTR-PNL-S:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the cables from the 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 148 on page 298).

Figure 189: Installing the Middle Card Cage Cable Manager Air Filter



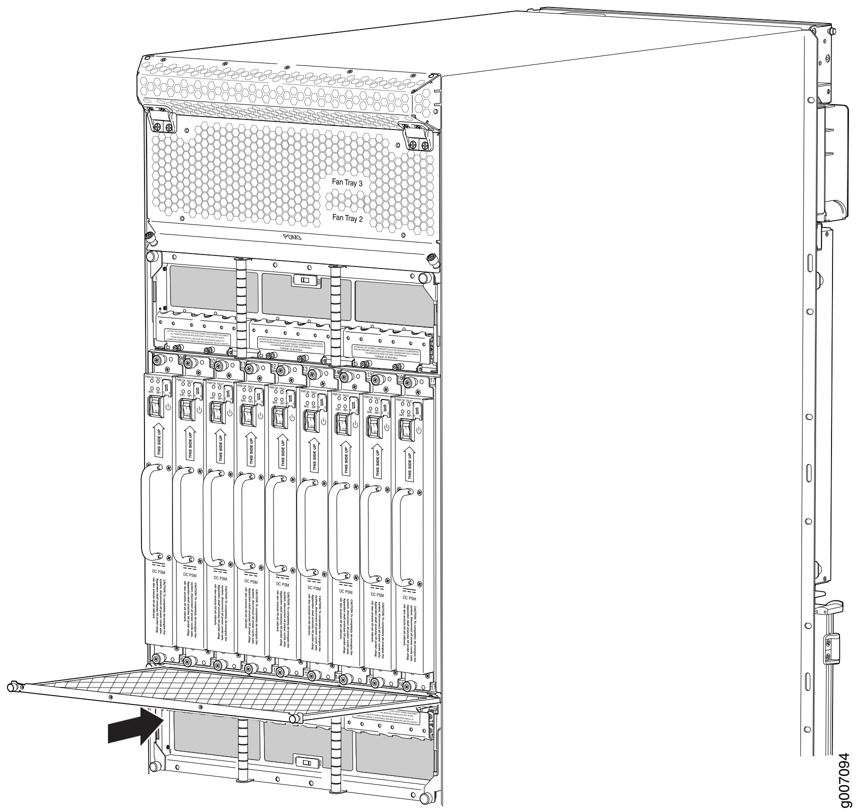
5. Push the air filter in place, close the door, and tighten the two captive screws.
6. Replace the cables in the middle card cage cable manager, if necessary.

To install the PSM air filter—MX2000-FLTR-PWR:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Ensure that the air filter is right side up.
3. Grasp the PSM air filter and insert into the chassis until it stops, (see Figure 149 on page 299).
4. Tighten the two captive screws to secure.

NOTE: The AC-powered MX2020 router has the same air filter.

Figure 190: Installing the PSM Air Filter



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Maintaining the MX2020 Air Filter on page 341

Replacing the MX2020 Cable Managers

The MX2020 router consist 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.

1. Removing the MX2020 Upper Cable Manager on page 438
2. Removing the MX2020 Lower Cable Manager on page 438
3. Removing the MX2020 DC Cable Manager on page 439
4. Installing the MX2020 Lower Cable Manager on page 440

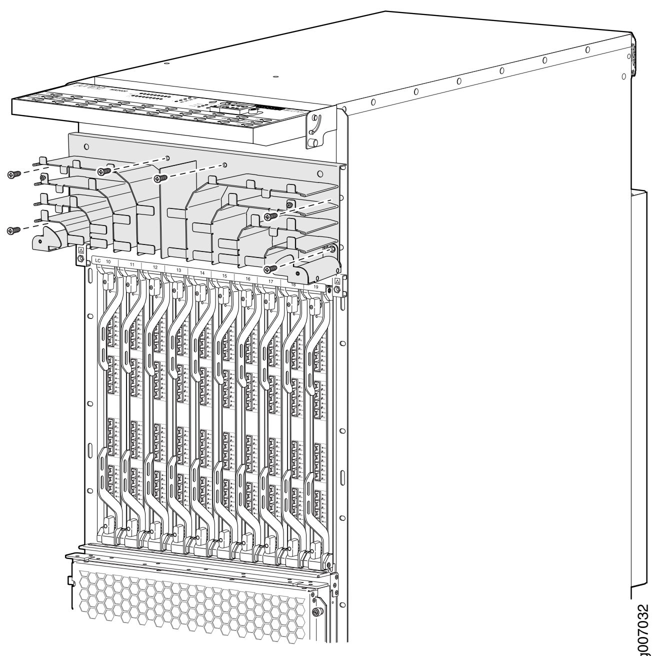
Removing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To remove the upper cable manager (see Figure 191 on page 438):

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 191: Removing the Standard Upper Cable Manager



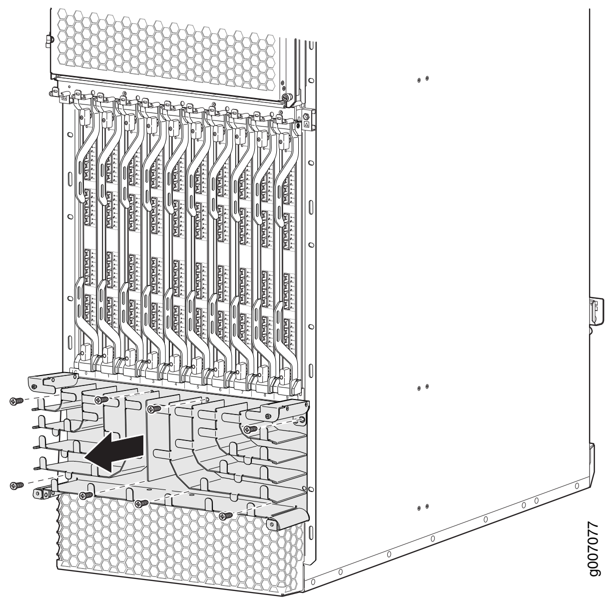
Removing the MX2020 Lower Cable Manager

NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To remove the lower cable manager (see Figure 192 on page 439):

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 192: Removing the Standard Lower Cable Manager

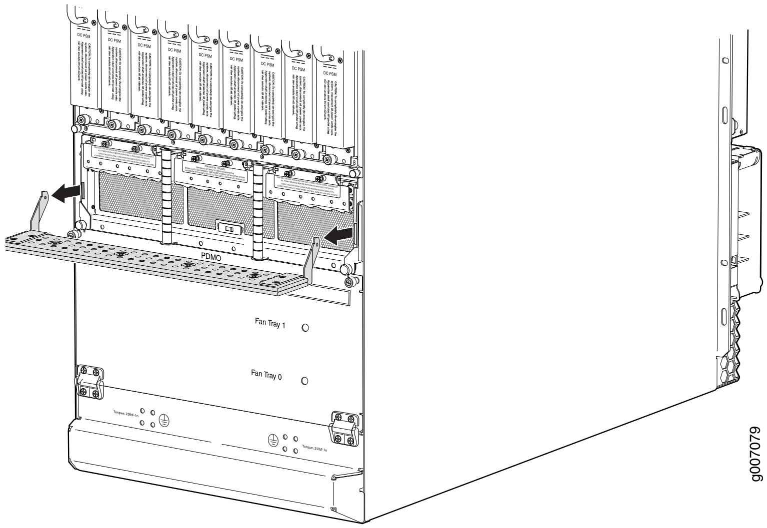


Removing the MX2020 DC Cable Manager

To remove the standard DC cable manager (see Figure 193 on page 440):

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 193: Removing the Standard DC Cable Manager



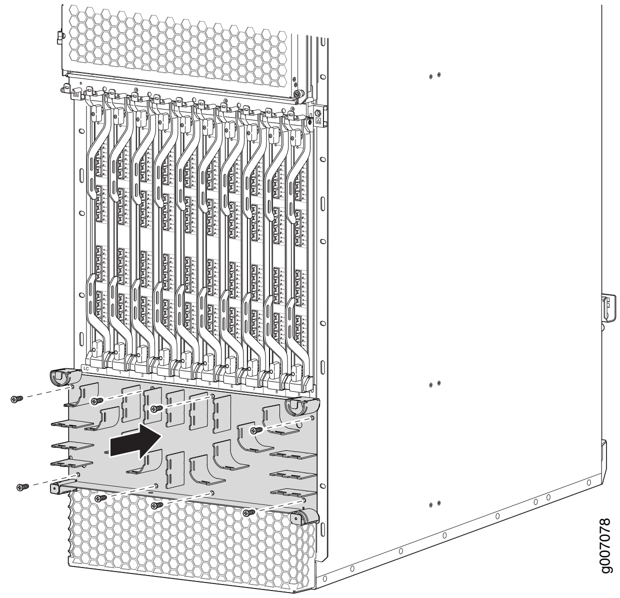
Installing the MX2020 Lower Cable Manager

NOTE: To accommodate additional clearance, you may order an extended lower cable manager from Juniper Networks.

To install the lower cable manager (see Figure 162 on page 315):

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 194: Installing the Standard Lower Cable Manager



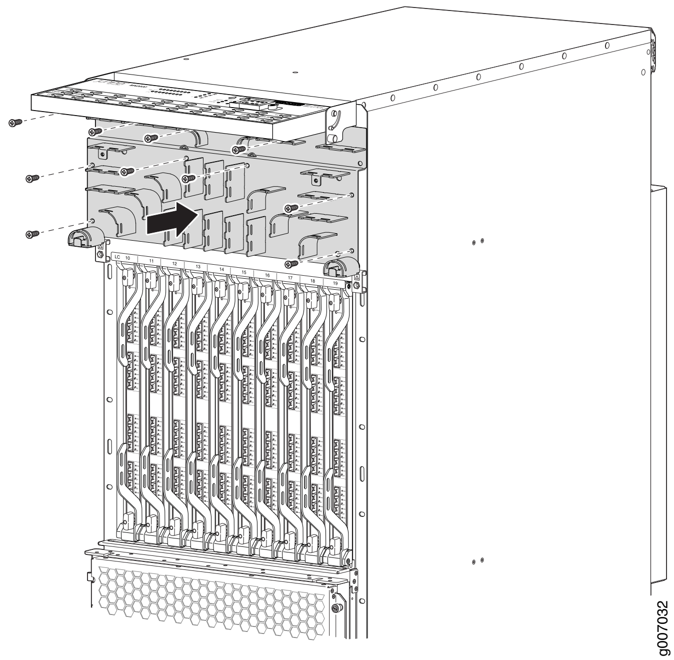
Installing the MX2020 Upper Cable Manager

NOTE: To accommodate additional clearance, you may order an extended upper cable manager from Juniper Networks.

To install the upper cable manager (see Figure 170 on page 333):

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 195: Installing the Standard Upper Cable Manager



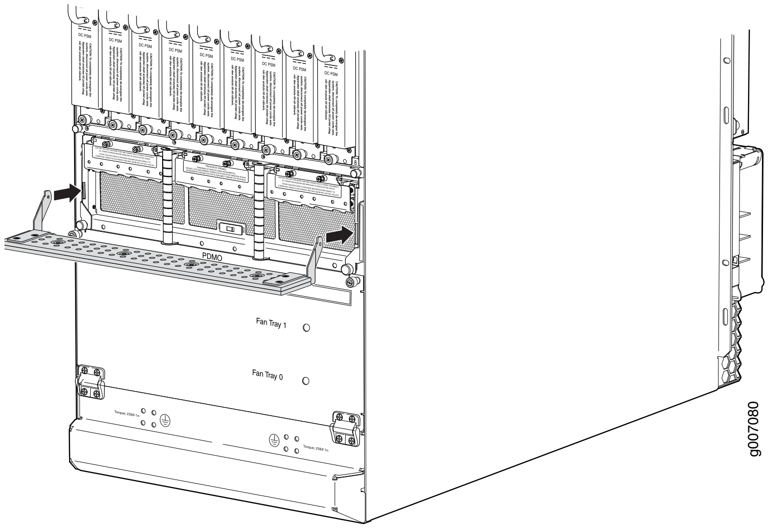
Installing the MX2020 DC Cable Manager

NOTE: To accommodate additional clearance, you may order an extended DC cable manager from Juniper Networks.

To install the DC cable manager (see Figure 153 on page 304):

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 196: Installing the Standard DC Cable Manager



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Cable Manager Description on page 45
- Replacing the MX2020 Extended Cable Managers on page 443

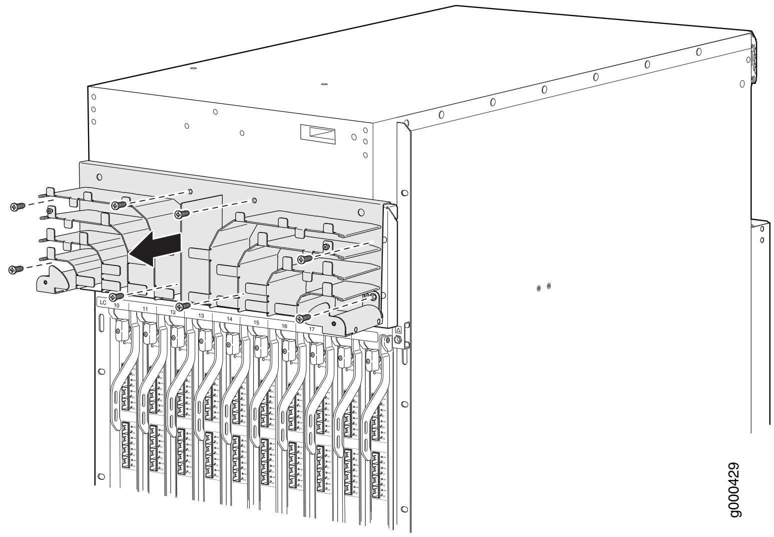
Replacing the MX2020 Extended Cable Managers

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*.
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 197 on page 444.
5. Pull the extended cable manager away from the chassis.

Figure 197: Removing the Extended Upper Cable Manager

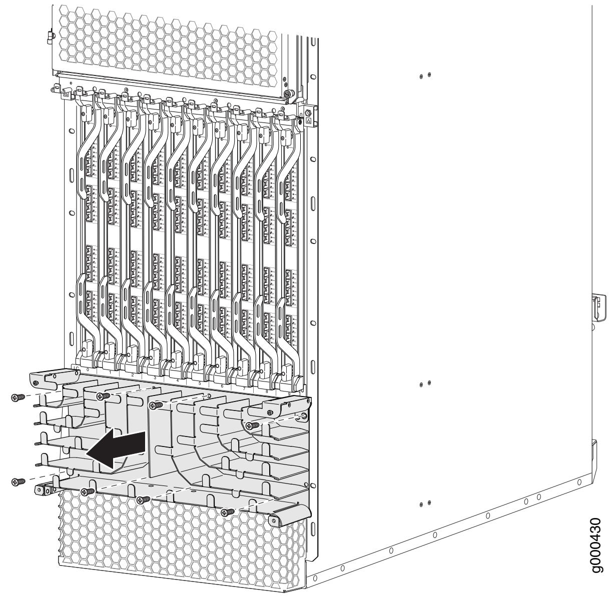


Removing the MX2020 Lower Extended Cable Manager

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 198 on page 445.
4. Pull the extended cable manager away from the chassis.

Figure 198: Removing the Extended Lower Cable Manager

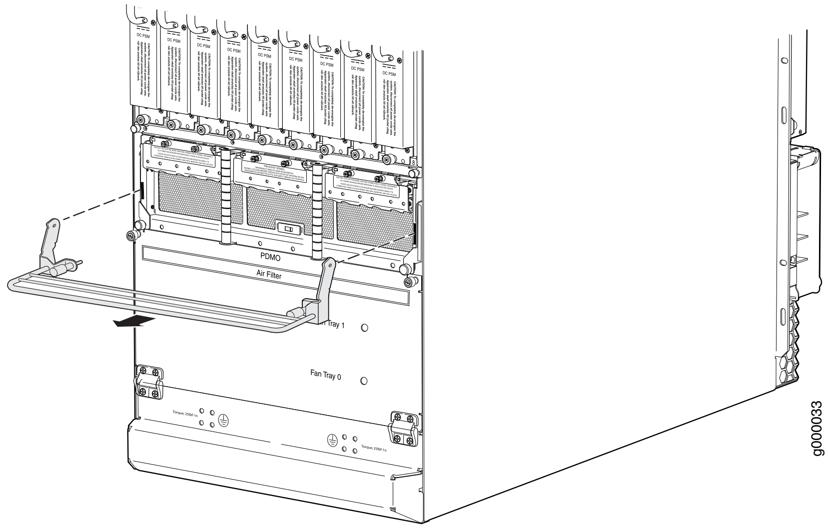


Removing the MX2020 Extended DC Cable Manager

To remove the extended DC cable manager (see Figure 199 on page 446):

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 199: Removing the Extended DC Cable Manager



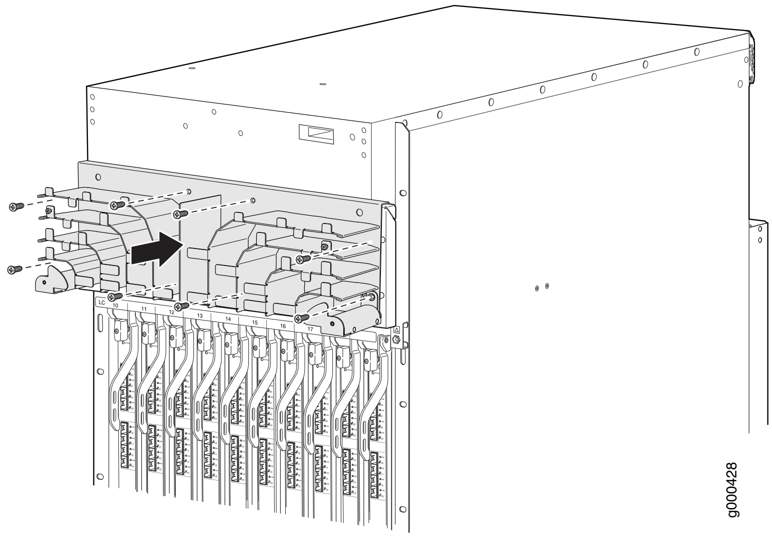
Installing the MX2020 Upper Extended Cable Manager

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 200 on page 447):

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 452.
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 200 on page 447.
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 300.

Figure 200: Installing the MX2020 Upper Extended Cable Manager

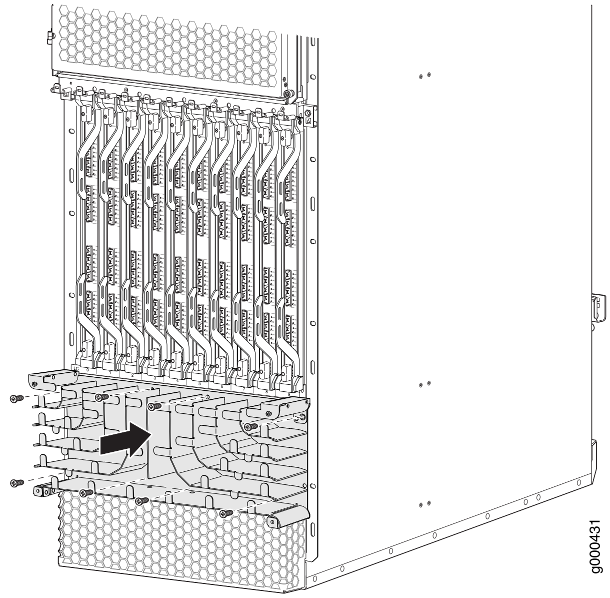


Installing the Lower MX2020 Extended Cable Manager

To install the lower extended cable manager (see Figure 201 on page 448):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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 201 on page 448.
4. Replace the cable manager cover, and secure it with the two captive screws.

Figure 201: Installing the Extended Lower Cable Manager

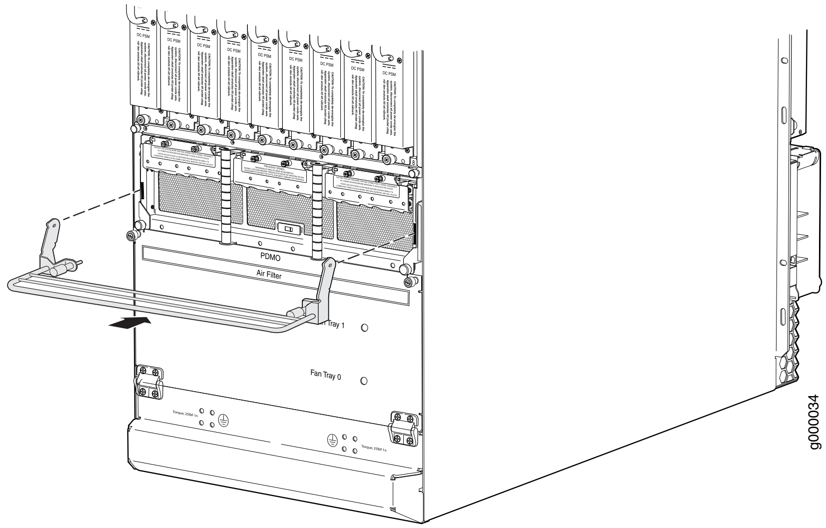


Installing the MX2020 Extended DC Cable Manager

To install the extended DC cable manager (see Figure 202 on page 449):

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 202: Installing the Extended DC Cable Manager



Removing an MX2020 CB-RE

To remove a CB-RE (see Figure 177 on page 420):

NOTE: You can remove the CB-RE as a unit.

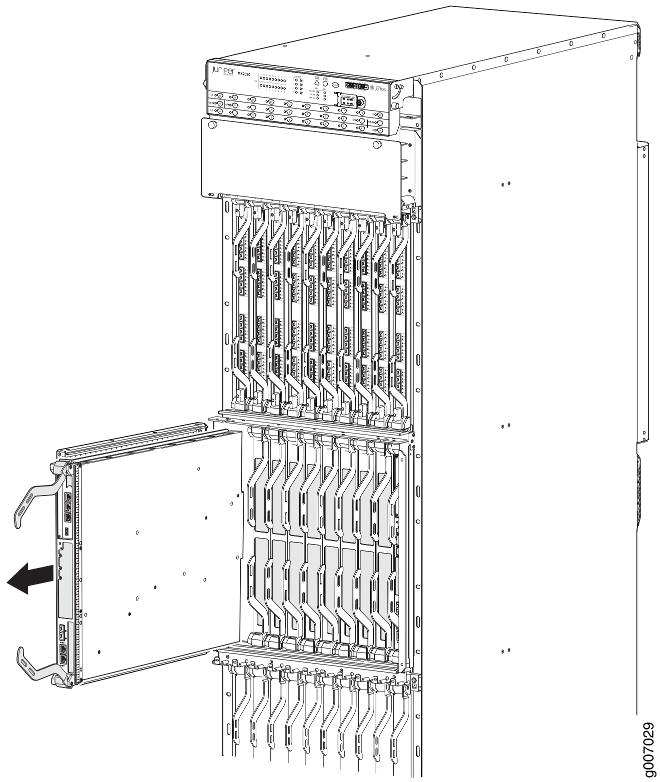
CAUTION: Before removing a CB-RE, ensure that you know how to operate the ejector handles properly to avoid damage to the equipment.

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 203: Removing a CB-RE



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Effect of Taking the MX2020 Host Subsystem Offline on page 402
- Taking an MX2020 Host Subsystem Offline on page 401
- Installing an MX2020 CB-RE on page 301

Replacing the MX2020 Craft Interface

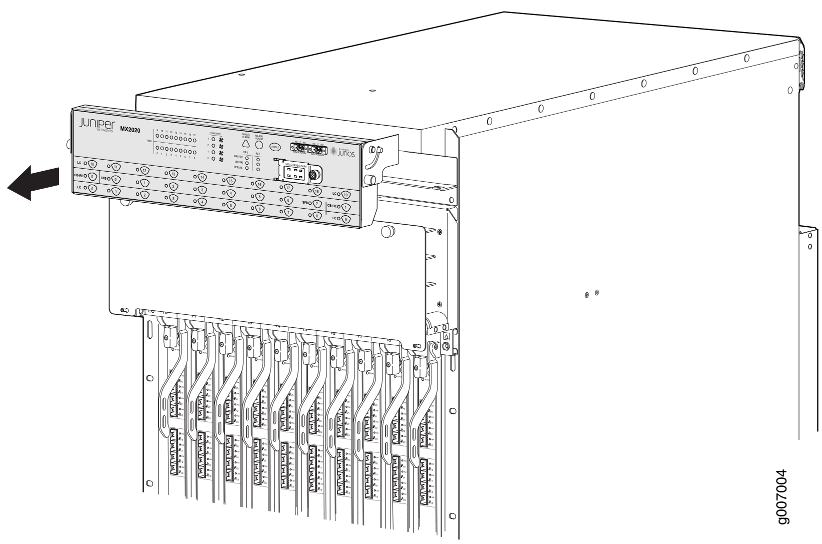
1. Removing the MX2020 Craft Interface on page 451
2. Installing the MX2020 Craft Interface on page 451

Removing the MX2020 Craft Interface

To remove the craft interface (see Figure 204 on page 451):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. 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 204: Removing the Craft Interface



Installing the MX2020 Craft Interface

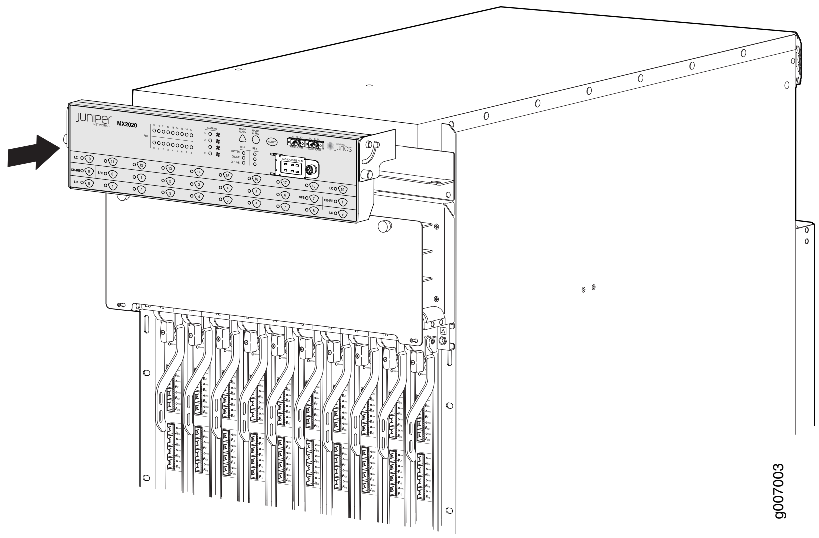
To install the craft interface (see Figure 150 on page 300):

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 205: Installing the Craft Interface



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Disconnecting the Alarm Relay Wires from the MX2020 Craft Interface on page 283
- MX2020 Craft Interface Description on page 37
- *MX2020 Craft Interface Serial Number Label*

Replacing an MX2020 Extended Craft Interface

1. Removing an MX2020 Extended Craft Interface on page 452
2. Installing an MX2020 Extended Craft Interface on page 453

Removing an MX2020 Extended Craft Interface

To remove the extended craft interface (see Figure 206 on page 453):

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.

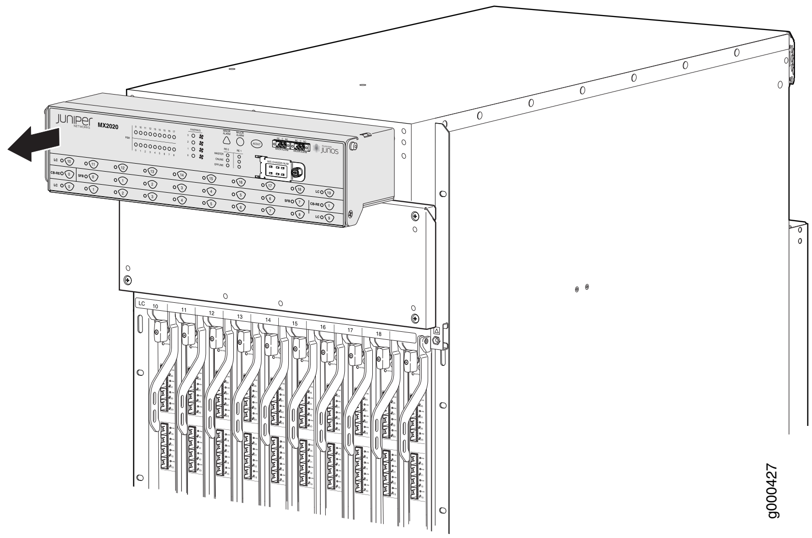
4. Remove the screws from the top corners on each side of the extended craft interface using a 4-mm Allen wrench.

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 206: Removing the Extended Craft Interface



Installing an MX2020 Extended Craft Interface

To install the extended craft interface (see Figure 151 on page 301):

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.

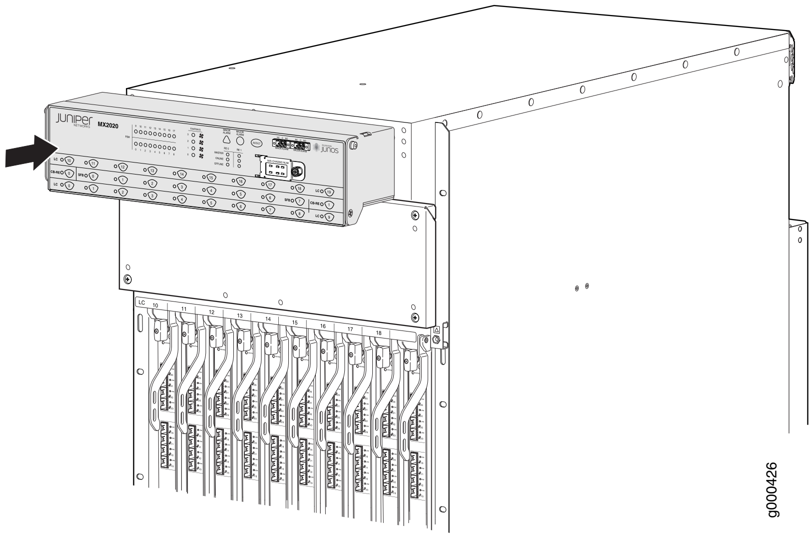
5. Align the bottom of the craft interface with the sheet metal above the card cage, and press it into place.

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 207: Installing the Extended Craft Interface



Replacing an MX2020 DC Power Supply Module

Removing an MX2020 DC 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 DC PSM (see Figure 208 on page 455):

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.

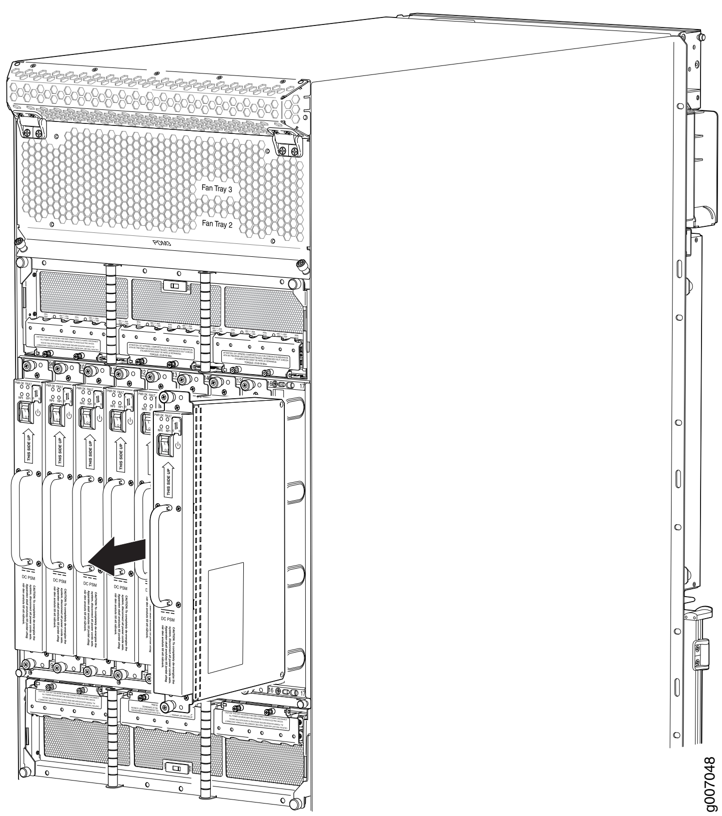
3. Loosen the two captive screws on the PSM faceplate. Apply between 10 lb-in. (1.13 Nm) to 12 lb-in. (1.35 Nm) of torque to each screw. Do not overtighten the screws.
4. While grasping the handle on the PSM faceplate with one hand, use your other hand to guide the PSM away from the chassis.
5. Pull 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 208: Removing a DC Power Supply Module from the MX2020 Router



Installing an MX2020 DC Power Supply Module

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.

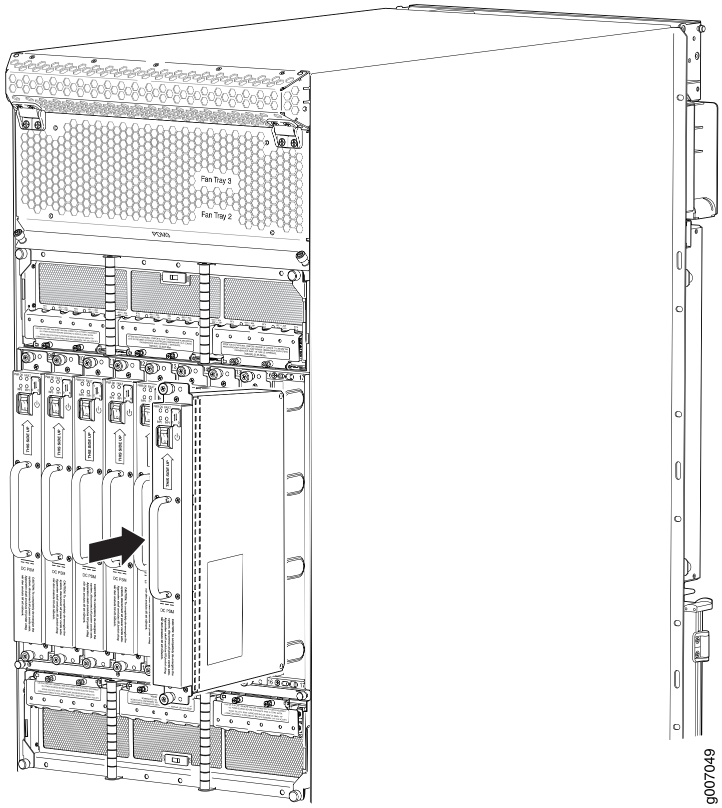
To install a DC PSM (see Figure 154 on page 306):

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 209: Installing a DC Power Supply Module



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 DC Power Supply Module Description on page 96
- MX2020 DC Power Electrical Safety Guidelines on page 585
- MX2020 DC Power Subsystem Electrical Specifications on page 179

Replacing an MX2020 DC Power Distribution Module

Removing an MX2020 DC 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.

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. Switch off (**O**) the DC PSMs and disengage all DC PSMs.
4. Verify that the **–48V** LEDs on the PDM to be removed are not lit.
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 DC circuit breaker on the power input source to the **OFF** position.
7. Remove the clear plastic covers 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. Remove the cable lugs from the terminal studs.
10. Carefully move the power cables out of the way.
11. Loosen the two captive screws on the locking levers, and pull away from the chassis.

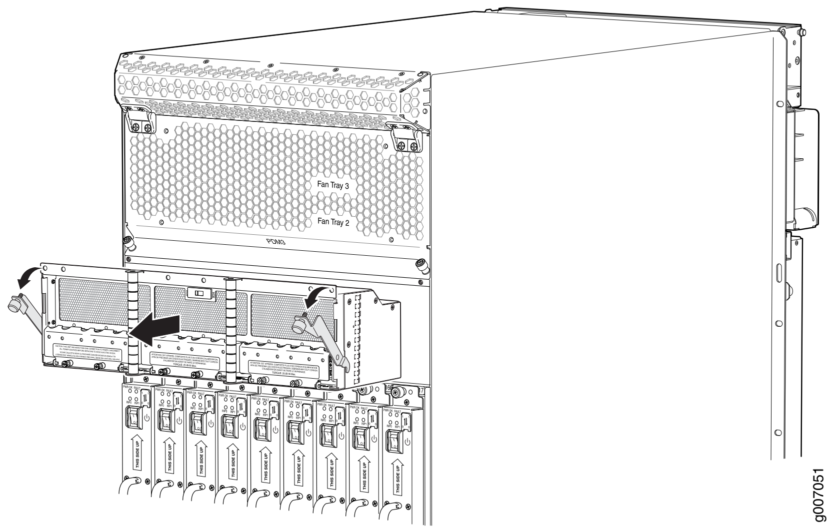
    NOTE: **PDM3/Input1** and **PDM1/Input1** locking levers are pulled down to release from chassis, and **PDM0/Input0** and **PDM2/Input0** locking levers are pulled up to release from chassis.

12. The PDM is extended slightly away from the chassis.
13. 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.

14. Place the PDM onto an antistatic mat or into a ESD bag.

Figure 210: Removing a DC Power Distribution Module from the MX2020 Router



NOTE: Each PDM slot not occupied by a DC PDM must be covered by a PDM blank panel.

Installing an MX2020 DC Power Distribution Module

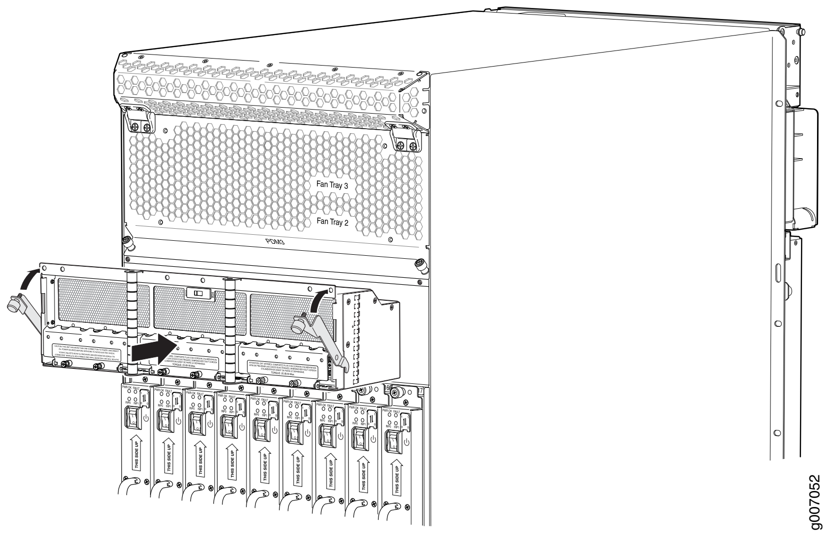
WARNING: Before performing DC power procedures, disconnect all power sources. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the **OFF** position, and tape the switch handle of the circuit breaker in the **OFF**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

To install a DC PDM (see Figure 211 on page 460):

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. Switch off (**O**) the DC PSMs that are powered only from the DC PDMs being removed.

5. Open both locking levers on either side of the PDM (see Figure 211 on page 460).
6. 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.

Figure 211: Installing a DC Power Distribution Module



7. Tighten both captive screws. 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. Remove the clear plastic cover protecting the terminal studs on the faceplate.
9. Remove the nut and washers from each of the terminal studs.
10. Secure each power cable lug to the terminal studs, first with the flat washer, then the split washer, and then 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 212 on page 462). Do not overtighten the nut. (Use a 7/16-in. (11 mm) torque-controlled driver or socket wrench.)
    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.

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 it 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 power supply 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**, **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. For information about connecting to DC power sources, see "MX2020 DC Power Subsystem Electrical Specifications" on page 179.

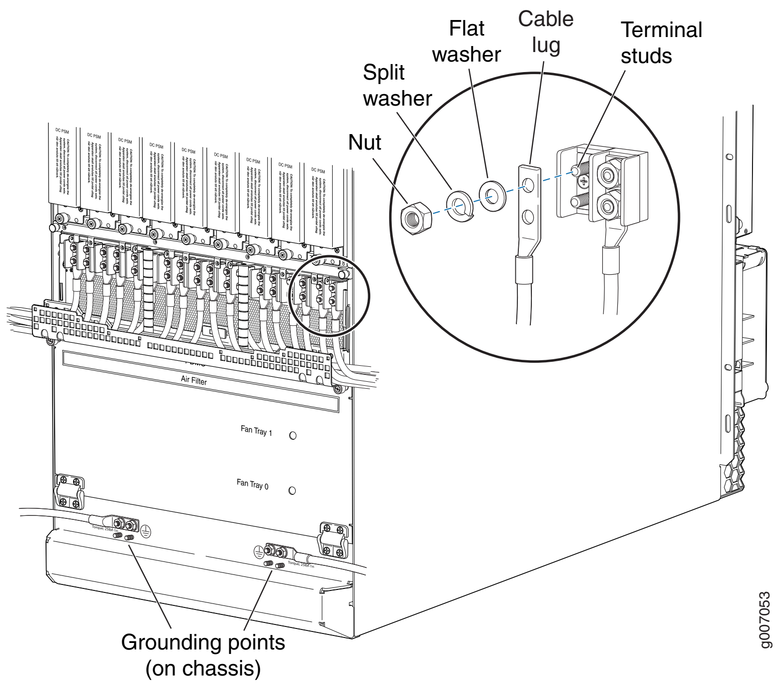
NOTE: Make sure the amperage switch is set to 60 A or 80 A to match the DC circuit input feed.

11. Replace the clear plastic cable restraint cover over the terminal studs on the faceplate.
12. Route the positive and negative DC power cables through the plastic cable restraint cover.
13. 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.
14. Switch on the dedicated customer site circuit breaker.
15. Verify that the **–48V** LED on the PDM is lit steadily.
16. For each of the DC PDMs, switch the DC circuit breaker to the **ON** position.

    NOTE: The circuit breaker may bounce back to the **OFF** position if you move the breaker too quickly.

17. Verify that the **–48V** LED is lit steadily green.
18. Turn the power switch to the on (**|**) position for the PSMs that are zoned for the PDMs that are installed.

Figure 212: Connecting DC Power to the MX2020 Router



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 DC Power Subsystem Electrical Specifications on page 179
- MX2020 DC Power Distribution Module Description on page 94
- MX2020 DC Power Electrical Safety Guidelines on page 585
- Connecting an MX2020 DC Power Distribution Module Cable on page 268
- Disconnecting an MX2020 DC Power Distribution Module Cable on page 463

Replacing an MX2020 DC Power Distribution Module Cable

1. Disconnecting an MX2020 DC Power Distribution Module Cable on page 463
2. Connecting an MX2020 DC Power Distribution Module Cable on page 463

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.)
8. Remove the cable lug from the terminal studs.
9. Carefully move the power cable out of the way.
10. Replace the clear plastic cover protecting the terminal studs on the faceplate.

Connecting an 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 connect a power cable for a DC PDM:

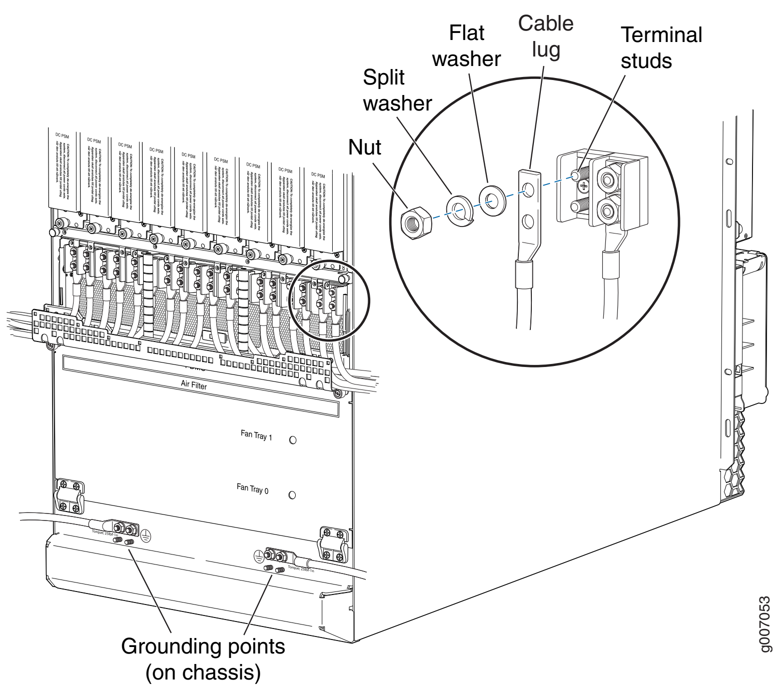
1. Locate a replacement power cable that meets the specifications defined in "MX2020 DC Power Subsystem Electrical Specifications" on page 179.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the **–48V** LED is off.
4. Secure the power cable lug to the terminal studs, first with the first with the flat washer, then the split washer, and then 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 128 on page 269). Do not overtighten the nut. (Use a 7/16-in. [11 mm)] torque-controlled driver or socket wrench.)

CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when the nut is improperly threaded 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.

Figure 213: Connecting Power Cables to the DC Power Distribution Module



5. Route the positive and negative DC power cables through the plastic cable restraint cover. Make sure that the cable does not touch or obstruct any router components.
6. Verify that the DC power cable is connected correctly, that it does not touch or block access to router components, and that it does not drape where people could trip on it.
7. Attach the power cable to the DC power source.

8. Turn on the dedicated customer site circuit breaker to the PDM.
9. Verify that the **–48V** LED on the PDM is lit steadily.
10. On each of the DC power input sources, switch the DC circuit breaker to the center position before moving it to the **ON** position.

    NOTE: **The circuit breaker may bounce back to the OFF position if you move the breaker too quickly.**

    Observe the status LEDs on the PDM faceplate. If the PDM is correctly installed and functioning normally, the **–48V** LEDs light green steadily.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 DC Power Distribution Module Description on page 94
- DC Power Cable Specifications for the MX2020 Router on page 184
- MX2020 DC Power Electrical Safety Guidelines on page 585

Replacing the MX2020 Standard EMI Covers

Removing the MX2020 Standard EMI Covers

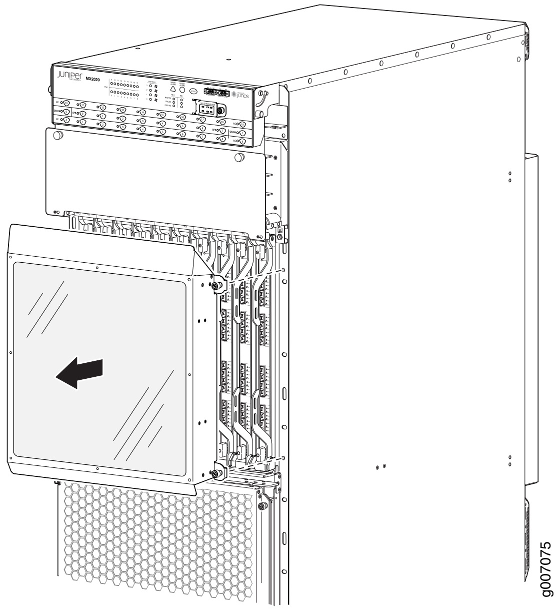
The MX2020 router supports a standard or extended set of EMI covers that you can order from Juniper Networks.

To remove the standard electromagnetic interference (EMI) card cage cover (see Figure 214 on page 466):

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 214: Removing the Standard EMI Card Cage Cover



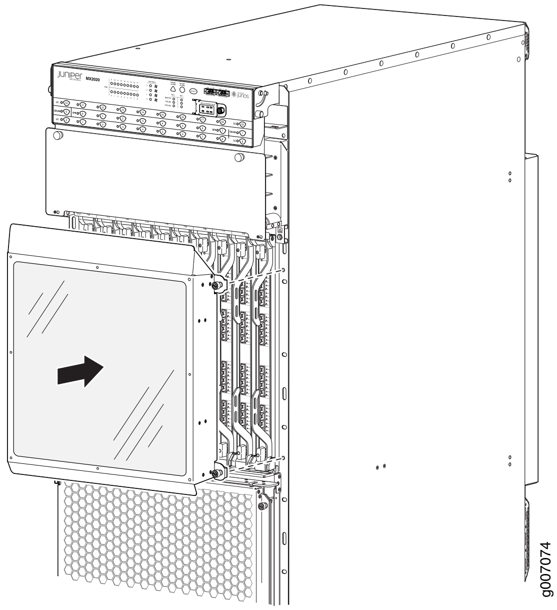
Installing the MX2020 Standard EMI Covers

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 156 on page 309).

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 215: Installing the Standard EMI Card Cage Cover



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Replacing the MX2020 Extended EMI Covers on page 467

Replacing the MX2020 Extended EMI Covers

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 216 on page 468):

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 217 on page 469).

Figure 216: Removing the Extended EMI Card Cage Cover

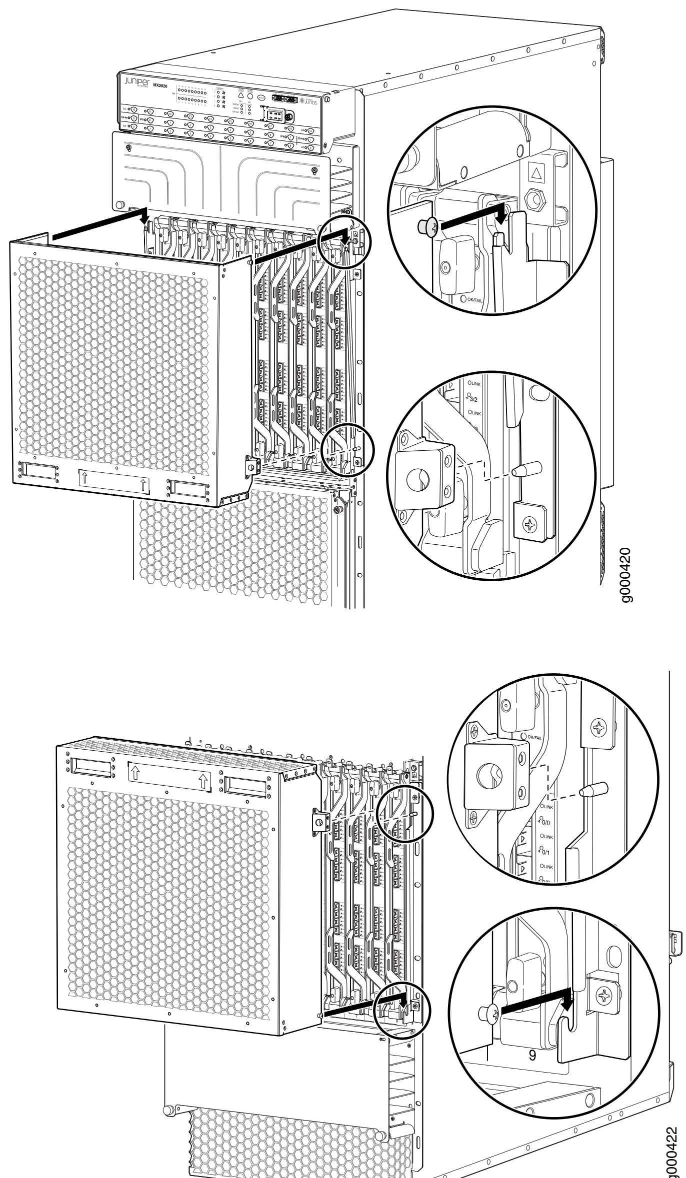
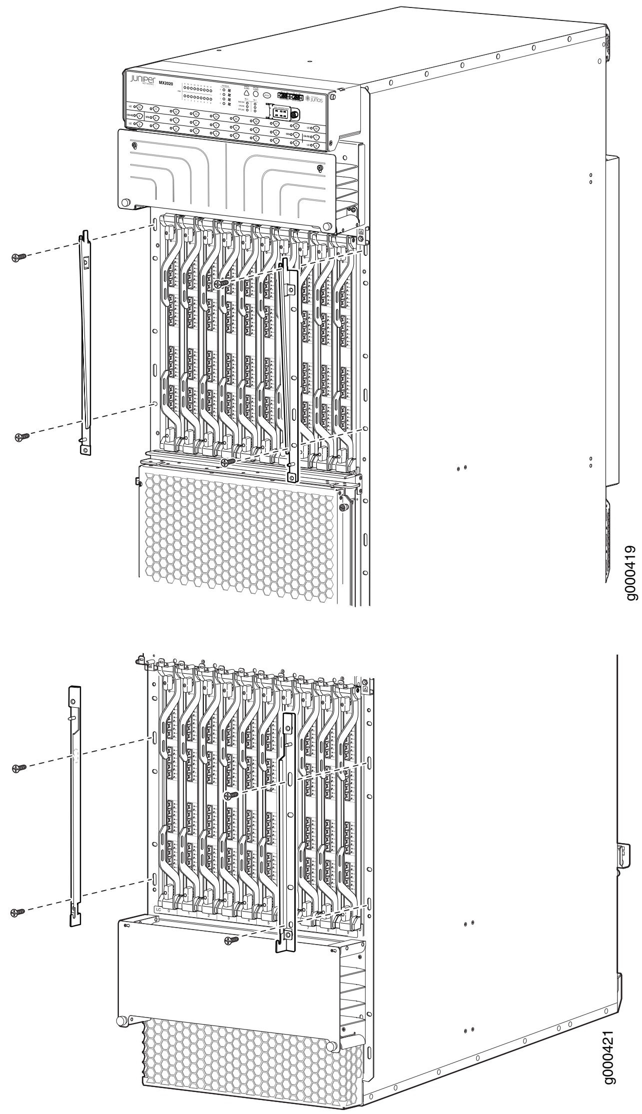


Figure 217: Removing the Extended EMI Cover Mounting Brackets



Installing the MX2020 Extended EMI Cover

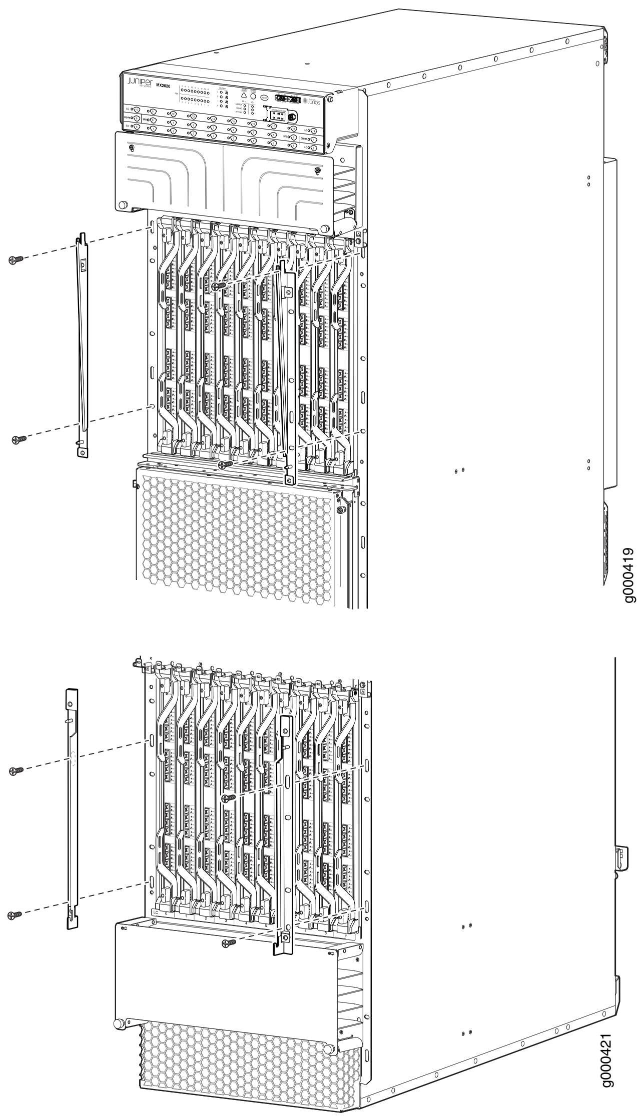
Two extended electromagnetic interference (EMI) covers attach to the router over the upper and lower card cages.

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 157 on page 310).

Figure 218: Installing the Extended EMI Cover Mounting Brackets



4. Orient the cover so that the arrows point up in front of the card cage.

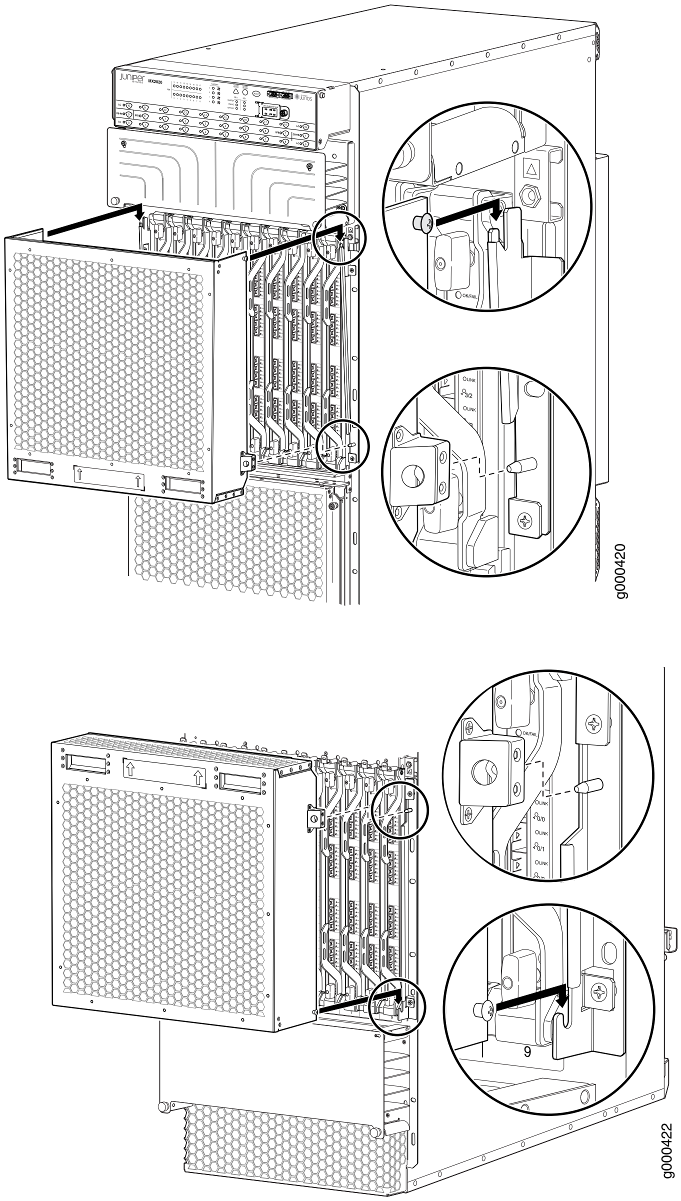
5. Angle the cover so that the points each side of the extended EMI cover fit into the grooves on the EMI cover mounting brackets.

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 219: Installing the Extended EMI Card Cage Cover



Related Documentation

- Replacing the MX2020 Standard EMI Covers on page 465

Replacing an MX2020 Fan Tray

1. Removing an MX2020 Fan Tray on page 472
2. Installing an MX2020 Fan Tray on page 473

Removing an MX2020 Fan Tray

CAUTION: **To prevent overheating, install the replacement fan tray immediately after removing the existing fan tray.**

To remove the upper or lower fan trays (see Figure 220 on page 473 and Figure 221 on page 473):

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.

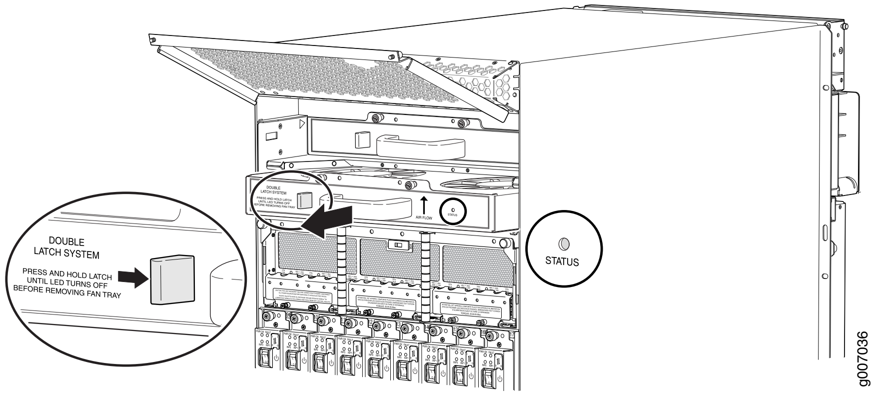
   NOTE: **The fan trays are interchangeable and are hot-insertable and hot-removable.**

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.**

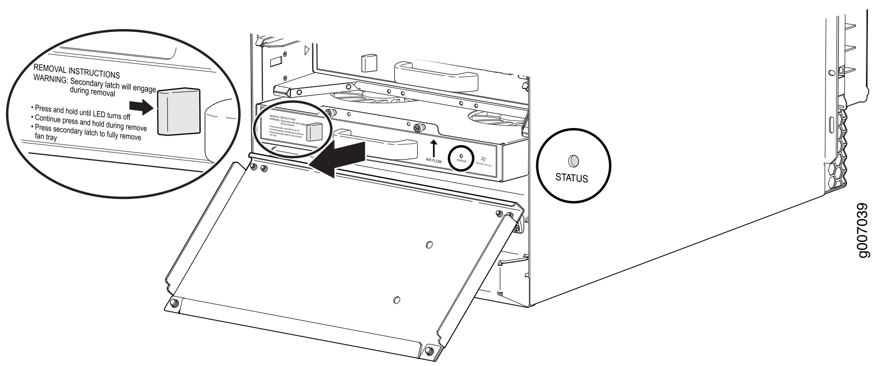
7. Place the fan tray on an antistatic mat or in an approved ESD bag.

Figure 220: Removing the Upper Fan Trays



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

Figure 221: Removing the Lower Fan Trays



Installing an MX2020 Fan Tray

This topic describes how to install the upper or lower fan trays in a MX2010. This procedure applies to both the standard fan tray and the optimized power fan tray.To install the upper or lower fan tray (see Figure 159 on page 313 and Figure 160 on page 313):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Reposition the DC cable manager, if necessary, before installing the upper or lower fan tray:
   - Unwrap any cables on the DC cable manager and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable manager, and tray and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.
3. Loosen the two captive screws on the access panel and then swing the panel open.

4. Remove the fan tray from the antistatic mat or ESD bag.
5. Grasp the fan tray by the handle, and place one hand under the fan tray for support. Insert the fan tray partially into the chassis while pressing the latch.

   NOTE: When inserting the fan tray observe the correct orientation by the "this side up" label on the fan tray.

6. Press and hold the latch again while carefully pushing the fan tray into the chassis.

   NOTE: The fan tray has a double locking safety mechanism that allows you to safely install the fan tray in a two-stage process.

7. Tighten the two captive screws on the fan tray faceplate. 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. Close the access panel and secure the two captive screws on either side of the access panel. 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. Reinstall the DC cable manager back into position, if necessary.

Figure 222: Installing Upper Fan Trays

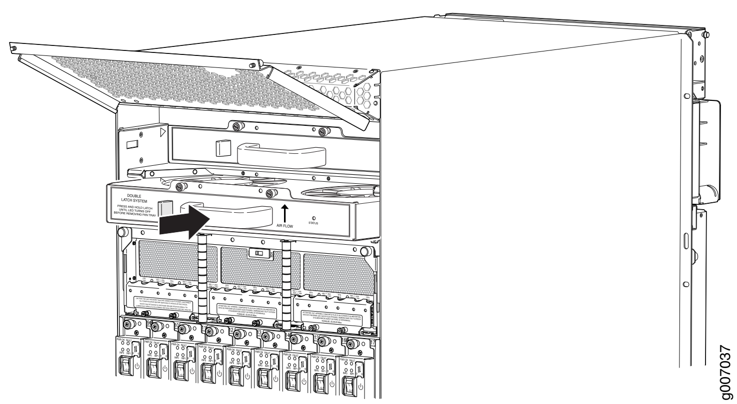
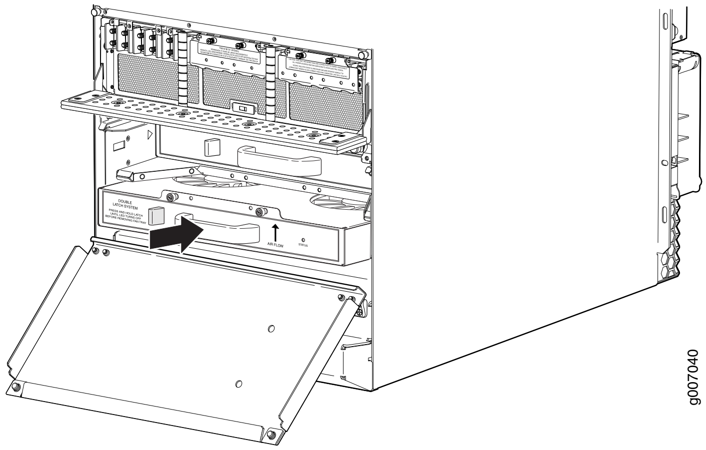


Figure 223: Installing Lower Fan Trays



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Maintaining the MX2020 Fan Trays on page 345

Replacing the MX2020 Air Baffle

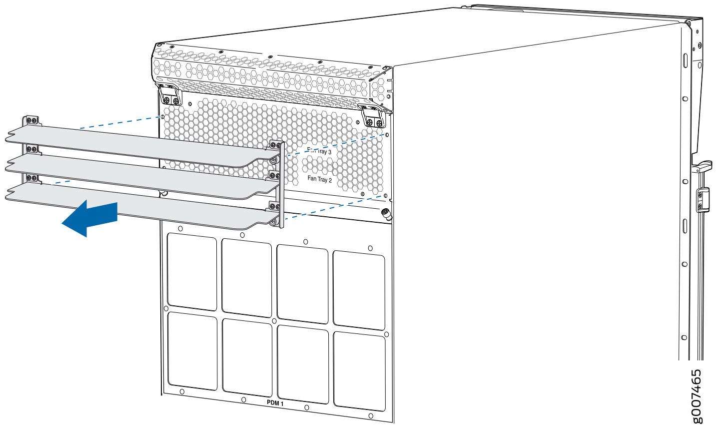
1. Removing the MX2020 Air Baffle on page 475
2. Installing the MX2020 Air Baffle on page 476

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 224 on page 476.

Figure 224: Removing the Air Baffle

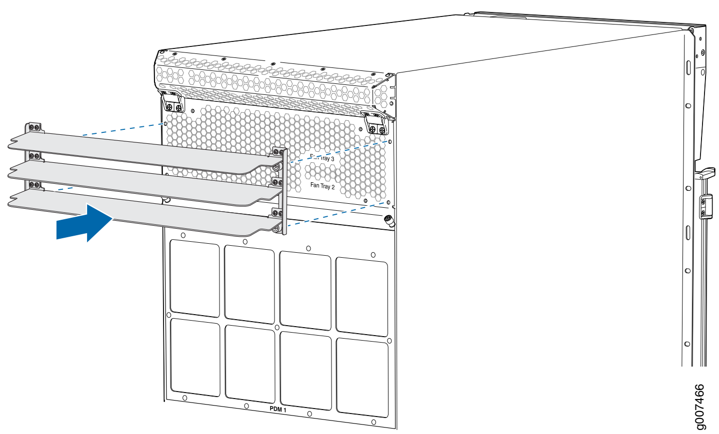


Installing the MX2020 Air Baffle

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 161 on page 314).
4. Tighten the four captive screws to secure the air baffle to the upper fan tray access door.

Figure 225: Installing the Air Baffle



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Cooling System Description on page 53
- Maintaining the MX2020 Air Baffle on page 344

Replacing an MX2020 MIC

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 226 on page 478):

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.

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

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

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

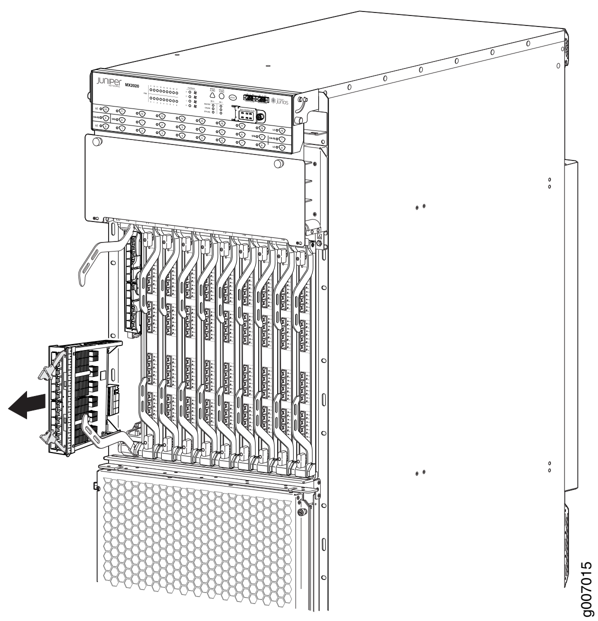
CAUTION: **Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.**

7. On the MPC, pull the ejector lever that is adjacent to the MIC you are removing away from the MPC faceplate. This disconnects the MIC from the MPC.

NOTE: **To remove a dual-wide MIC that takes up both MIC slots, you must pull both ejector levers away from the MPC faceplate.**

8. Grasp the handles on the MIC faceplate, and slide the MIC out of the MPC card carrier. Place it in the electrostatic bag or on the antistatic mat.
9. If you are not reinstalling a MIC into the emptied MIC slot within a short time, install a blank MIC panel over the slot to maintain proper airflow in the MPC card cage.

Figure 226: Removing a Single-Wide MIC



Installing an MX2020 MIC

To install a MIC (see Figure 164 on page 317):

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 163 on page 316):
   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 487.

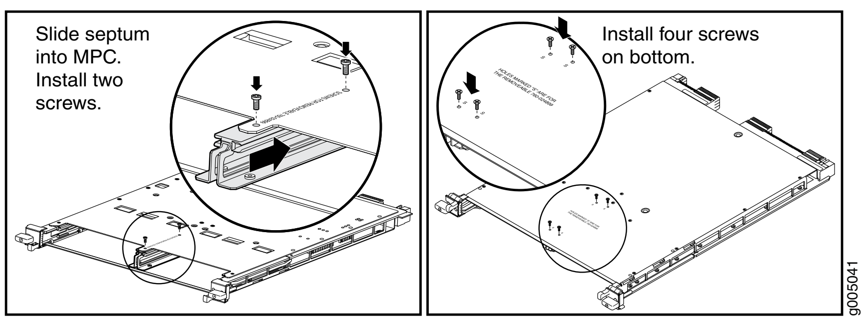
   b. Position the septum in the center of the MPC so that it lines up with holes labeled **S** on the top of the MPC.

   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 492.

Figure 227: 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.

   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.**

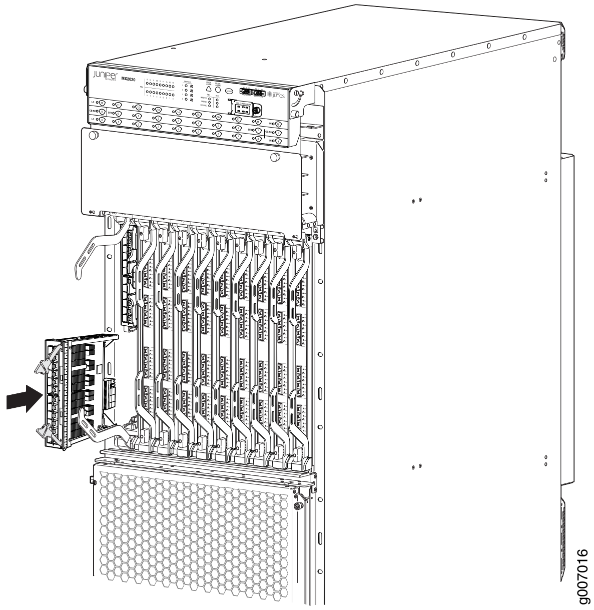
11. Use one of the following methods to bring the MIC online:
    - Press the MIC offline/online button until the MIC **OK/FAIL** LED lights green.
    - Issue the following CLI command:

      `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 374.

Figure 228: Installing a MIC

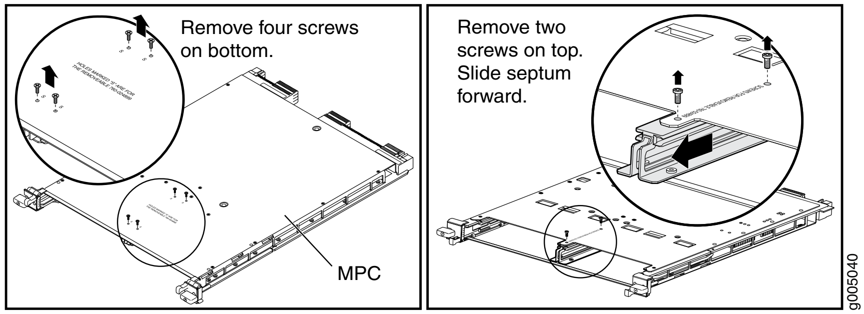


Installing an MX2020 Dual-Wide MIC

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 155 on page 307):
   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 487.
   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 492.

Figure 229: 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.

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 374.

Replacing a MIC Installed on an MPC6E

The MPC6E line cards are supported on the MX2010 and MX2020 routers. You can install the MPC6E directly into the 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" on page 74.

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:

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

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Modular Interface Card Description on page 73
- Maintaining MX2020 MICs on page 374
- Troubleshooting the MX2020 MICs on page 537

Replacing an MX2020 MPC

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.

   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.**

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 230 on page 489):

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.

> 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.

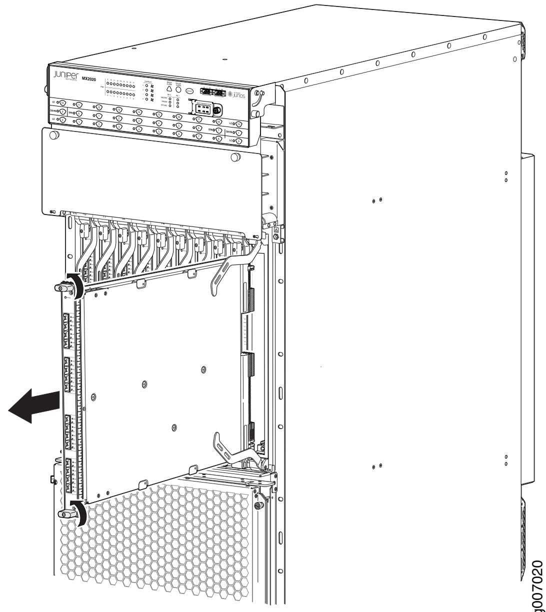
When the MPC is out of the ADC, do not hold it by the knobs, bus bars, or edge connectors. They cannot support its weight.

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 230: Removing an MPC from the ADC



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 487.
3. Issue the following CLI command to take the ADC offline:

   `user@host>`**request chassis fdc slot *slot-number* offline**

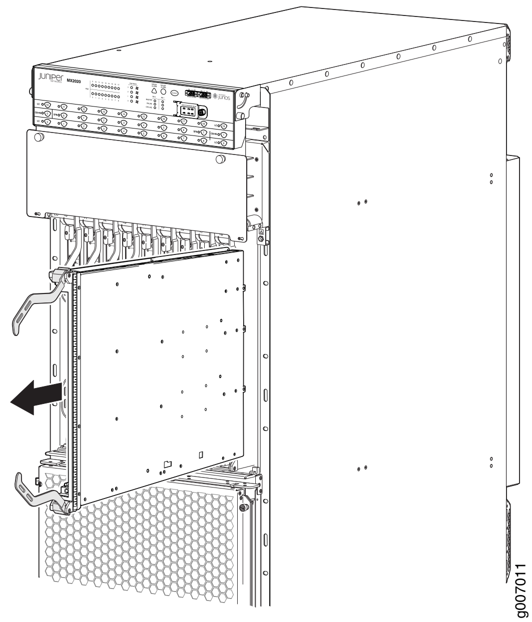
   For more information about the command, see the *Junos OS System Basics and Services Command Reference*.

   NOTE: **When issuing the request chassis fdc 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 231: Removing an ADC



Installing an MX2020 Adapter Card

An ADC weighs up to 15 lb (6.80 kg). Be prepared to accept its full weight.

To install an ADC (see Figure 146 on page 296):

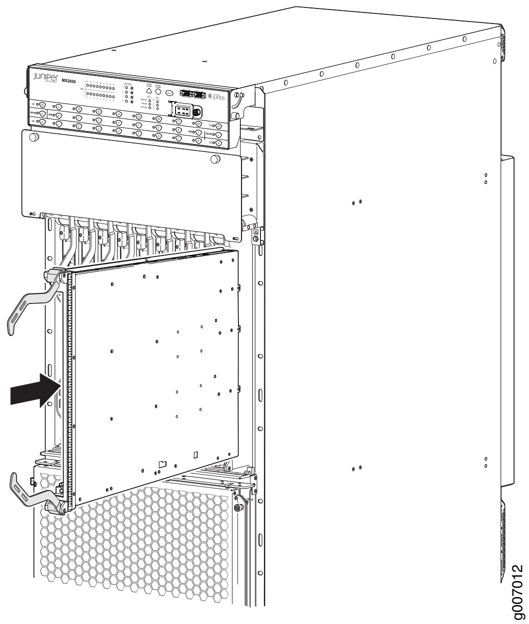
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the ADC from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Orient the ADC so that the faceplate faces you vertically.
5. Lift the ADC into place, and carefully align the sides 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.
8. Issue the following CLI command to bring the ADC online:

   `user@host>`**request chassis fdc 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 fdc online** command, the FRU will gain power, and the system total power will decrease.

Figure 232: Installing an ADC



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 233 on page 494):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Remove the MPC from its electrostatic bag.
3. Identify the slot on the router where it will be installed.
4. Verify that each fiber-optic transceiver is covered with a rubber safety cap.
5. Orient the MPC so that the faceplate faces you vertically.
6. Lift the MPC into place, and carefully align the sides of the MPC with the guides inside the ADC.
7. Slide the MPC all the way into the ADC until you feel resistance.
8. Grasp both knobs, and rotate them clockwise simultaneously until the MPC is fully seated into the ADC.
9. Remove the rubber safety cap from each fiber-optic transceiver and cable.

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

10. Insert the cables into the cable connector ports on each MPC (see Figure 234 on page 494).
11. Arrange the cable in the cable manager to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop. Placing fasteners on the loop helps to maintain its shape.

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

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

12. Use one of the following methods to bring the MPC online:
    - Press and hold the corresponding MPC **LC** online button on the craft interface until the green **OK** LED next to the button lights steadily, in about 5 seconds.
    - Issue the following CLI command:

      `user@host>`**request chassis 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.

Figure 233: Installing an MPC into an ADC

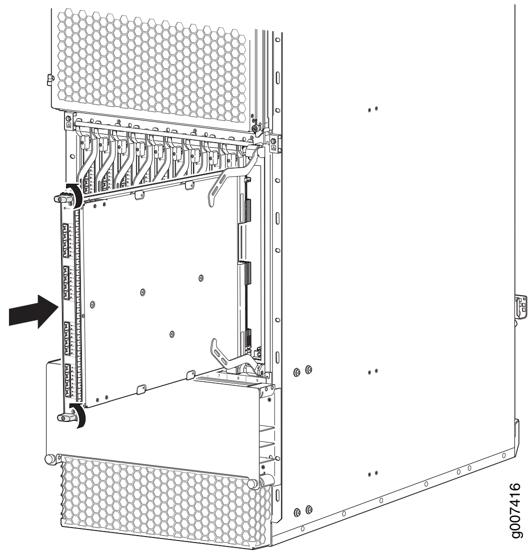
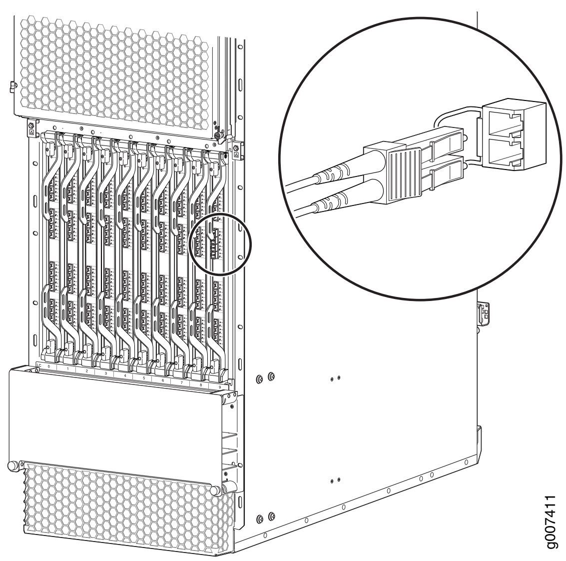


Figure 234: Attaching a Cable to an MPC



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 MPC Terminology on page 73
- Maintaining MX2020 MPCs on page 375
- Troubleshooting the MX2020 MPCs on page 538

Replacing an MX2020 SFB

1. Removing an MX2020 SFB on page 495
2. Installing an MX2020 SFB on page 496

Removing an MX2020 SFB

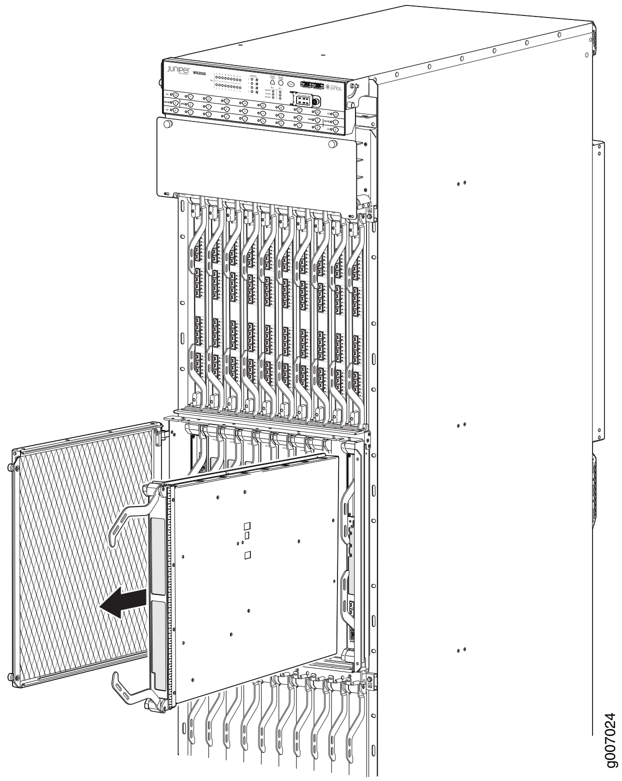
To remove an SFB (see Figure 235 on page 496):

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 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.
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.
7. If you are not replacing the SFB immediately, install a blank panel over the empty slot.

Figure 235: Removing an SFB



Installing an MX2020 SFB

To install an SFB (see Figure 165 on page 323):

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 SFB from the electrostatic bag.
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. 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 “Contacting Customer Support” on page 549.
7. Check the status of the SFB 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
```



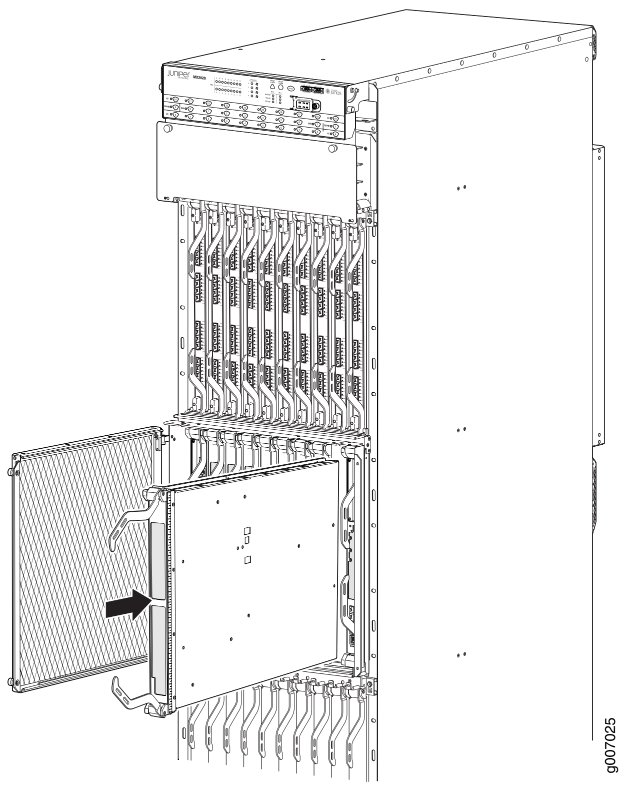
```
      LTC3880-XF0-1.0v-RAIL     1029 mV
      LTC3880-XF0-1.0v-CH0      1029 mV
      LTC3880-XF0-1.0v-CH1      1032 mV
      LTC3880-3.3v-RAIL         3300 mV
      LTC3880-3.3v-CH0          3300 mV
      LTC3880-3.3v-CH1          3300 mV
  SFB 4 status:
    State                      Online
    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
```

Figure 236: Installing an SFB



Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Switch Fabric Board Description on page 64
- Maintaining the MX2020 SFB on page 397

Replacing an SFP or XFP Transceiver on an MX2020 MPC or MIC

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 237 on page 503):

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.

   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.**

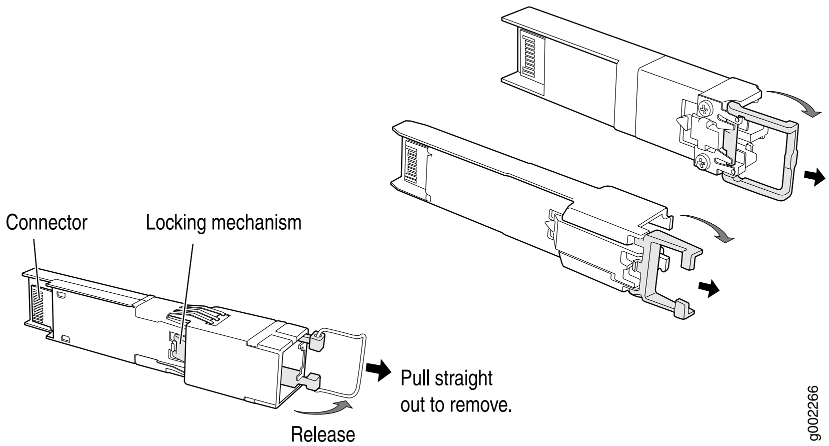
6. Pull the ejector handle out from the transceiver to unlock the transceiver.

   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 237: 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.**

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.

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

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Replacing an MX2020 MIC on page 477
- Replacing an MX2020 MPC on page 485

Replacing an MX2020 Three-Phase Delta AC Power Cord

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

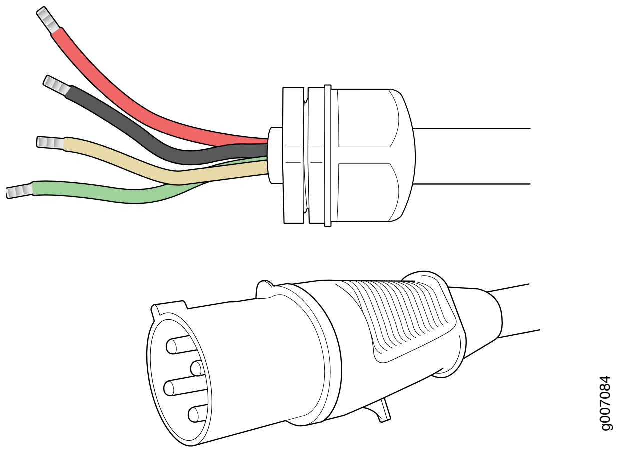
To remove a three-phase delta AC power cord:

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 238 on page 505) from the power source.

Figure 238: Three-Phase Delta AC Power Cord



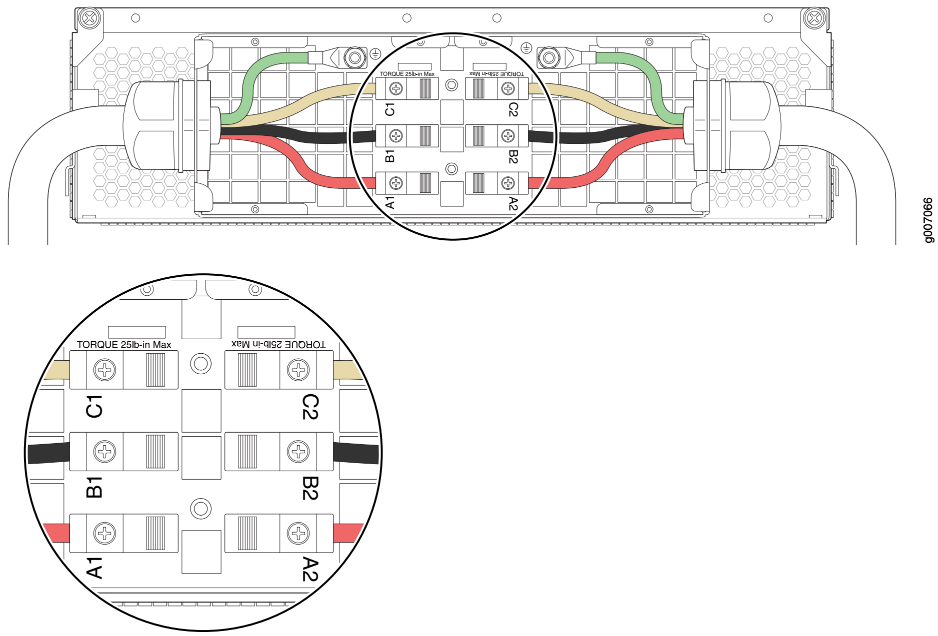
6. Remove the ESD grounding strap from the approved site ESD grounding point. See the instructions for your site. Reconnect the strap to one of the ESD points on the chassis.
7. Using a number 2 Phillips (+) screwdriver, loosen the four screws on the cover of the metal wiring compartment that protects 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 239 on page 506). 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 239: 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.

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 240 on page 508). 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 97 on page 509 for approved AC wire gauge).

    To insert wires into the terminal block that serves six PSMs:

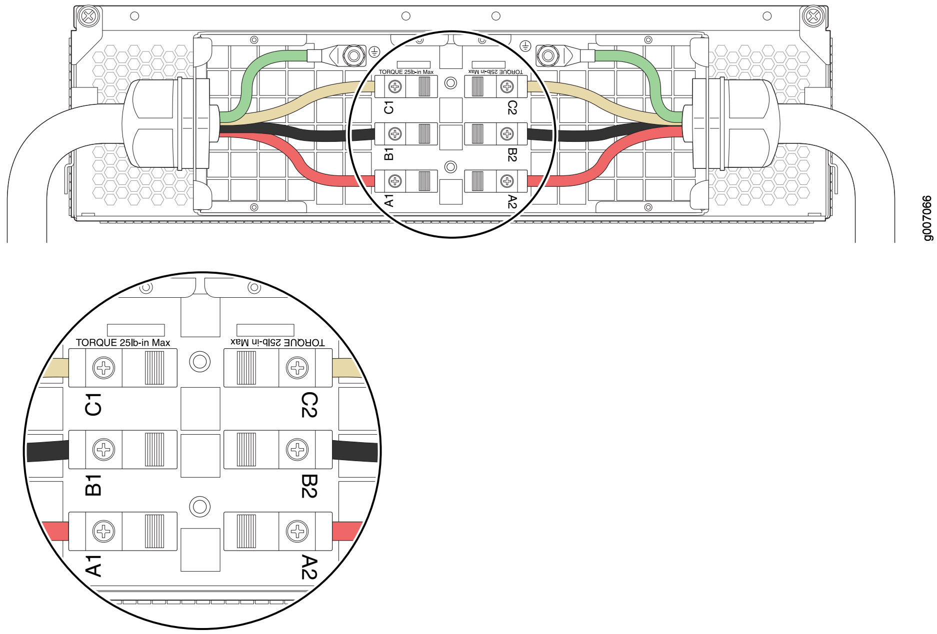
    a. Insert the grounding wire into the grounding point labeled **GND**.

    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 240: 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 97: 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.**

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs on page 91
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Cord Specifications on page 154
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163

Replacing an MX2020 Three-Phase Delta AC Power Distribution Module

Removing an MX2020 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.

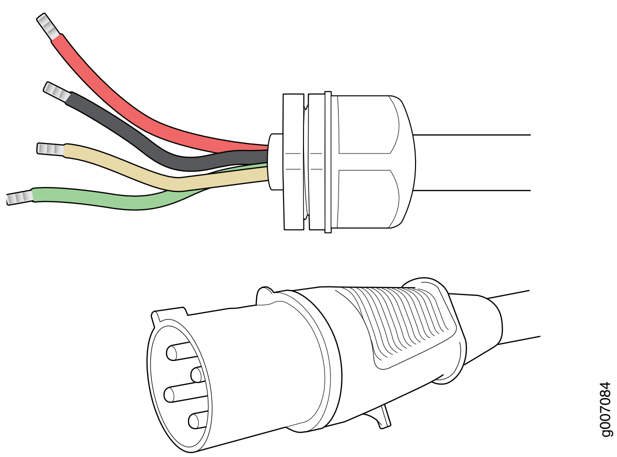
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each PDM slot must contain either a PDM or a blank panel. If you remove a PDM, you must install a replacement PDM or a blank panel shortly after the removal.

NOTE: After powering off a PDM, wait at least 60 seconds before turning the circuit breaker to the **ON** position.

To remove a three-phase delta AC PDM:

1. Switch off the dedicated customer site circuit breakers to the PDM being remove. 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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.
4. 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.
5. Disconnect the AC power cord (see Figure 241 on page 511) from the power source.

Figure 241: 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 AC wiring compartment.

9. Disconnect the wires from the AC terminal block on the three-phase delta AC PDM (see Figure 242 on page 512), 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:

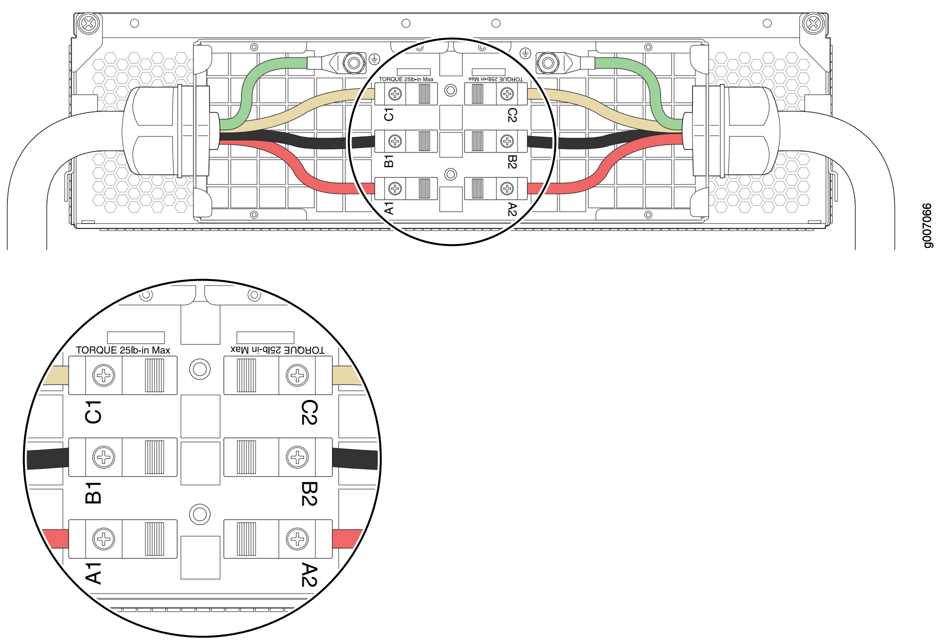
   a. Remove the wire labeled **L3** from the input terminal labeled **C1**.

   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 242: 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.

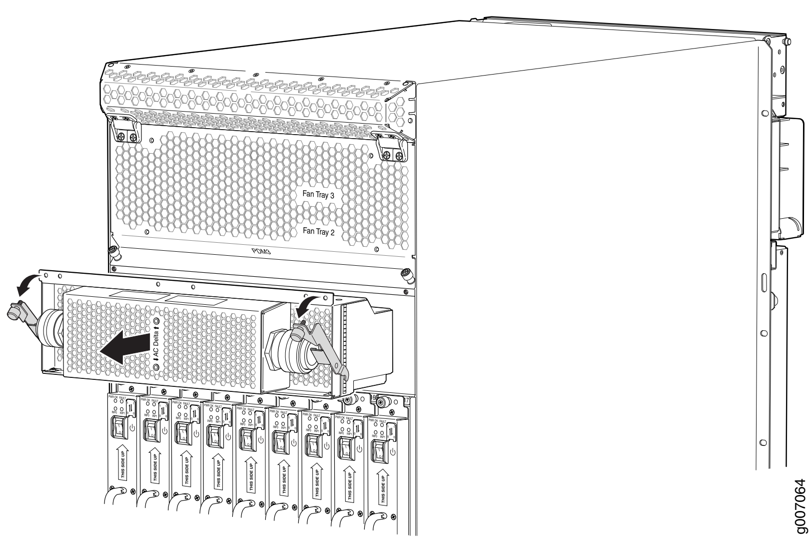
NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

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 both of the AC power cords from the AC PDM.
15. Loosen the two captive screws on the locking levers of the PDM faceplate completely.
16. Pull the locking levers on either side of the faceplate up to unseat the PDM.
17. Grasp the levers on the PDM faceplate and pull firmly. Slide it halfway out of the chassis (see Figure 243 on page 513).

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.

18. Place one hand underneath the PDM to support it, and slide it completely out of the chassis.

Figure 243: Removing a Three-Phase Delta AC Power Distribution Module



NOTE: Each PDM slot not occupied by a AC PDM must be covered by a PDM blank panel.

Installing an MX2020 Three-Phase Delta AC Power Distribution Module

Before you install 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.

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 PDU (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:

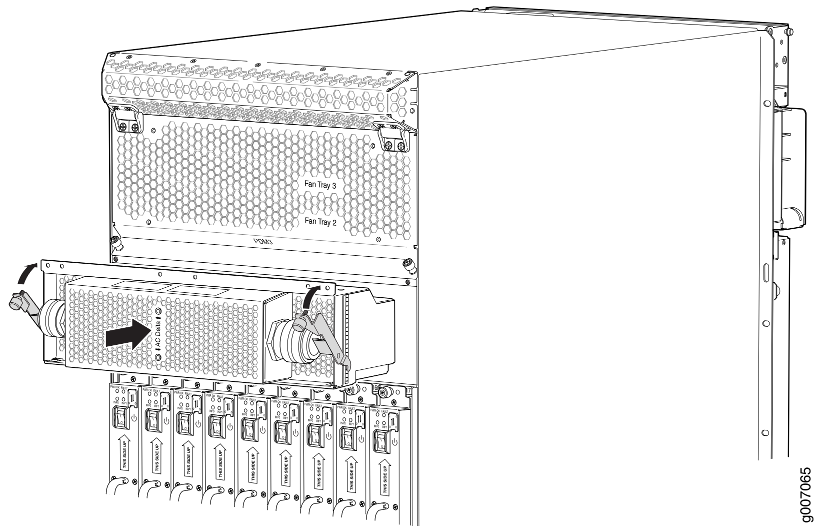
1. Make sure that the voltage across the AC power source cord is 0 V and that there is no chance that the cord might become active during the installation process.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Switch off (**O**) the PSMs 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.

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 166 on page 325).

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. 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 244: Installing a Three-Phase Delta AC Power Distribution Module

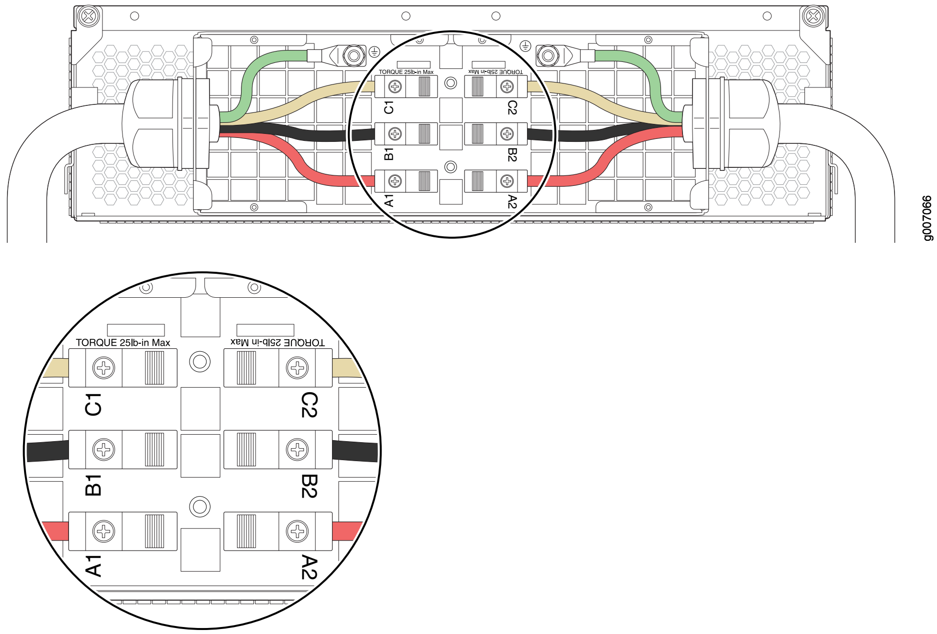


9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Put the wires of the AC power 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 167 on page 326). 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 91 on page 327 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 245: 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 may 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 98: 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 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.
24. Switch the power switch on all the PSMs to the on (|) position to provide power to the router components.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs on page 91
- Connecting AC Power to an MX2020 Router with Three-Phase Delta AC Power Distribution Modules on page 249
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Cord Specifications on page 154
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163

Replacing an MX2020 Three-Phase Wye AC Power Distribution Module

Removing an MX2020 Three-Phase Wye AC Power Distribution Module

Before you remove a three-phase wye 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: To avoid damage and electrical shock, do not touch the power connectors on the PDM .

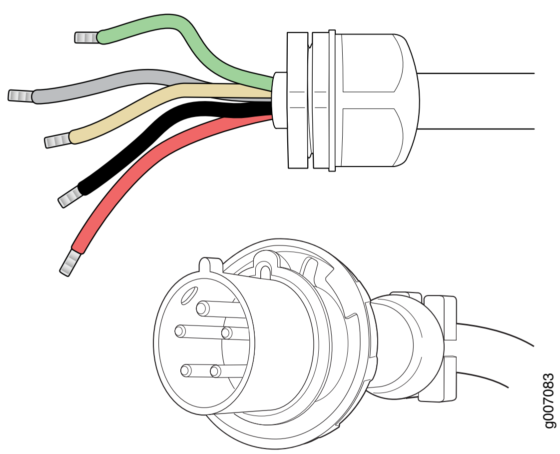
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each PDM slot must contain either a PDM or a blank panel. If you remove a PDM, you must install a replacement PDM or a blank panel shortly after the removal.

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. Switch off the dedicated customer site circuit breakers to the PDM being remove. 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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.
4. 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.
5. Disconnect the AC power cord (see Figure 246 on page 519) from the power source.

Figure 246: Three-Phase Wye 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 AC wiring compartment.
9. Disconnect the wires from the AC terminal block on the three-phase delta AC PDM (see Figure 247 on page 520), 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 **N** from the input terminal labeled **N1**.

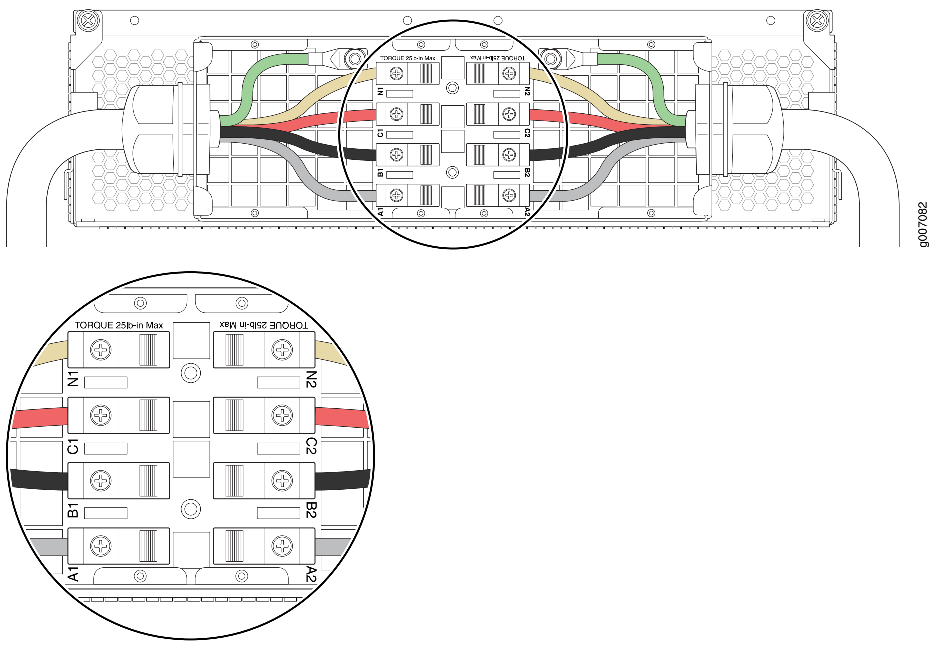
b. Remove the wire labeled **L3** from the input terminal labeled **C1**.

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 247: Disconnecting the Power Cord from a Three-Phase Wye AC Power Distribution Module



To remove wires from the terminal block that serves three PSMs:

a. Remove the wire labeled **N** from the input terminal labeled **N2**.

b. Remove the wire labeled **L3** from the input terminal labeled **C2**.

c. Remove the wire labeled **L2** from the input terminal labeled **B2**.

d. Remove the wire labeled **L1** from the input terminal labeled **A2**.

e. Remove the grounding wire from the grounding point labeled **GND**.

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

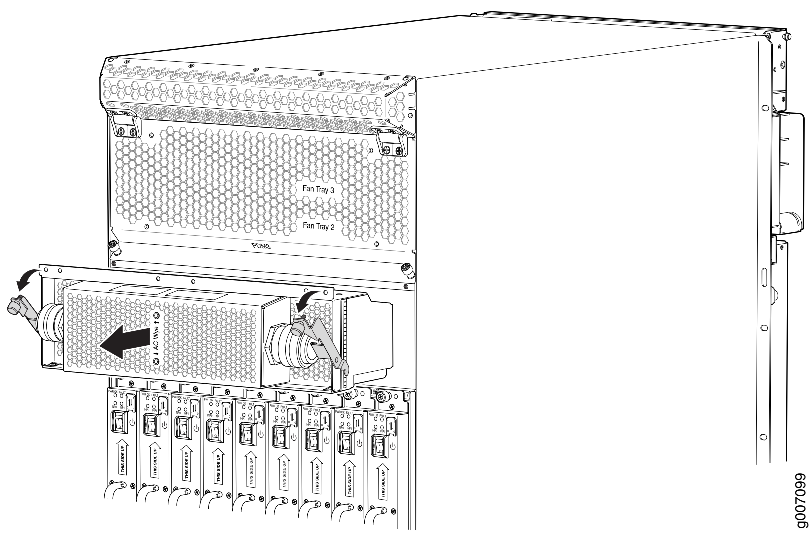
NOTE: The terminal connections have either slotted screws or hex screws. Use a 1/4-in. slotted screwdriver for the slotted screws. Use a 5/32-in. (4 mm) Allen wrench for the 5/16-in. hex screws.

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.
15. Loosen the two captive screws on the locking levers of the PDM faceplate completely.
16. Pull the locking levers on either side of the faceplate up to unseat the PDM.
17. Grasp the levers on the PDM faceplate and pull firmly. Slide if halfway out of the chassis (see Figure 248 on page 521).

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.

18. Place one hand underneath the PDM to support it, and slide it completely out of the chassis .

Figure 248: Removing a 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 MX2020 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, 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.

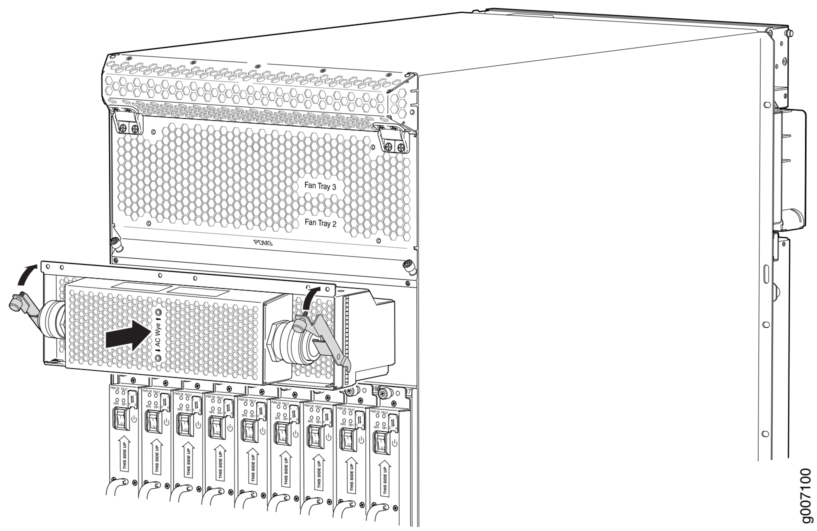
CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each PDM slot must contain either a PDM or a blank panel. If you remove a PDM, you must install a replacement PDM or a blank panel shortly after the removal.

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 PDU (AC or DC) to another 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. Switch off (**O**) the AC PSMs and disengage all AC PSMs.
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 168 on page 329).
6. Push the lock levers completely into 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.

Figure 249: Installing a Three-Phase Wye AC Power Distribution Module

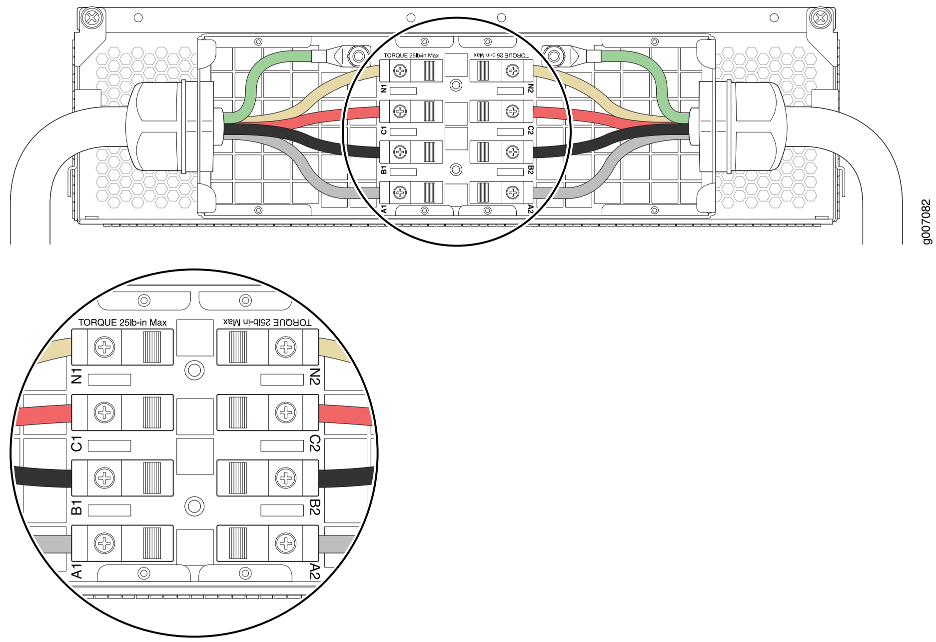


9. Remove the cover of the metal AC wiring compartment.
10. Unscrew the retaining nut from the AC power cord.
11. Place the retaining nut inside the metal wiring compartment.
12. Put the wires of the AC power cord through the hole of the retaining nut and rubber grommet.
13. Put the wires of the AC power 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 169 on page 330). 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 92 on page 331 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 250: 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 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**.

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 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-N1, B1-N1, C1-N1, A2-N2, B2-N2, and C2-N2 for three-phase wye 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 wye AC wire assembly kits can be purchased from Juniper Networks.

Table 99: 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. 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.
24. Switch the power switches on all the PSMs to the on (|) position to provide power to the router components.

Related Documentation

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- MX2020 Three-Phase Delta and Wye AC Power Distribution Module LEDs on page 91
- *Replacing an MX2020 Three-Phase Wye AC Power Cord*
- Troubleshooting the MX2020 Power Subsystem on page 541
- MX2020 AC Power Cord Specifications on page 154

CHAPTER 26

Powering Off the Router

Powering Off the AC-Powered MX2020 Router

NOTE: After powering off a 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 their 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 PSM faceplate for each AC PSM to the off (**O**) position.

Related Documentation

- Connecting the MX2020 Router to Management and Alarm Devices on page 275
- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558

Powering Off the DC-Powered MX2020 Router

NOTE: After powering off a 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 their 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 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

- Preventing Electrostatic Discharge Damage to an MX2020 Router on page 558
- Grounding the MX2020 Router on page 247
- Powering On the DC-Powered MX2020 Router on page 273

PART 5

Troubleshooting Hardware

CHAPTER 27

Troubleshooting Components

MX2020 Troubleshooting Resources

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 master. 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 master 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 on page 37
- Troubleshooting the MX2020 Cooling System on page 534
- Troubleshooting the MX2020 MPCs on page 538
- Troubleshooting the MX2020 MICs on page 537
- Troubleshooting the MX2020 Power Subsystem on page 541

Troubleshooting the MX2020 Cooling System

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 100 on page 535.

Table 100: 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.

Table 100: MX2020 Cooling System Alarms *(continued)*

Component	Alarm Type	CLI Message	Alarm Condition	Solution
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
	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 on page 37
- Replacing an MX2020 Fan Tray on page 471
- Maintaining the MX2020 Air Filter on page 341
- Maintaining the MX2020 Fan Trays on page 345

Troubleshooting the MX2020 Host Subsystems

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

- MX2020 Host Subsystem Description on page 57
- MX2020 Craft Interface Description on page 37

Troubleshooting the MX2020 MICs

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

- MX2020 Modular Interface Card Description on page 73
- Maintaining MX2020 MICs on page 374
- Maintaining Cables That Connect to MX2020 MPCs or MICs on page 338
- Replacing an MX2020 MIC on page 477

Troubleshooting the MX2020 MPCs

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 on page 37
- MX2020 Modular Port Concentrator Description on page 68
- Maintaining MX2020 MPCs on page 375
- Replacing an MX2020 MPC on page 485

Troubleshooting the MX2020 Power Subsystem

Problem **Description:** The following alarms, LEDs, and other conditions indicate a problem with the AC or DC power system:

- If all AC or DC PSMs have failed, the system temperature might have exceed the threshold, causing the system to shut down.
- The yellow **PWR OK** LED blinks when a AC or DC PSM is out of power limit or over current condition.
- The red **FAULT** LED lights when the PSM is not receiving enough airflow to maintain 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 will blink 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 will blink 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.

Solution To troubleshoot the MX2020 power subsystem:

1. Check the LEDs on all AC or DC PSM faceplate.
   - **PWR OK** PSM LED is blinking—Check the fans and air filters to be sure 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 the PSMs are inserted and if the are operating.
   - If a AC or DC 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 PDM faceplate.
   - **–48V** PDM LED is off—Check that the PDM is receiving voltage.
   - **–48V** PDM LED is lit red—Check that the PDM is connected to correct input voltage and polarity.
   - Check that the DC PDM switch is set to **60 A** or **80 A** depending on current feed coming from the DC source circuit breaker.

- **–48V** 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 three-phase delta and wye 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 the MX2020 Router" on page 168.
   - 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.
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 cables or AC power cord from the power source to the router are not damaged. If the insulation is cracked or broken, immediately replace the DC power cable or AC 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.

   PWR OK LED on the installed spare does not light—the replaced PSM might be faulty. To return it for replacement, see "Contacting Customer Support" on page 549.
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.

   The output displays the AC PSM input status:

   `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
PSM 4 status:
  State                 Online
  Temperature           OK
  AC Input              Feed       Voltage(V)  Current(A) Power(W)
                        INP0         225.00      1.30       292.50
                        INP1         0.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          51.75      4.50       232.88     11.09
  Hours Used            7438
PSM 5 status:
  State                 Online
  Temperature           OK
  AC Input              Feed       Voltage(V)  Current(A) Power(W)
                        INP0         225.00      1.30       292.50
                        INP1         5.00        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          51.75      4.00       207.00     9.86
  Hours Used            7462
PSM 6 status:
  State                 Online
  Temperature           OK
  AC Input              Feed       Voltage(V)  Current(A) Power(W)
                        INP0         222.50      1.50       333.75
                        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            7462
PSM 7 status:
  State                 Online
  Temperature           OK
  AC Input              Feed       Voltage(V)  Current(A) Power(W)
                        INP0         225.00      1.20       270.00
                        INP1         3.75        0.00       0.00
  DC Output             Voltage(V) Current(A)  Power(W)   Load(%)
                          52.00      3.75       195.00     9.29
  Hours Used            7462
PSM 8 status:
  State                 Online
  Temperature           OK
  AC Input              Feed       Voltage(V)  Current(A) Power(W)
                        INP0         225.00      1.40       315.00
```

```
                         INP1        3.75        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     4.00        208.00     9.90
  Hours Used             7462
PSM 9 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        223.75      2.40       537.00
                         INP1        5.00        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     8.75        455.00     21.67
  Hours Used             6862
PSM 10 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        225.00      2.20       495.00
                         INP1        3.75        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     8.50        442.00     21.05
  Hours Used             6862
PSM 11 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        225.00      2.10       472.50
                         INP1        0.00        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     8.25        429.00     20.43
  Hours Used             7438
PSM 12 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        223.75      2.20       492.25
                         INP1        0.00        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     8.25        429.00     20.43
  Hours Used             6838
PSM 13 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        225.00      2.30       517.50
                         INP1        0.00        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           52.00     8.50        442.00     21.05
  Hours Used             7438
PSM 14 status:
  State                  Online
  Temperature            OK
  AC Input               Feed       Voltage(V)  Current(A) Power(W)
                         INP0        225.00      2.20       495.00
                         INP1        0.00        0.00       0.00
  DC Output              Voltage(V) Current(A)  Power(W)   Load(%)
                           51.75     8.00        414.00     19.71
  Hours Used             7462
PSM 15 status:
  State                  Online
  Temperature            OK
```



```
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         223.75      2.20      492.25
                           INP1         0.00        0.00      0.00
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.00      8.00       416.00     19.81
  Hours Used               6837
PSM 16 status:
  State                    Online
  Temperature              OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         226.25      2.20      497.75
                           INP1         5.00        0.00      0.00
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             52.00      8.25       429.00     20.43
  Hours Used               7462
PSM 17 status:
  State                    Online
  Temperature              OK
  AC Input                 Feed       Voltage(V)  Current(A) Power(W)
                           INP0         225.00      2.20      495.00
                           INP1         3.75        0.00      0.00
  DC Output                Voltage(V) Current(A)  Power(W)   Load(%)
                             51.75      8.25       426.94     20.33
  Hours Used               7462
```

The output displays the DC PSM input status:

```
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
PSM 13 status:
  State                   Online
  Temperature             OK
  DC Input                Feed       Voltage(V)  Current(A) Power(W)
                          INP0         0.00        0.00       0.00
                         INP1         52.00       10.50      546.00
  DC Output               Voltage(V) Current(A)  Power(W)   Load(%)
                            51.25      9.50       486.88     23.18
  Hours Used              810
PSM 14 status:
  State                   Online
  Temperature             OK
  DC Input                Feed       Voltage(V)  Current(A) Power(W)
                          INP0         0.00        0.00       0.00
                          INP1         50.80       10.50      533.40
  DC Output               Voltage(V) Current(A)  Power(W)   Load(%)
                            51.25      9.50       486.88     23.18
  Hours Used              1722
PSM 15 status:
  State                   Online
  Temperature             OK
  DC Input                Feed       Voltage(V)  Current(A) Power(W)
                          INP0         0.00        0.00       0.00
                          INP1         50.80       10.15      515.62
  DC Output               Voltage(V) Current(A)  Power(W)   Load(%)
                            51.25      9.50       486.88     23.18
  Hours Used              2970
PSM 16 status:
  State                   Online
  Temperature             OK
  DC Input                Feed       Voltage(V)  Current(A) Power(W)
                          INP0         0.00        0.00       0.00
                          INP1         51.60       10.15      523.74
  DC Output               Voltage(V) Current(A)  Power(W)   Load(%)
                            51.25      9.25       474.06     22.57
  Hours Used              2970
PSM 17 status:
  State                   Online
  Temperature             OK
  DC Input                Feed       Voltage(V)  Current(A) Power(W)
                          INP0         0.00        0.00       0.00
                          INP1         51.60       10.15      523.74
  DC Output               Voltage(V) Current(A)  Power(W)   Load(%)
                            51.25      9.25       474.06     22.57
  Hours Used              2970
```

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: On the display and in the CLI, the PSMs are referred to as **PSM0** through **PSM8** (bottom) and **PSM9** through **PSM17** (top).

If the system temperature exceeds the threshold, the Junos OS shuts down all PSMs so that no status is displayed.

The Junos OS also can shut down one of the PSMs for other reasons. In this case, the remaining PSMs provide power to the router, and you can still view the system status through the CLI or display.

10. If you cannot determine the cause of the problem or need additional assistance, see “Contacting Customer Support” on page 549.

Related Documentation

- MX2020 Craft Interface Description on page 37
- MX2020 DC Power Supply Module Description on page 96
- MX2020 DC Power Distribution Module Description on page 94
- MX2020 AC Power Supply Module Description on page 158
- MX2020 Three-Phase Delta AC Power Distribution Module Description on page 86
- MX2020 Three-Phase Wye AC Power Distribution Module Description on page 88
- Replacing an MX2020 DC Power Supply Module on page 454
- Replacing an MX2020 DC Power Distribution Module on page 457
- Replacing an MX2020 AC Power Supply Module on page 428
- Replacing an MX2020 Three-Phase Delta AC Power Distribution Module on page 510
- Replacing an MX2020 Three-Phase Wye AC Power Distribution Module on page 518
- MX2020 Troubleshooting Resources on page 531

CHAPTER 28

Contacting Customer Support and Returning the Chassis or Components

Contacting 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 Case Manager link at:

  http://www.juniper.net/support/

- By telephone:

  From the US and Canada: 1-888-314-JTAC

  From all other locations: 1-408-745-9500

  If contacting JTAC by phone, enter your 11-digit case number followed by the # key if this is an existing case, or press the * 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 case number, if you have one
- Details of the failure or problem
- Type of activity being performed on the platform when the problem occurred
- Configuration data using one or more of the show commands

Related Documentation

- Returning a Hardware Component to Juniper Networks, Inc. on page 412

PART 6

Safety and Compliance Information

CHAPTER 29

General Safety Guidelines and Warnings

Definition of Safety Warning Levels

The documentation uses the following levels of safety warnings:

NOTE: You might find this information helpful in a particular situation, or might otherwise overlook it.

CAUTION: You must observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the hardware device.

WARNING: This symbol alerts you to the risk of personal injury from a 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 be familiar 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.

Attention 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.

Related Documentation

- General Safety Warnings for Juniper Networks Devices on page 556
- Installation Safety Warnings for Juniper Networks Devices on page 563
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 573
- General Electrical Safety Warnings for Juniper Networks Devices on page 579
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 586

General Safety Guidelines for Juniper Networks Devices

The following guidelines help ensure your safety and protect the hardware equipment 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 this documentation. Make sure that only authorized service personnel perform other system services.
- Keep the area around the chassis 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 chassis.
- 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 hardware equipment only when the chassis is properly grounded.
- Do not open or remove chassis covers or sheet metal parts unless instructions are provided in this documentation. 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 hardware component. Such an action could cause electrical shock or damage the hardware equipment.
- 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 router might become hot. The following label provides the warning of the hot surfaces on the router: 

Related Documentation

- General Safety Warnings for Juniper Networks Devices on page 556

General Safety Warnings for Juniper Networks Devices

Qualified Personnel Warning

WARNING: Only trained and qualified personnel should install or replace the hardware equipment.

Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

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

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

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

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

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

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

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

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

Restricted-Access Area Warning

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

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

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

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

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

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

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

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

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

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

Related Documentation

- Installation Safety Warnings for Juniper Networks Devices on page 563
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 573
- General Electrical Safety Warnings for Juniper Networks Devices on page 579
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 586

Preventing Electrostatic Discharge Damage to an MX2020 Router

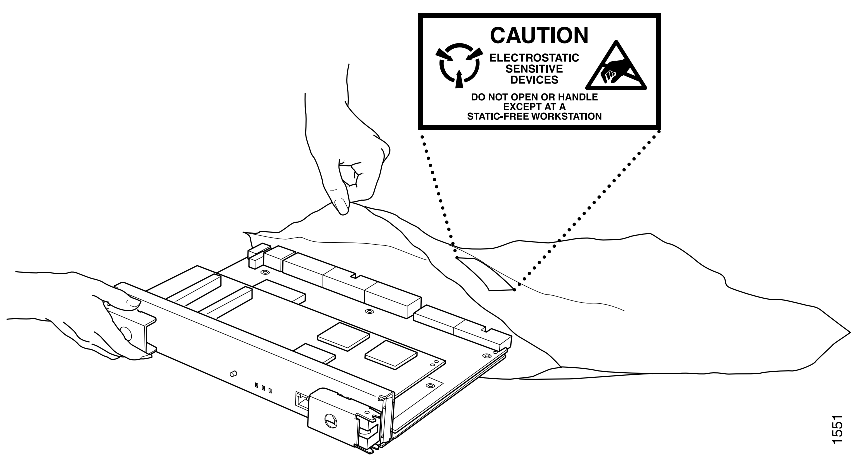
Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. 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 or ankle strap, and make sure that it is in direct contact with your skin.

CAUTION: **For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 through 10 Mohms.**

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the ESD points on the chassis.
- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.
- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see Figure 251 on page 558) . If you are returning a component, place it in an electrostatic bag before packing it.

Figure 251: Placing a Component into an Electrostatic Bag



Related Documentation

- Definition of Safety Warning Levels on page 553
- General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 583
- Installation Safety Warnings for Juniper Networks Devices on page 563

CHAPTER 30

Fire Safety Requirements

Fire Safety Requirements for Juniper Networks Devices

General Fire Safety Requirements

In the event of a fire emergency involving network devices, the safety of people is the primary concern. Establish procedures for protecting people in a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, establish procedures to protect your equipment in 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 you observe all local fire, safety, and electrical codes and ordinances when installing and operating your equipment.

Fire Suppression

In the event of an electrical hazard or an electrical fire, 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 (CO_2) and Halotron, are most effective for suppressing electrical fires. Type C fire extinguishers displace the 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, use this type of inert oxygen displacement extinguisher instead of an extinguisher that leave residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers) near Juniper Networks devices. The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and difficult to clean.

In addition, in 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.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556
- General Electrical Safety Warnings for Juniper Networks Devices on page 579
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 586

CHAPTER 31

Installation Safety Guidelines and Warnings

Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

Intrabuilding Ports Warning

WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Installation Instructions Warning

WARNING: Read the installation instructions before you connect the hardware equipment to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Attention 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.

Rack-Mounting Requirements and Warnings

Ensure that the equipment rack into which the chassis is installed is evenly and securely supported, to avoid the hazardous condition that could result from uneven mechanical loading.

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

- The chassis must be installed into a rack that is secured to the building structure.
- When mounting the chassis in 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 devices, install the stabilizers before mounting the chassis in the rack or servicing the hardware equipment.

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 router 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:

- Router 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.

Attention 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 router 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 router 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 router 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:

- Router 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 router 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, o posteriormente 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 router 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:

- Router 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.

Ramp Warning

WARNING: When installing the hardware equipment, 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.

Attention 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.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 573

CHAPTER 32

Laser and LED Safety Guidelines and Warnings

General Laser Safety Guidelines for Juniper Networks Devices

Devices with single-mode optical interfaces 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 according to EN 60825–1 +A11 +A2 requirements.

When working around devices with optical interfaces, 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.

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.**

Related Documentation

- Laser Safety Warnings for Juniper Networks Devices on page 569
- General Safety Warnings for Juniper Networks Devices on page 556

Laser Safety Warnings for Juniper Networks Devices

Class 1 Laser Product Warning

WARNING: Class 1 laser product.

Waarschuwing Klasse-1 laser produkt.

Varoitus Luokan 1 lasertuote.

Attention 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

WARNING: Class 1 LED product.

Waarschuwing Klasse 1 LED-product.

Varoitus Luokan 1 valodiodituote.

Attention 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

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.

Attention 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

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.

Attention 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 a 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.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556
- Installation Safety Warnings for Juniper Networks Devices on page 563

CHAPTER 33

Maintenance and Operational Safety Guidelines and Warnings

Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:

Battery Handling Warning

WARNING: Replacing the battery incorrectly might result in an explosion. Replace the 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.

Attention 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.

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.

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.

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 batería 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 weld the metal object 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.

Attention 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.

Attention 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 hardware equipment from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104° F (40° C). To prevent airflow restriction, allow at least 6 inches (15.2 cm) of clearance around the ventilation openings.

Waarschuwing Om te voorkomen dat welke router van de 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 router-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.

Attention Pour éviter toute surchauffe des routeurs de la gamme router, 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 router 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 router, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40º 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 router Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40º C (104º 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 router, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40º 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 router se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40º 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 router överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40º 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 product 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.

Attention 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.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556

CHAPTER 34

Electrical Safety Guidelines and Warnings

General Electrical Safety Warnings for Juniper Networks Devices

Grounded Equipment Warning

WARNING: The network device is intended to be grounded. Ensure that the network device is connected to earth ground during normal use.

Waarschuwing Deze apparatuur hoort geaard te worden Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.

Varoitus Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaite on yhdistetty maahan normaalikäytön aikana.

Attention Cet équipement doit être relié à la terre. S'assurer que l'appareil hôte est relié à la terre lors de l'utilisation normale.

Warnung Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.

Avvertenza Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.

Advarsel Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

Varning! Denna utrustning är avsedd att jordas. Se till att värdenheten är jordad vid normal användning.

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 unit. The grounding conductor is a separately derived system at the supply transformer or motor generator set.

WARNING: When installing the network device, you must always make the ground connection first and disconnect it 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.

Attention 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.

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.

Attention 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.

Power Disconnection Warning

WARNING: Before working on the chassis or near power supplies, switch off the power at the DC circuit breaker.

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; voor gelijkstroom toestellen dient u de stroom uit te schakelen bij de stroomverbreker.

Varoitus Kytke irti vaihtovirtalaitteiden virtajohto ja katkaise tasavirtalaitteiden virta suojakytkimellä, ennen kuin teet mitään asennuspohjalle tai työskentelet virtalähteiden läheisyydessä.

Attention Avant de travailler sur un châssis ou à proximité d'une alimentation électrique, débrancher le cordon d'alimentation des unités en courant alternatif; couper l'alimentation des unités en courant continu au niveau du disjoncteur.

Warnung Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw. schalten Sie bei Gleichstromeinheiten den Strom am Unterbrecher ab.

Avvertenza Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA; scollegare l'alimentazione all'interruttore automatico sulle unità CC.

Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut p vekselstrømsenheter og strømmen kobles fra ved strømbryteren på likestrømsenheter.

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; desligue a corrente no disjuntor nas unidades de corrente contínua.

¡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); cortar la alimentación desde el interruptor automático en los equipos de corriente continua (CC).

Varning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden och för likströmsenheter bryta strömmen vid överspänningsskyddet.

Related Documentation

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 586

General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices

- Install the router in compliance with the following local, national, or international electrical codes:
  - United States—National Fire Protection Association (NFPA 70), United States National Electrical Code.
  - Canada—Canadian Electrical Code, Part 1, CSA C22.1.
  - Other countries—International Electromechanical Commission (IEC) 60364, Part 1 through Part 7.
- 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.
- 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 router within marked electrical ratings and product usage instructions.
- For the router and peripheral equipment to function safely and correctly, use the cables and connectors specified for the attached peripheral equipment, and make certain they are in good condition.

Many router components can be removed and replaced without powering off or disconnecting power to the router. Never install equipment if it appears damaged.

Related Documentation

- *In Case of an Electrical Accident*

TN Power Warning for MX2020 Routers

WARNING: The router is designed to work with TN power systems.

Waarschuwing Het apparaat is ontworpen om te functioneren met TN energiesystemen.

Varoitus Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.

Attention Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.

Warnung Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.

Avvertenza Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.

Advarsel Utstyret er utfomet til bruk med TN-strømsystemer.

Aviso O dispositivo foi criado para operar com sistemas de corrente TN.

¡Atención! El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.

Varning! Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.

Related Documentation

- Definition of Safety Warning Levels on page 553
- General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 583
- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556

MX2020 AC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to an AC-powered MX2020 router with three-phase AC power distribution modules:

- AC-powered routers are shipped with three-phase electrical cords with grounding. Do not circumvent this safety feature. Equipment grounding must comply with local and national electrical codes.
- The delta cores in the terminal block are labeled as follows:
  - Terminal block labeled **GND**—Earth
  - Terminal block labeled **A1**
  - Terminal block labeled **B1**
  - Terminal block labeled **C1**
  - Terminal block labeled **GND**—Earth
  - Terminal block labeled **A2**
  - Terminal block labeled **B2**
  - Terminal block labeled **C2**
- The wye cores in the terminal block are labeled as follows:
  - Terminal block labeled **GND**—Earth
  - Terminal block labeled **A1**
  - Terminal block labeled **B1**

- Terminal block labeled **C1**
- Terminal block labeled **N1**
- Terminal block labeled **GND**—Earth
- Terminal block labeled **A2**
- Terminal block labeled **B2**
- Terminal block labeled **C2**
- Terminal block labeled **N2**

Related Documentation

- General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices on page 583
- MX2020 Three-Phase Wye AC Power Distribution Module Specifications on page 163
- MX2020 Three-Phase Delta AC Power Distribution Module Specifications on page 163
- Site Electrical Wiring Guidelines for MX Series Routers on page 592

MX2020 DC Power Electrical Safety Guidelines and Warnings

MX2020 DC Power Electrical Safety Guidelines

The following electrical safety guidelines apply to a DC-powered router:

- A DC-powered router is equipped with a DC terminal block that is rated for the power requirements of a maximally configured router. To supply sufficient power, terminate the DC input wiring on a facility DC source capable of supplying at least 60 A per feed @ –48 VDC (nominal) for the system. We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 80 A (–48 VDC) minimum, or as required by local code. Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the –48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 80 A.
- A DC-powered router that is equipped with a DC terminal block is intended for installation in a restricted access location only. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.

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

DC Power Electrical Safety Warnings for Juniper Networks Devices

When working with DC-powered equipment, observe the following warnings:

- DC Power Copper Conductors Warning on page 586
- DC Power Disconnection Warning on page 587
- DC Power Wiring Terminations Warning on page 588

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 procedures on power supplies, 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.

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.

Attention 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 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.

Attention 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. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden 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.

DC Power Electrical Safety Warnings for Juniper Networks Devices

When working with DC-powered equipment, observe the following warnings:

- DC Power Copper Conductors Warning on page 589
- DC Power Disconnection Warning on page 590
- DC Power Wiring Terminations Warning on page 591

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 procedures on power supplies, 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.

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.

Attention 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 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.

Attention 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. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden 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.

Related Documentation

- General Safety Warnings for Juniper Networks Devices on page 556
- General Electrical Safety Warnings for Juniper Networks Devices on page 579

Site Electrical Wiring Guidelines for MX Series Routers

Distance Limitations for Signaling

Improperly installed wires can emit radio interference. In addition, the potential for damage from lightning strikes increases if wires exceed recommended distances or if wires pass between buildings. The electromagnetic pulse (EMP) caused by lightning can damage unshielded conductors and destroy electronic devices. If your site has previously experienced such problems, you might want to consult experts in electrical surge suppression and shielding.

Radio Frequency Interference

You can reduce or eliminate the emission of radio frequency interference (RFI) from your site wiring by using twisted-pair cable with a good distribution of grounding conductors. If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.

Electromagnetic Compatibility

If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, you might want to seek expert advice. Strong sources of electromagnetic interference (EMI) can destroy the signal drivers and receivers in the router and conduct power surges over the lines into the equipment, resulting in an electrical hazard. It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.

WARNING: The intrabuilding port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 555
- General Safety Warnings for Juniper Networks Devices on page 556

CHAPTER 35

Agency Approvals and Compliance Statements

Agency Approvals and Compliance Statements for the MX2020 Router

Agency Approvals for MX2020 Routers

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 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.

Compliance Statements for EMC Requirements for the MX2020 Router

- Canada on page 596
- European Community on page 597
- Israel on page 597
- Japan on page 597
- United States on page 597

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

אזהרה

מוצר זה הוא מוצר Class A.
בסביבה ביתית,מוצר זה עלול לגרום הפרעות בתדר רדיו,ובמקרה זה המשתמש עשוי להידרש
לנקוט אמצעים מתאימים.

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

Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

Translation from Japanese—This is a Class A product. In a domestic environment this product 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.

Compliance Statements for Environmental Requirements for Juniper Networks Devices

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.

Related Documentation

