MX5, MX10, MX40, and MX80 3D Universal Edge Router Hardware Guide

Modified: 2015-06-01

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

MX5, MX10, MX40, and MX80 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

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:

- MX5
- MX10
- MX40
- MX80
- MX80T

Documentation Conventions

Table 1 on page xviii 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 xviii 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 https://www.juniper.net/cgi-bin/docbugreport/.

- 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

System Overview

MX5, MX10, MX40, and MX80 Router Overview

The Juniper Networks MX5, MX10, MX40, and MX80 3D Universal Edge Routers are Ethernet-optimized edge routers that provide both switching and carrier-class Ethernet routing. The MX5, MX10, MX40, and MX80 routers run Junos operating system (Junos OS), enabling a wide range of business and residential applications and services, including high-speed transport and virtual private network (VPN) services, next-generation broadband multiplay services, and high-volume Internet data center internetworking. Each router provides full duplex, high-density Ethernet interfaces and high- capacity switching throughput and uses the Junos Trio chipset for increased scalability of L2/L3 packet forwarding, buffering, and queuing.

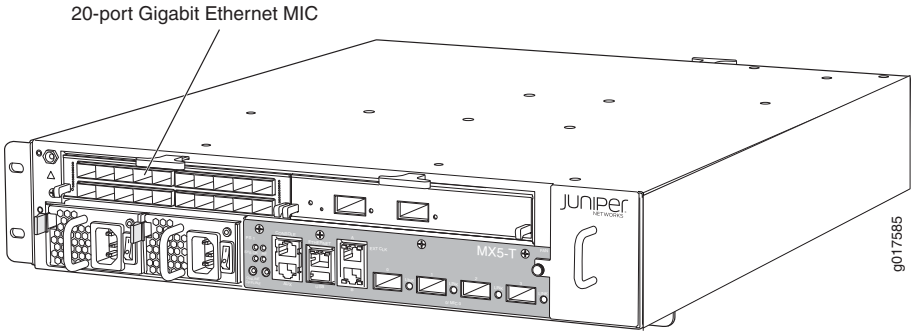
The routers each contain a built-in Routing Engine and one Packet Forwarding Engine. The Packet Forwarding Engine has two “pseudo” Flexible PIC Concentrators (FPC 0 and FPC1). Because there is no switching fabric, the single Packet Forwarding Engine takes care of both ingress and egress packet forwarding.

The routers are compact and two rack units (U) tall. Several routers can be stacked in a single floor-to-ceiling rack for increased port density per unit of floor space.

For scalable configuration options you can install a variety of Modular Interface Cards (MICs) in the two front slots of the router, and the optional *Multiservices MIC* can be installed in the rear slot. Software licenses allow you to upgrade from one router to another without a hardware upgrade. The ports are restricted based on the router’s associated license as follows:

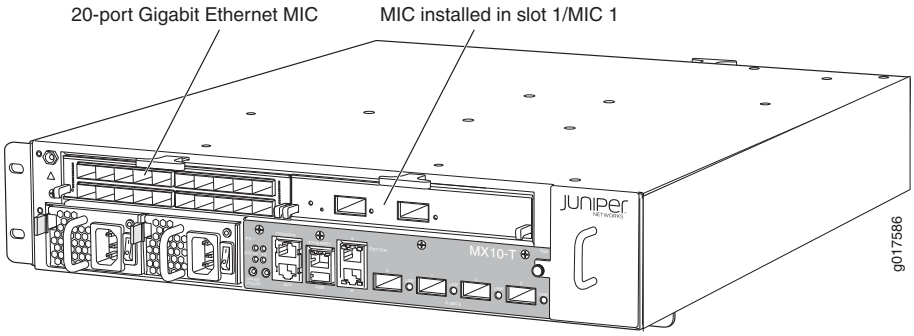
- MX5 router: Allows usage of the MIC slot labeled **1/MIC 0**, which comes prepopulated with the *Gigabit Ethernet MIC with SFP*.

Figure 1: MX5 Router



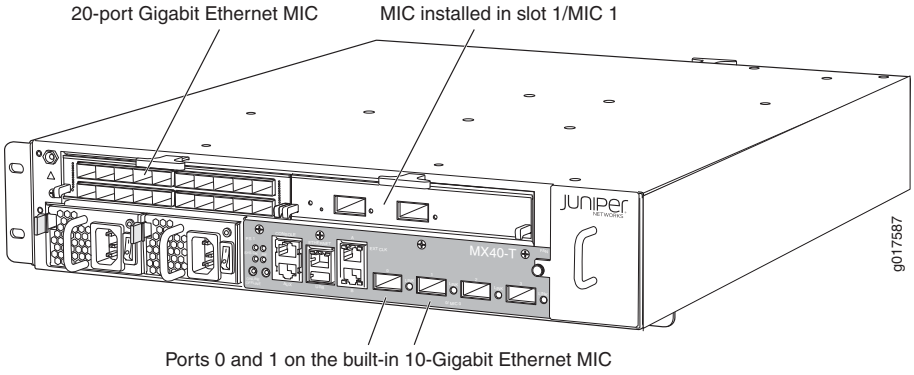
- MX10 router: Allows usage of the MIC slot labeled **1/MIC 0**, which comes prepopulated with the *Gigabit Ethernet MIC with SFP* and the second MIC slot labeled **1/MIC 1**.

Figure 2: MX10 Router



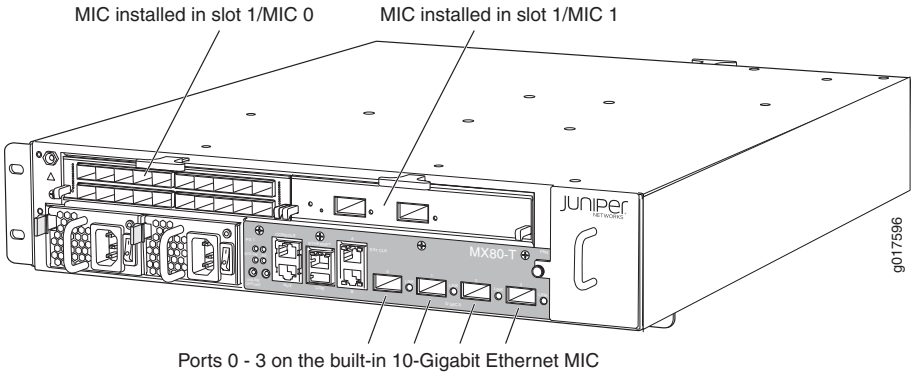
- MX40 router: Allows usage of the front MIC slots and ports **0** and **1** of the built-in 10-Gigabit Ethernet MIC (labeled **0/MIC 0**).

Figure 3: MX40 Router



- MX80 router: Allows usage of all MIC slots (front and back) and all four ports of the built-in 10-Gigabit Ethernet MIC (labeled **0/MIC 0**).

Figure 4: MX80 Router



A fixed version of the MX80 router (model number: MX80-48T) has 48 fixed 10/100/1000Base-T RJ45 ports in place of the MIC slots.

For a list of MICs supported on the MX5, MX10, MX40, and modular MX80 routers, see "MICs Supported by MX Series Routers" on page 26 in the *MX Series Interface Module Reference*.

Related Documentation

- MX5, MX10, MX40, and MX80 Chassis Description on page 9
- MX5, MX10, MX40, and MX80 Router Models on page 5
- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- MX5, MX10, MX40, and MX80 Front Panel Description on page 13
- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- MX5, MX10, MX40, and MX80 Power System Description on page 35
- MX5, MX10, MX40, and MX80 Routers Physical Specifications on page 41

MX5, MX10, MX40, and MX80 Router Models

The MX5, MX10, MX40, and MX80 routers are available in different models. The tables below list the various MX5, MX10, MX40 and MX80 router models available and provide a brief description of each base units.

Table 3 on page 5 lists the different MX5 router models available.

Table 3: MX5 Router Models

Model Number	Description
MX5-T-DC	DC chassis
MX5-T-AC	AC chassis

Table 4 on page 6 lists the different MX10 router models available.

Table 4: MX10 Router Models

Model Number	Description
MX10-T-DC	DC chassis
MX10-T-AC	AC chassis

Table 5 on page 6 lists the different MX40 router models available.

Table 5: MX40 Router Models

Model Number	Description
MX40-T-DC	DC chassis
MX40-T-AC	AC chassis

Table 6 on page 6 lists the different MX80 router models available.

Table 6: MX80 Router Models

Model Number	Description
MX80-AC	MX80 AC chassis
MX80-DC	MX80 DC chassis
MX80-T-AC	MX80 AC chassis with timing support
MX80-T-DC	MX80 DC chassis with timing support
MX80-P-AC	MX80 AC chassis with PTP (IEEE 1588v2) support
MX80-P-DC	MX80 DC chassis with PTP (IEEE 1588v2) support
MX80-48T-AC	MX80 fixed 48 GE port AC chassis
MX80-48T-DC	MX80 fixed 48 GE port DC chassis
MX80-T-48T-AC	MX80 fixed 48 GE port AC chassis with timing support
MX80-T-48T-DC	MX80 fixed 48 GE port DC chassis with timing support

Related Documentation

- MX5, MX10, MX40, and MX80 Router Overview on page 3

MX5, MX10, MX40, and MX80 Hardware Components and CLI Terminology

The MX5, MX10, MX40, and MX80 routers support the components in Table 7 on page 7, listed in alphabetic order.

Table 7: MX5, MX10, MX40, and MX80 Routers Hardware Components and CLI Terminology

Component	Hardware Model Number	CLI Name	Description
Chassis	N/A	• **MX5** • **MX10** • **MX40** • **MX80** • **MX80–P** • **MX80–T** • **MX80–48T**	"MX5, MX10, MX40, and MX80 Chassis Description" on page 9
Cooling system, including fan trays and air filters			"MX5, MX10, MX40, and MX80 Cooling System Description" on page 19
Air filter kit	FLTR-KIT-MX80	N/A	
Fan tray	FANTRAY-MX80	**Fan Tray**	
Power system components			"MX5, MX10, MX40, and MX80 Power System Description" on page 35
Power blank cover	PWR-BLANK-MX80	N/A	
Power supply	• AC: PWR-MX80-AC • DC: PWR-MX80-DC	**PEM**	
MIC	See *MX Series Interface Module Reference*.		"MX5, MX10, MX40, and MX80 Modular Interface Card Description" on page 23
MPC	N/A (built-in)	**FPC**	"MX5, MX10, MX40, and MX80 Modular Interface Card Description" on page 23
Routing Engine	N/A (built-in)	**Routing Engine**	"MX5, MX10, MX40, and MX80 Routing Engine Description" on page 21
Transceiver	See *MX Series Interface Module Reference*.	**Xcvr**	"MX5, MX10, MX40, and MX80 Routing Engine Description" on page 21

Related Documentation

- MX5, MX10, MX40, and MX80 Router Overview on page 3

CHAPTER 2

Chassis Components and Descriptions

MX5, MX10, MX40, and MX80 Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see Figure 5 on page 9, Figure 6 on page 10, Figure 7 on page 10, Figure 8 on page 10, Figure 9 on page 11, and Figure 10 on page 11). The chassis measures 3.5 in. (8.9 cm) high, 17.5 in. (44.5 cm) wide, and 23.46 in. (59.6 cm) deep. The chassis installs in standard 600-mm deep (or larger) enclosed cabinets, 19-in. equipment racks, or telco open-frame racks.

Figure 5: Front View of the MX5 Router

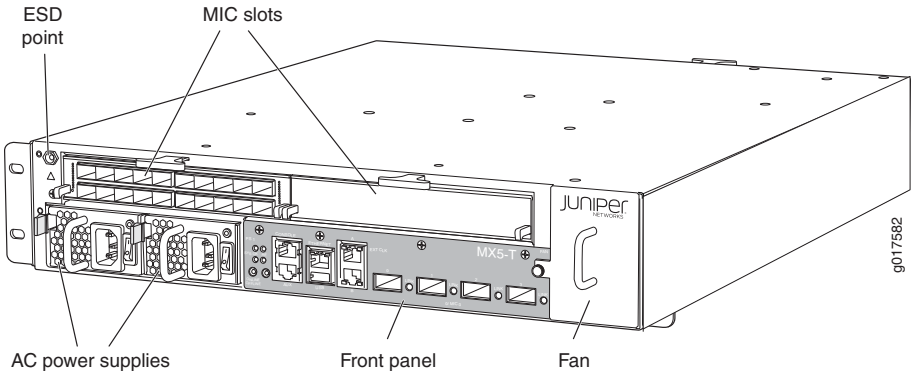


Figure 6: Front View of the MX10 Router

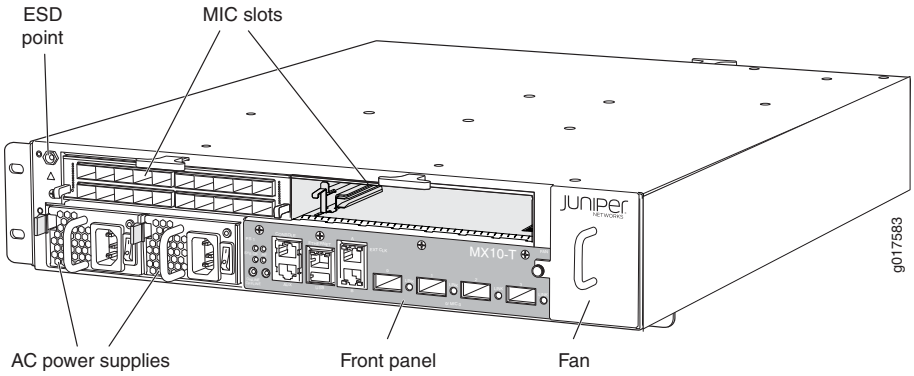


Figure 7: Front View of the MX40 Router

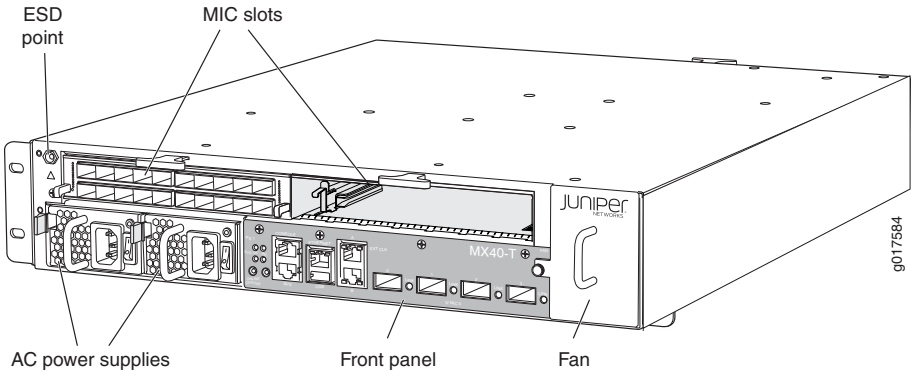


Figure 8: Front View of the MX80 Router (Fixed Chassis)

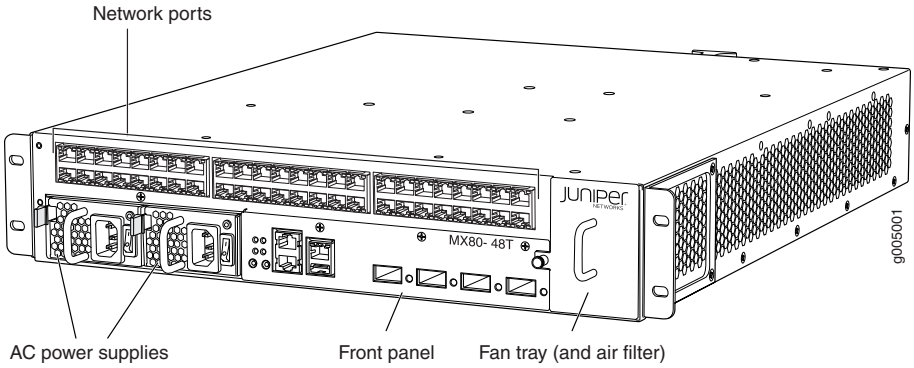


Figure 9: Front View of the MX80 Router (Modular Chassis)

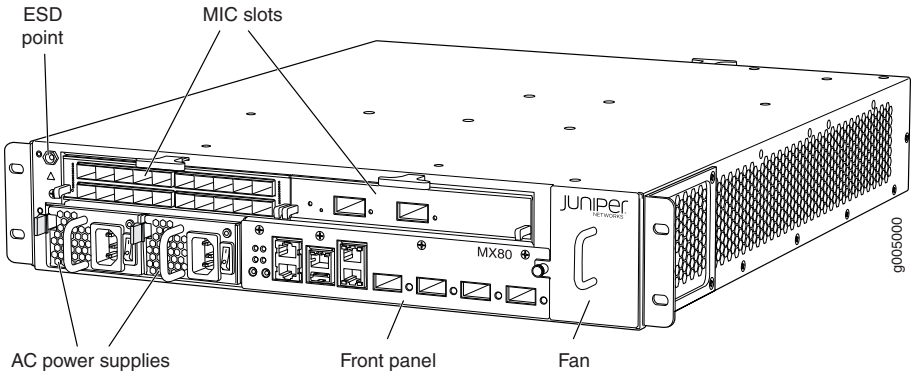
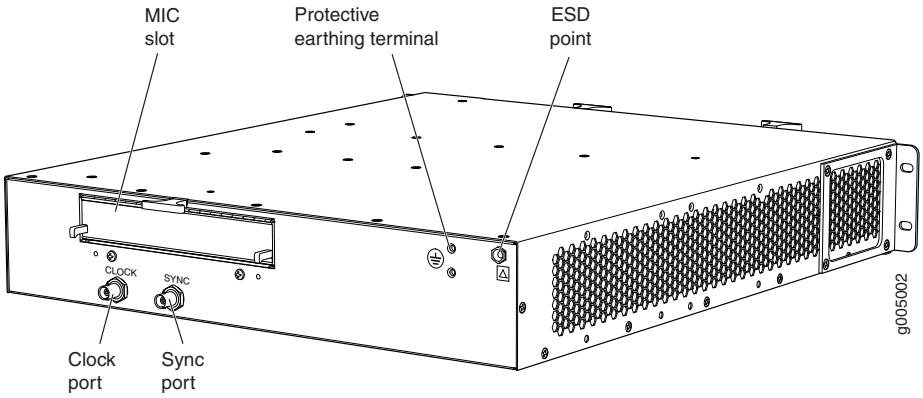


Figure 10: Rear View of the MX5, MX10, MX40, and MX80 Routers



NOTE: The port labeled CLOCK provides 10 Mhz output. The port labeled SYNC provides 1 PPS output.

Related Documentation

- MX5, MX10, MX40, and MX80 Router Overview on page 3
- MX5, MX10, MX40, and MX80 Router Models on page 5
- MX5, MX10, MX40, and MX80 Routers Physical Specifications on page 41

MX5, MX10, MX40, and MX80 Baseboard Description

The baseboard is located in the center of the chassis and forms the rear of the MIC card cage. The baseboard is not replaceable. The MICs and power supplies install into the baseboard from the front of the chassis. Data packets are transferred across the baseboard from the MIC to the Packet Forwarding Engine, and from the Packet Forwarding Engine across the baseboard to the destination MIC.

The baseboard provides the following functions:

- Powers on and powers off MICs
- Controls clocking, system resets, and booting
- Monitors and controls system functions, including fan speed, board power status, PDM status and control, and the front panel
- Provides interconnections to all the MICs within the chassis

Baseboard Components

The baseboard consists of the following components:

- Junos Trio chipset—Manages packet data memory, queuing systems, and performs packet lookup and encapsulation.
- MIC connectors for both built-in and replaceable MICs including a WAN interface for the built-in 10-Gigabit Ethernet MIC.
- Intake and exhaust temperature sensors.
- Circuits for chassis management and control.
- Power circuits for the system components and Ethernet interfaces.
- Routing Engine processor, which includes a 1.33-GHz CPU, and 2 GB of SDRAM.
- 2 4-GB NAND flash storage devices.
- Packet Forwarding Engine processor, which includes a 1-GHz CPU, a system controller, and 1 GB of SDRAM. Connects to the Routing Engine through a Gigabit Ethernet link.
- Clock logic.

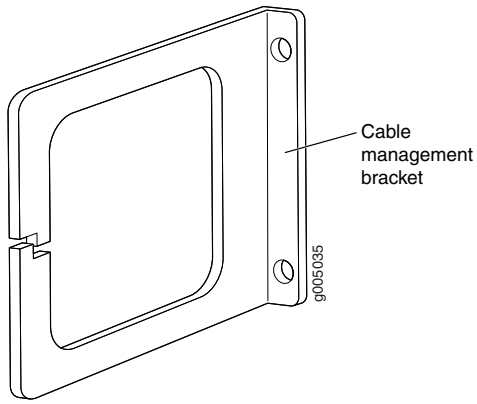
Related Documentation

- MX5, MX10, MX40, and MX80 Router Overview on page 3
- MX5, MX10, MX40, and MX80 Chassis Description on page 9
- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21

MX5, MX10, MX40, and MX80 Cable Management Bracket Description

The cable management bracket (see Figure 11 on page 13) consists of plastic dividers and installs on the left side of the chassis. The cable management bracket allows you to route the cables outside the router and away from the MICs.

Figure 11: Cable Management Bracket for the MX5, MX10, MX40, and MX80 Routers



Related Documentation

- Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 87
- Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 105
- Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers on page 107
- Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs on page 160

MX5, MX10, MX40, and MX80 Front Panel Description

The front panel is located on the front of the router and allows you to view status and troubleshooting information at a glance. The front panel contains LEDs for the router components, online/offline and reset buttons, auxiliary and console ports, clocking ports, and ports for the 10-Gigabit Ethernet MIC.

Figure 12: Front Panel on the Fixed MX80 Router

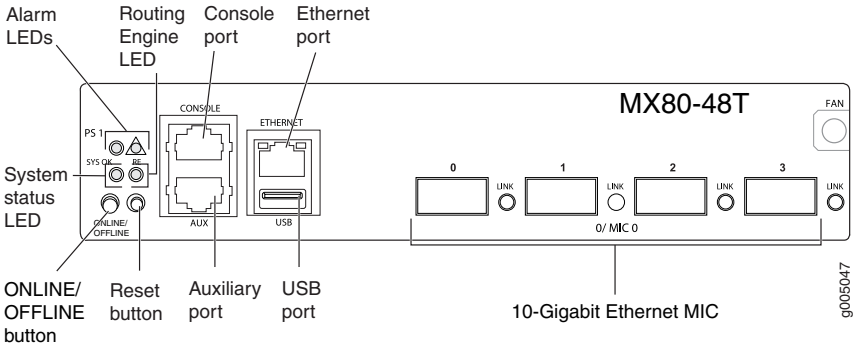
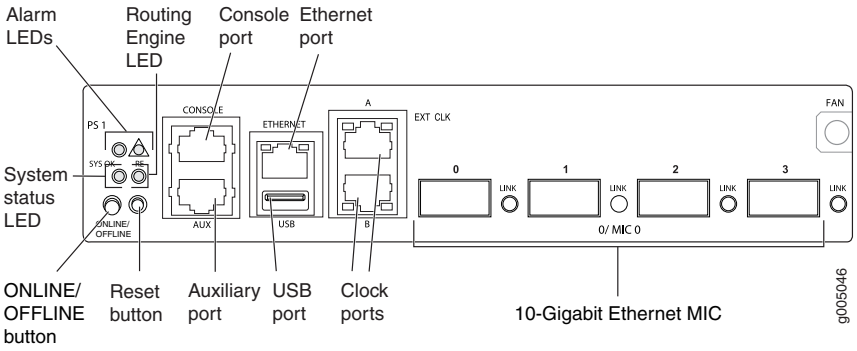


Figure 13: Front Panel on the Modular MX5, MX10, MX40, and MX80 Routers

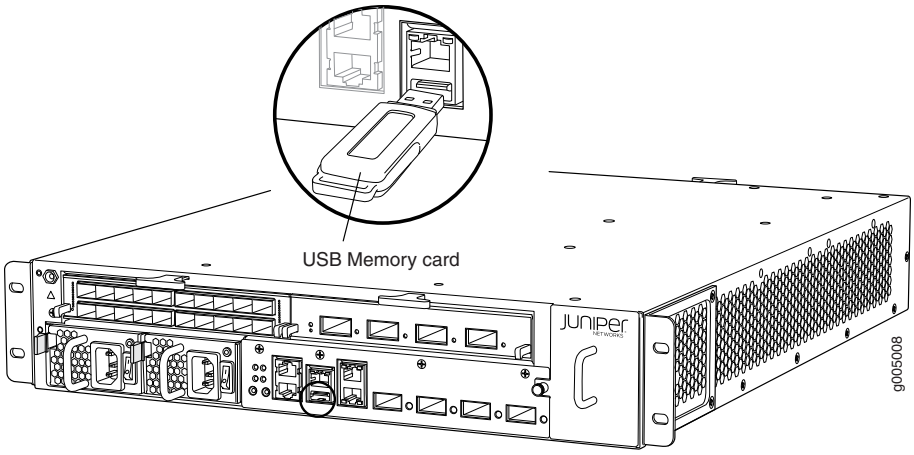


Front Panel Components

Each front panel consists of the following components:

- Interface ports—The **AUX**, **CONSOLE**, and **ETHERNET** ports provide access to management devices. Each Routing Engine has one 1-Gbps 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.
- Two ports for primary and secondary BITS clock input—Available on the modular MX80 chassis.
- One fixed 10-Gigabit Ethernet MIC with four ports for uplink connections. For more information see "MX5, MX10, MX40, and MX80 Modular Interface Card Description" on page 23.
- **USB** port—Provides a removable media interface through which you can install the Junos OS manually. (See Figure 14 on page 15.) Junos OS supports USB version 1.0.
- Router online/offline button—Takes the router online or offline when pressed.
- Reset button—Reboots the Routing Engine when pressed.
- LEDs—Indicate component and system status and troubleshooting information at a glance.

Figure 14: USB Memory Device in an MX5, MX10, MX40, and MX80 Router



Related Documentation

- Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel on page 15
- Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel on page 15

Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel

Two alarm LEDs are located at the left of the front panel. 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.

Table 8 on page 15 describes the alarm LEDs in more detail.

Table 8: Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel

Shape	Color	State	Description
○	Red	On steadily	Critical alarm LED—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 LED—Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature.

Component LEDs on the MX5, MX10, MX40, and MX80 Front Panel

- Link LEDs on the Front Panel on page 16
- Routing Engine LED on the Front Panel on page 16
- System LED on the Front Panel on page 16

Link LEDs on the Front Panel

The front panel has a 10-Gigabit Ethernet MIC with four ports for uplink connections. Each port has one **LINK** LED located to the right of the port. Table 9 on page 16 describes the link LEDs in more detail.

Table 9: Link LEDs on the Front Panel

Label	Color	State	Description
LINK	Green	On steadily	Link is up.
	–	Off	No link.

Routing Engine LED on the Front Panel

One LED on the left side of the front panel indicates the status of the Routing Engine. The LED is located below the **RE** label. Table 10 on page 16 describes the Routing Engine LED in more detail.

Table 10: Routing Engine LED on the Front Panel

Label	Color	State	Description
LINK	Green	Blinking	Routing Engine is transitioning online.
	Red	Blinking	Routing Engine has failed.
	–	Off	Routing Engine is functioning normally.

System LED on the Front Panel

One LED on the left side of the front panel indicates the status of the router. The LED is located below the **SYS OK** label. Table 11 on page 16 describes the system LED in more detail.

Table 11: System LED on the Front Panel

Label	Color	State	Description
SYS OK	Green	On steadily	Routing Engine is functioning normally.
	—	Off	Routing Engine is transitioning online.

Related Documentation

- Alarm LEDs on the MX5, MX10, MX40, and MX80 Front Panel on page 15
- Troubleshooting Resources for MX5, MX10, MX40, and MX80 Routers on page 165
- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 167
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168

- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168

CHAPTER 3

Cooling System Components and Descriptions

MX5, MX10, MX40, and MX80 Cooling System Description

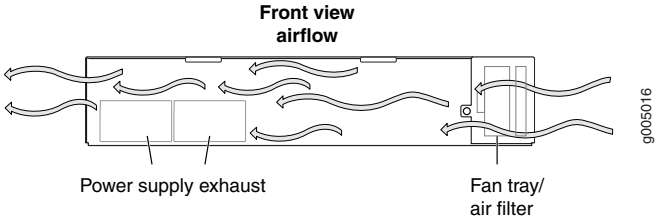
The cooling system consists of the following components:

- Fan tray
- Air filter

The cooling system components work together to keep all router components within the acceptable temperature range (see Figure 15 on page 19 and Figure 16 on page 20). The router has one fan tray and one air filter that install vertically in the front of the router. The fan tray contains five fans.

The air intake to cool the chassis is located on the right side of the chassis next to the air filter. Air is pulled through the air filter toward the fan tray, where it is exhausted out the left side of the system. The power supplies are self-cooling and are located in the front of the router to the left of the front panel. The exhaust for the power supplies is located on the left side of the chassis.

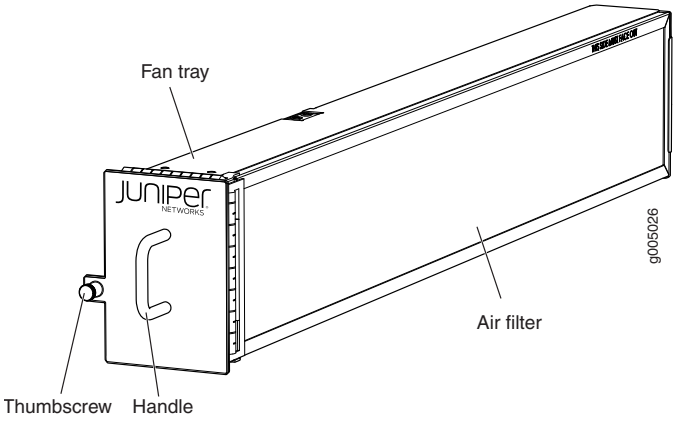
Figure 15: Airflow Through the MX5, MX10, MX40, and MX80 Routers



The chassis 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. If the ambient maximum temperature specification is exceeded and the system cannot be adequately cooled, the

Routing Engine shuts down the system by disabling output power from each power supply.

Figure 16: Fan Tray and Air Filter



Related Documentation

- Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 158
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 167
- Replacing an MX5, MX10, MX40, and MX80 Fan Tray on page 119

CHAPTER 4

Host Subsystem Components and Descriptions

MX5, MX10, MX40, and MX80 Routing Engine Description

The Routing Engine is built-in on the MX5, MX10, MX40, and MX80 baseboard and cannot be replaced.

The Routing Engine consists of the following components:

- Processor—Runs Junos OS to maintain the router's routing tables and routing protocols.
- DRAM—Buffers incoming packets and provides storage for the routing and forwarding tables and for other Routing Engine processes. To view the amount of DRAM installed on your router, issue the **show chassis routing-engine** command.
- NAND flash—Provides primary storage for software images, configuration files, and microcode.

Related Documentation

- MX5, MX10, MX40, and MX80 Routing Engine LED on page 21
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162
- *show chassis routing-engine*

MX5, MX10, MX40, and MX80 Routing Engine LED

The Routing Engine LED appears on the left of the front panel and is labeled **RE**. For more information see "Routing Engine LED on the Front Panel" on page 16.

Related Documentation

- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162

CHAPTER 5

Line Card Components and Descriptions

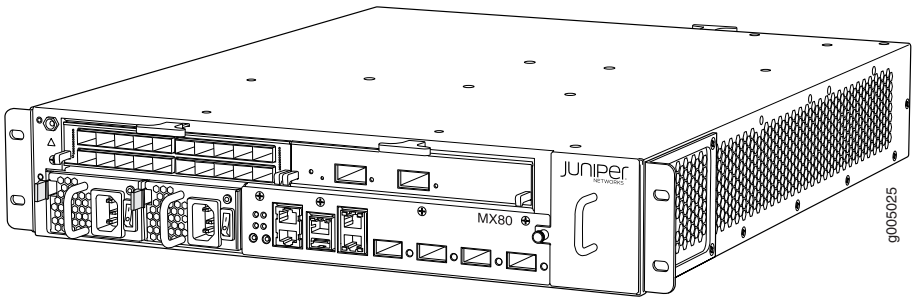
MX5, MX10, MX40, and MX80 Modular Interface Card Description

Modular Interface Cards (MICs) provide the physical connections to various network media types. 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. Before transmitting outgoing data packets through the MIC interfaces, the router encapsulates the packets received.

On the fixed MX80 chassis, the MICs come preinstalled and cannot be replaced.

On the modular MX5, MX10, MX40, and MX80 chassis, you can install a variety of MICs in the two front slots of the router, and the optional *Multiservices MIC* can be installed in the rear slot.

Figure 17: MICs Installed in an MX5, MX10, MX40, and MX80 Router



The MX5, MX10, MX40, and MX80 routers support the following types of MICs:

- Front-Pluggable MICs on page 24
- Fixed (Built-in) MICs on page 24

Front-Pluggable MICs

You can install and remove MICs in the MX5, MX10, MX40, and modular MX80 chassis. The MIC slots are labeled **1/MIC 0** and **1/MIC 1**. Each MIC slot has an ejector handle located above the MIC slot.

You can install MICs of different media types as long as the router supports those MICs. For complete specifications, see "MICs Supported by MX Series Routers" on page 26.

Fixed (Built-in) MICs

Built-in 10-Gigabit Ethernet MIC

The built-in 10-Gigabit Ethernet MIC is fixed on the MX5, MX10, MX40, and MX80 routers. The MIC is labeled **0/MIC 0** and is located on the front panel. The built-in 10-Gigabit Ethernet MIC has the following components:

Hardware features:

- Four 10-Gigabit Ethernet ports labeled **0** through **3**, left to right.
- High-performance throughput on each port at speeds up to 10 Gbps
- Line-rate on all four 10-Gigabit Ethernet ports
- LAN-PHY mode at 10.3125 Gbps
- WAN-PHY mode at 9.953 Gbps
- Maximum transmission units (MTUs) of up to 9192 bytes
- Link LED, one green per port. For more information, see "Link LEDs on the Front Panel" on page 16.

Software features:

- Configurable LAN-PHY and WAN-PHY mode options
- Synchronous Ethernet support
- Optical diagnostics and related alarms
- Virtual Router Redundancy Protocol (VRRP) support
- IEEE 802.1Q virtual LANs (VLANs) support
- Remote monitoring (RMON) EtherStats
- Source MAC learning
- MAC accounting and policing—Dynamic local address learning of source MAC addresses
- Flexible Ethernet encapsulation
- Multiple tag protocol identifiers (TPID)

Cables and connectors:

- Duplex LC/PC connector (Rx and Tx)

- Fiber-optic 10-gigabit small form-factor pluggable (XFP) transceivers:
  - Connector: Duplex LC/PC (Rx and Tx)
  - 10GBASE-E (model number: XFP-10G-E-OC192-IR2)
  - 10GBASE-L (model number: XFP-10G-L-OC192-SR1)
  - 10GBASE-S (model number: XFP-10G-S)
  - 10GBASE-Z (model number: XFP-10G-Z-OC192-LR2)

  Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*.
- DWDM Tunable XFP transceivers:
  - Connector: Duplex LC/PC (Rx and Tx)
  - 10GBASE-ZR (model number: XFP-10G-CBAND-T50-ZR)

    DWDM supported wavelengths—see *10-Gigabit Ethernet DWDM Transceiver Wavelengths*

    NOTE: XFP-10G-CBAND-T50-ZR is supported in Junos 11.2R2 and later

  Optical interface specifications—see *10-Gigabit Ethernet 10GBASE Optical Interface Specifications*

Built-in Tri-Rate MIC

The built-in 48-port Tri-Rate MIC is available only on the fixed MX80 chassis (MX80-48T) and is not replaceable. The built-in Tri-Rate MIC has the following components:

- 48 autonegotiating 10Base-T, 100Base-TX, or 1000Base-T Megabit Ethernet ports.
- Autonegotiation between Gigabit Ethernet circuit partners.
- Maximum transmission units (MTUs) of up to 9192 bytes.
- Connector: Four-pair, Category 5 shielded twisted-pair connectivity through an RJ-45 connector.
- Pinout: MDI/MDI-X.
- Maximum distance: 328 ft (100 m).
- Link LED, one green per port. For more information, see Table 16 on page 33.

Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card LEDs on page 33
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126

MICs Supported by MX Series Routers

Table 12 on page 26 lists the first supported Junos OS release for MICs on MX240, MX480, MX960, MX2010, and MX2020 routers. Table 13 on page 28 lists the first supported Junos OS release for MICs on MX5, MX10, MX40, MX80, and MX104 routers.

Table 12: 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	–	–
Channelized E1/T1 Circuit Emulation MIC (H)	MIC-3D-16CHE1-T1-CE-H	16	13.2R2	–	–
Gigabit Ethernet					
Gigabit Ethernet MIC with SFP	MIC-3D-20GE-SFP	20	10.1	12.3	12.3
Gigabit Ethernet MIC with SFP (E)	MIC-3D-20GE-SFP-E	20	13.3	13.3	13.3
Gigabit Ethernet MIC with SFP (EH)	MIC-3D-20GE-SFP-EH	20	–	–	–
10-Gigabit Ethernet					
10-Gigabit Ethernet MICs with XFP	MIC-3D-2XGE-XFP	2	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

Table 12: 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
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
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
Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H)	MIC-4COC3-1COC12-CE-H	4	13.2R2	13.2R2	13.2R2
Tri-Rate					
Tri-Rate MIC	MIC-3D-40GE-TX	40	10.2	12.3	12.3

Table 12: 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
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 13: 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	12.3	12.3	12.3	12.3	13.2R2
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

Table 13: MICs Supported by MX5, MX10, MX40, MX80, and MX104 Routers *(continued)*

MIC Name	MIC Model Number	Ports	MX5	MX10	MX40	MX80	MX104
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
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*

MX5, MX10, MX40, and MX80 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 MX5, MX10, MX40, and MX80 routers, the MPCs are built into the chassis and are represented in the CLI as either **FPC 0** or **FPC 1**.
- *pic*—Logical PIC on the MIC. The number of logical PICs varies depending on the type of MIC.
- *port*—Port number.

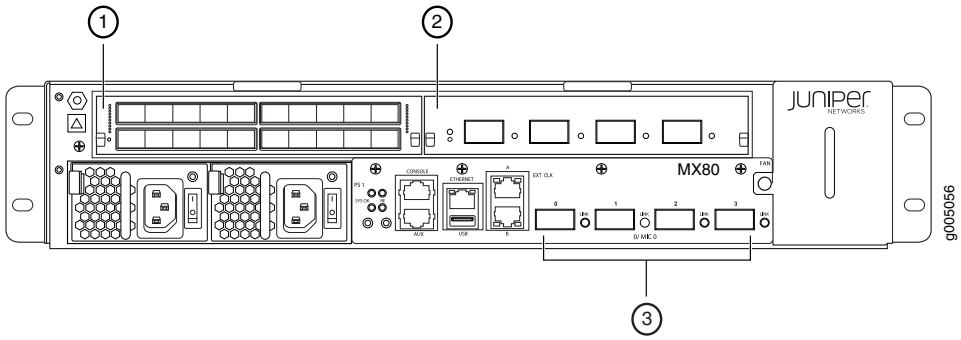
NOTE: **The MIC number is not included in the interface name.**

- Port and Interface Numbering on the MX5, MX10, MX40, and MX80 Routers on page 30
- Port and Interface Numbering on MX80-48T Routers on page 31

Port and Interface Numbering on the MX5, MX10, MX40, and MX80 Routers

Each modular MX5, MX10, MX40, and MX80 router is capable of having the components shown in Figure 18 on page 30.

Figure 18: MX5, MX10, MX40, and MX80 Interface Port Mapping



1—MIC slot 1/0 (FPC 1, PIC 0 and PIC 1)	3—10-Gigabit Ethernet ports (FPC 0, PIC 0)
2—MIC slot 1/1 (FPC 1, PIC 2 and PIC 3)	

The chassis has two built-in MPCs, which are represented in the CLI as **FPC 0** and **FPC 1**.

MPC 0 (**FPC 0**) contains a 4-port 10-Gigabit Ethernet MIC. Both the MPC and the MIC are considered fixed and are built into the front of the chassis. The MIC is represented as **MIC 0** in the CLI and is logically divided into a single PIC, which is represented as **PIC 0**.

MPC 1 (**FPC 1**) has two slots, which accept up to two MICs. The MICs are represented as **MIC 0** and **MIC 1** in the CLI and are logically divided into PICs depending on their type. A MIC installed in MIC slot **1/0** is represented in the CLI as **PIC 0** and **PIC 1**. A MIC installed in MIC slot **1/1** is represented as **PIC 2** and **PIC 3**.

MX80 series routers also contain a MIC slot in the rear of the chassis that supports the optional Juniper Networks *Multiservices MIC*.

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

Table 14 on page 31 summarizes the relationship between the components and the interface names.

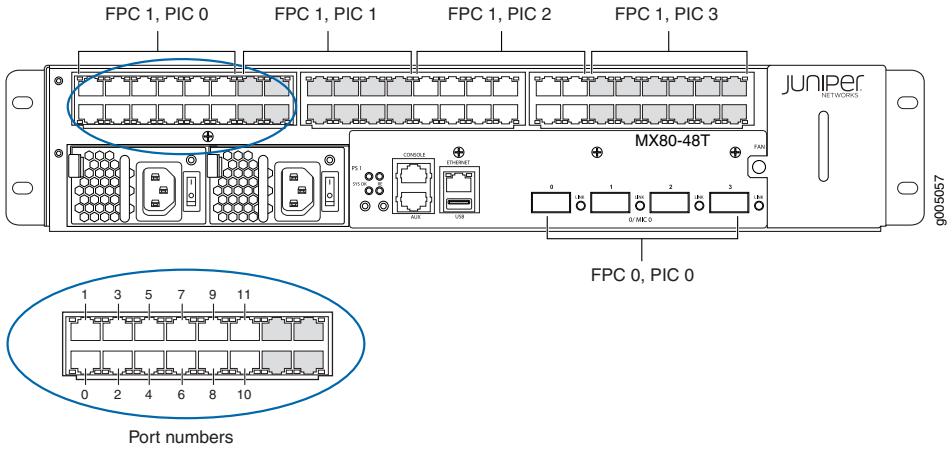
Table 14: MX5, MX10, MX40, and MX80 Components and Their Interface Names

Component	Name in the CLI	Interface Names
Built-in 4-port 10-Gigabit Ethernet MIC	4x 10GE XFP	**xe-0/0/0** through **xe-0/0/3**
MIC installed in MIC slot 1/0	See *MX Series Interface Module Reference*.	***type*-1/0/*port*** ***type*-1/1/*port***
MIC installed in MIC slot 1/1	See *MX Series Interface Module Reference*.	***type*-1/2/*port*** ***type*-1/3/*port***

Port and Interface Numbering on MX80-48T Routers

Each MX80-48T router contains two built-in MPCs, which are represented in the CLI as **FPC 0** and **FPC 1** (see Figure 19 on page 32).

Figure 19: MX80-48T Interface Port Mapping



MPC 0 (**FPC 0**) contains a 4-port 10-Gigabit Ethernet MIC and is built into the front of the chassis. The MIC is represented as **MIC 0** in the CLI and is logically divided into a single PIC, which is represented as **PIC 0**.

MPC 1 (**FPC 1**) contains a 48-port Tri-Rate MIC and is built into the front of the chassis. The MIC is represented as **MIC 0** in the CLI and is logically divided into four PICs, which are numbered 0 through 3. Each logical PIC on the built-in Tri-Rate MIC contains twelve ports, which are numbered 0 through 11 (see Figure 19 on page 32).

Table 15 on page 32 summarizes the relationship between the components and the interface names.

Table 15: MX80-48T Components and Interface Names

Component	Name in the CLI	Interface Names
Built-in 4-port 10-Gigabit Ethernet MIC	4x 10GE XFP	**xe-0/0/0** through **xe-0/0/3**
Built-in 48-port Tri-Rate MIC	48x1 RJ45 Each PIC is shown as 12x 1GE(LAN) RJ45	**ge-1/0/*port*** **ge-1/1/*port*** **ge-1/2/*port*** **ge-1/3/*port***

Related Documentation

- MX5, MX10, MX40, and MX80 Hardware Components and CLI Terminology on page 7
- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- MICs Supported by MX Series Routers on page 26

MX5, MX10, MX40, and MX80 Modular Interface Card LEDs

The fixed 10-Gigabit Ethernet Modular Interface Card (MIC) has link LEDs located on the front panel. For more information about the link LEDs for the 10-Gigabit Ethernet MIC, see "Link LEDs on the Front Panel" on page 16.

Each hot-removable and hot-insertable 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*.

On the fixed MX80 chassis, each of the 48 ports on the fixed Tri-Rate MIC has a link LED. Table 16 on page 33 describes the link LEDs in more detail.

Table 16: Tri-Rate MIC LEDs

Color	State	Description
Green	On steadily	Link is up.
	Off	No link.

Related Documentation

- MICs Supported by MX Series Routers on page 26
- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126

CHAPTER 6

Power System Components and Descriptions

MX5, MX10, MX40, and MX80 Power System Description

The MX5, MX10, MX40, and MX80 routers use either AC or DC power supplies (see Figure 20 on page 36 and Figure 21 on page 36). The router contains either one or two power supplies located at the front of the chassis in slots **PS0** and **PS1** (right to left). Each power supply has a handle, an ejection lever, a power switch, and a status LED. The power supplies connect to the baseboard, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements. When two power supplies are present, they share power almost equally within a fully populated system. If one power supply in a redundant configuration fails or is removed, the remaining power supply assumes the entire electrical load without interruption. A single power supply provides the maximum configuration with full power for as long as the router is operational. A second power supply can be installed for redundancy. Each power supply is cooled by its own internal cooling system.

Redundant power supplies are hot-removable and hot-insertable. When you remove a power supply from a router that uses only one power supply, the router might shut down depending on your configuration.

CAUTION: **The router cannot be powered from AC and DC power supplies simultaneously.**

NOTE: **Routers configured with only one power supply are shipped with a blank panel installed over the power supply slot that is not populated.**

Figure 20: AC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router

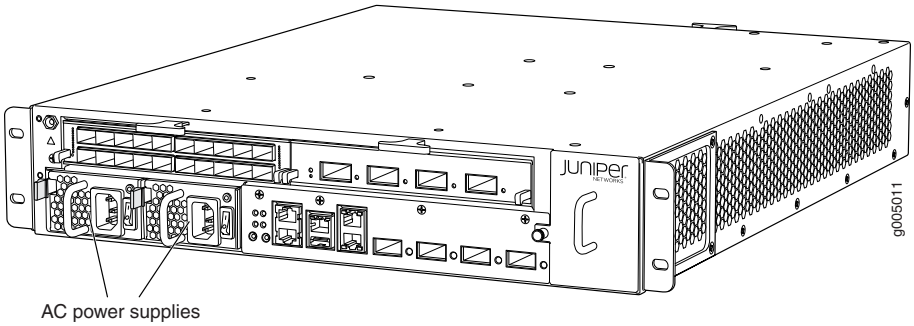
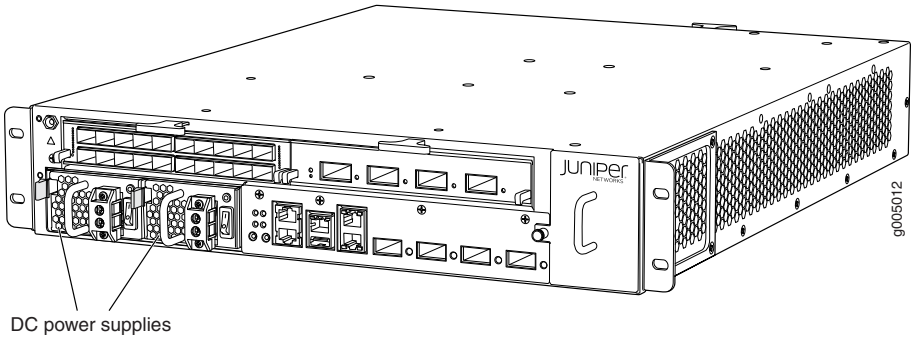


Figure 21: DC Power Supplies Installed in an MX5, MX10, MX40, and MX80 Router



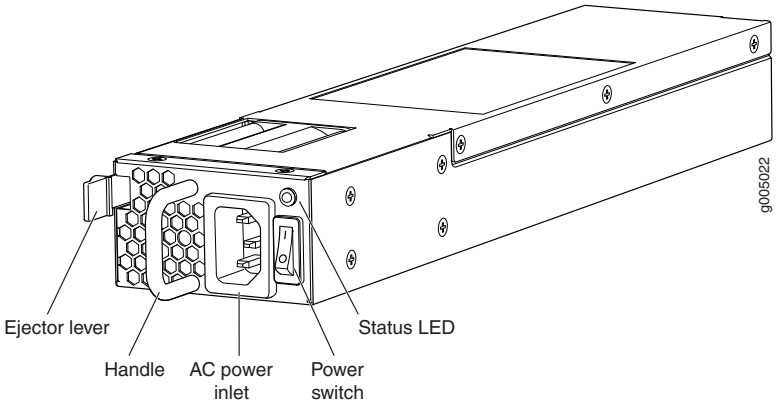
- AC Power Supply Description on page 36
- DC Power Supply Description on page 37

AC Power Supply Description

Each AC power supply weighs approximately 2.6 lb (1.18 kg) and consists of a handle, an ejection lever, an AC appliance inlet, an AC input switch, a fan, and an LED to monitor the status of the power supply. Figure 22 on page 37 shows the power supply.

Each inlet requires a dedicated AC power feed and a dedicated customer site circuit breaker. We recommend that you use a minimum 15 A (110 VAC) customer site circuit breaker, or as required by local code.

Figure 22: AC Power Supply

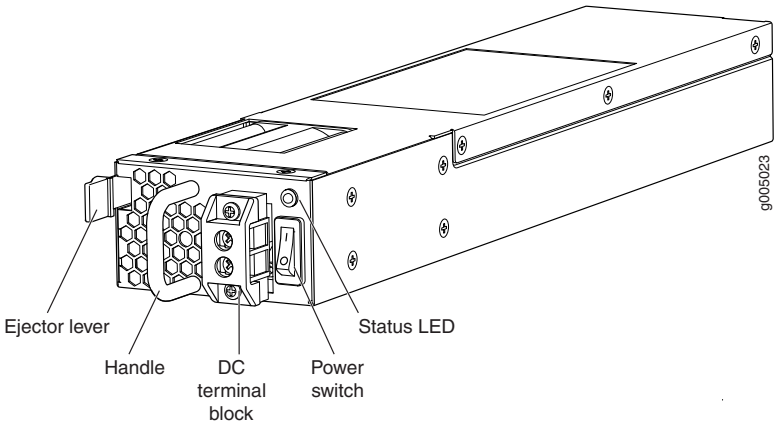


WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for SAE 10-32 ground screws) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

DC Power Supply Description

Each DC power supply has a handle, an ejection lever, a power switch, a status LED, and a terminal block that provides a single DC input (–48 VDC and return) that requires a dedicated customer site circuit breaker. We recommend that you use a dedicated customer site circuit breaker rated for 13 A (–48 VDC) minimum, or as required by local code. Figure 23 on page 37 shows the power supply.

Figure 23: DC Power Supply



Related Documentation

- MX5, MX10, MX40, and MX80 Power Supply LED on page 38
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168

- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59

MX5, MX10, MX40, and MX80 Power Supply LED

Each power supply has a bi-color status LED located above the power switch on the power supply.

Table 17: Power Supply LED

Color	State	Description
Blue	On steadily	Power supply is functioning normally.
Red	Blinking	Power supply has failed.
Red	Offline	PEM is in offline mode.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59

PART 2

Site Planning, Preparation, and Specifications

CHAPTER 7

Preparation Overview

MX5, MX10, MX40, and MX80 Routers Physical Specifications

Table 18 on page 41 summarizes the physical specifications for the router.

Table 18: MX5, MX10, MX40, and MX80 Physical Specifications

Description	Weight	Width	Depth	Height
Fixed chassis	Chassis with fan tray and power supplies: 28 lb (12.7 kg)	17.5 in. (44.5 cm)	23.46 in. (59.6 cm) (including cable management bracket and MIC release lever)	3.5 in. (8.9 cm)
Modular chassis	Chassis with fan tray, power supplies, and MICs: 30 lb (13.6 kg)	17.5 in. (44.5 cm)	23.46 in. (59.6 cm) (including cable management bracket and MIC release lever)	3.5 in. (8.9 cm)
Air filter	0.1 lb (0.05 kg)	0.25 in. (0.64 cm)	18.43 in. 46.81 cm)	3.35 in. (8.5 cm)
MIC	Maximum up to 1.2 lb (0.54 kg)	6.25 in. (15.9 cm)	6.8 in (17.3 cm)	1.2 in. (3.05 cm)
Dual-wide MIC	1.9 lb (0.9 kg)	12.5 in. (31.75 cm)	6.8 in (17.3 cm)	1.2 in. (3.05 cm)
Fan tray	2.3 lb (1.04 kg)	2.75 in. (6.96 cm)	20.5 in. 52.07 cm)	3.35 in. (8.5 cm)

Table 18: MX5, MX10, MX40, and MX80 Physical Specifications *(continued)*

Description	Weight	Width	Depth	Height
DC power supply	2.6 lb (1.18 kg)	2.8 in. (7.1 cm)	13.2 in. (33.5 cm)	1.6 in. (4.1 cm)
AC power supply	2.6 lb (1.18 kg)	2.8 in. (7.1 cm)	13.2 in. (33.5 cm)	1.6 in. (4.1 cm)

Related Documentation

- MX5, MX10, MX40, and MX80 Router Overview on page 3
- MX5, MX10, MX40, and MX80 Chassis Description on page 9
- MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines on page 197

MX5, MX10, MX40, and MX80 Router Environmental Specifications

Table 19 on page 42 specifies the environmental specifications required for normal router operation. In addition, the site should be as dust-free as possible.

Table 19: Router Environmental Specifications

Description	Value
Altitude	No performance degradation to 10,000 ft (3048 m)
Relative humidity	Normal operation ensured in relative humidity range of 5% to 90%, noncondensing
Temperature	Normal operation ensured in temperature range of 32°F (0°C) to 104°F (40°C) Nonoperating storage temperature in shipping container: –40°F (–40°C) to 158°F (70°C)
Seismic	Designed to meet Telcordia Technologies Zone 4 earthquake requirements
Maximum thermal output	1705 BTU/hour (500 W)

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

- Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers on page 157
- General Safety Guidelines for Juniper Networks Devices on page 189
- General Safety Warnings for Juniper Networks Devices on page 190

MX5, MX10, MX40, and MX80 Router Grounding Specifications

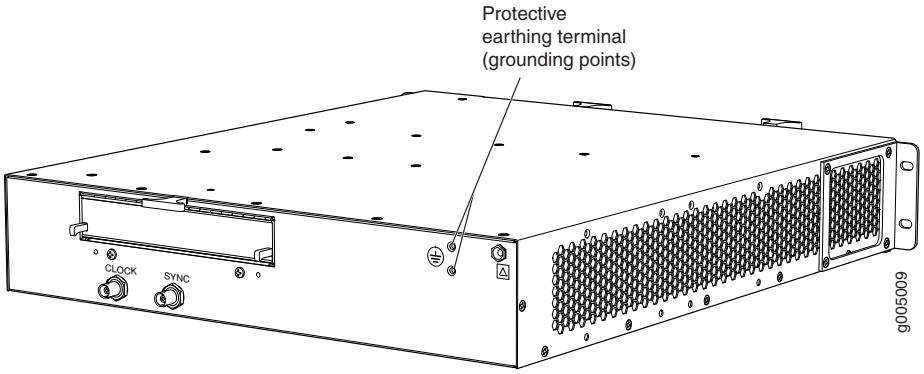
Grounding Points Specifications

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 and 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 24 on page 43).

Two threaded holes are provided on the upper rear of the chassis for connecting the router to earth ground. The grounding points fit SAE 10-32 screws (American). The grounding points are spaced at 0.625-in. (15.86-mm) centers.

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

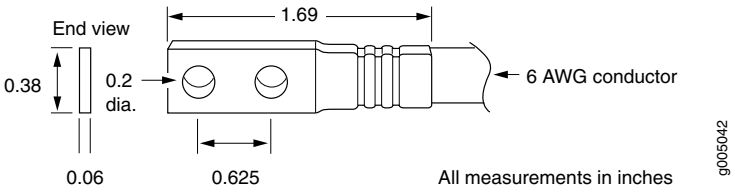
Figure 24: Grounding Points on MX5, MX10, MX40, and MX80 Routers



Grounding Cable Lug Specifications

The accessory box shipped with the router includes one cable lug that attaches to the grounding cable (see Figure 25 on page 44) and two SAE 10–32 screws used to secure the grounding cable to the grounding points.

Figure 25: Grounding 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.

Grounding Cable Specifications

You must provide one grounding cable that meets the following specifications: 6-AWG (13.3 mm^2), minimum 60º C wire, or as required by the local code.

Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59

MX5, MX10, MX40, and MX80 Site Preparation Checklist

The checklist in Table 20 on page 44 summarizes the tasks you must perform when preparing a site for router installation.

Table 20: MX80 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.	"MX5, MX10, MX40, and MX80 Router Environmental Specifications" on page 42		
Power			
Locate sites for connection of system grounding.	"MX5, MX10, MX40, and MX80 Router Grounding Specifications" on page 43		

Table 20: MX80 Site Preparation Checklist *(continued)*

Item or Task	For More Information	Performed By	Date
Measure distance between external power sources and router installation site.	"MX5, MX10, MX40, and MX80 Routers AC Power Specifications" on page 53 "MX5, MX10, MX40, and MX80 Routers DC Power Specifications" on page 59		
Calculate the power consumption and requirements.	"Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 54 "Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 60		
Rack			
Select the type of rack or cabinet.	"MX5, MX10, MX40, and MX80 Rack Requirements" on page 46 "MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications" on page 48		
Plan rack or cabinet location, including required space clearances.	"MX5, MX10, MX40, and MX80 Rack Requirements" on page 46 "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 47 "MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications" on page 48		
If a rack is used, secure rack to floor and building structure.	"MX5, MX10, MX40, and MX80 Rack Requirements" on page 46		
Cables			
Acquire cables and connectors: • Determine the number of cables needed based on your planned configuration. • Review the maximum distance allowed for each cable. Choose the length of cable based on the distance between the hardware components being connected.	"Calculating Power Budget and Power Margin for Fiber-Optic Cables" on page 74		

Related Documentation

- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack on page 92

- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

MX5, MX10, MX40, and MX80 Rack Requirements

The router can be installed in a rack. Many types of racks are acceptable, including four-post (telco) racks and open-frame racks. An example of an open-frame rack appears in Figure 26 on page 47. Table 21 on page 46 summarizes rack requirements and specifications for the MX5, MX10, MX40, and MX80 router.

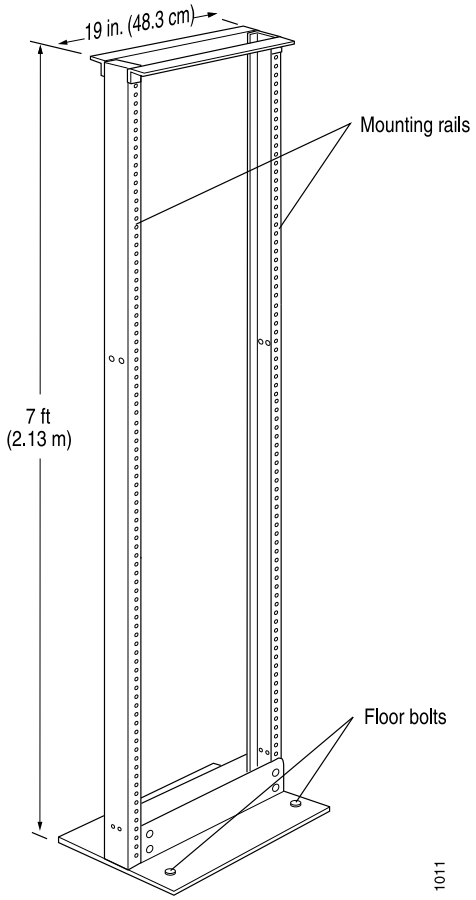
Table 21: MX5, MX10, MX40, and MX80 Rack Requirements and Specifications

Rack Requirement	Guidelines
Rack type and mounting bracket hole spacing	Use a four-post rack or a two-post rack. You can mount the router on any four-post or two-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75-in./4.44-cm) increments and that meets the size and strength requirements specified in this table. 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).

Rack size and strength	• Ensure that the rack is a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association (http://www.eia.org).
	• Ensure that the rack is one of the following standard lengths:
	  ◦ 23.62 in. (600 mm)
	  ◦ 30.0 in. (762 mm)
	  ◦ 31.5 in. (800 mm)
	• The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 3.5 in. (8.9 cm) high, 23.46 in. (59.6 cm) deep, and 17.5 in. (44.5 cm) wide. The outer edges of the mounting brackets extend the width to 19.2 in. (48.7 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 47.
	• The router ships with the mounting brackets installed in the front-mount position. You can also move the brackets to the center-mount position. For instructions about moving the mounting hardware, see "Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers" on page 88.
	• The chassis height of 3.5 in. (8.9 cm) is approximately 2 U.
	• The rack must be strong enough to support the weight of the fully configured router, up to 30 lb (13.6 kg).
	• Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 47.

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

Figure 26: Typical Open-Frame Rack



Related Documentation

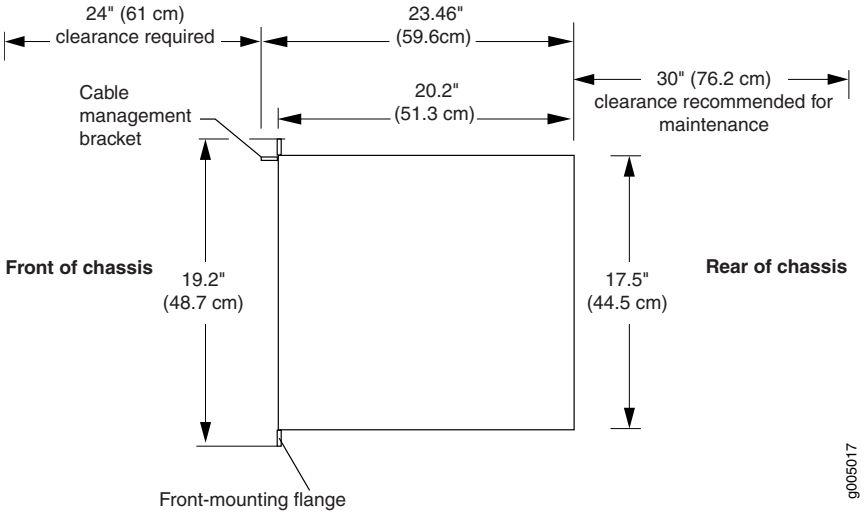
- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance

When planning the installation site, allow sufficient clearance around the rack (see Figure 27 on page 48):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. Allow at least 6 in. (15.2 cm) of clearance between side-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. At least 24 in. (61 cm) are required both in front of and behind the router. NEBS GR-63 recommends that you allow at least 30 in. (76.2 cm) in front of the rack and 24 in. (61 cm) behind the router.

Figure 27: MX5, MX10, MX40, and MX80 Chassis Dimensions and Clearance Requirements



Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Rack Requirements on page 46
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93
- MX5, MX10, MX40, and MX80 Routers Physical Specifications on page 41

MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications

Table 22 on page 48 summarizes cabinet requirements and specifications for MX5, MX10, MX40, and MX80 routers.

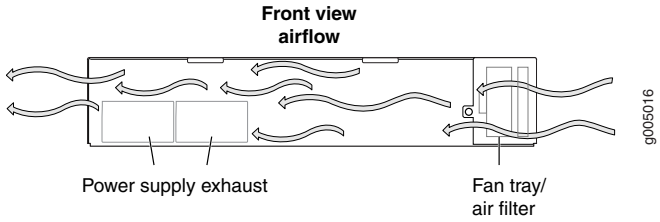
Table 22: Cabinet Requirements and Specifications for an MX5, MX10, MX40, and MX80 Router

Cabinet Requirement	Guidelines for the MX80 Router
Cabinet size and clearance	• The minimum-sized cabinet that can accommodate the router is 19-in. (482-mm) wide and 23.62-in. (600-mm) deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. If you provide adequate cooling air and airflow clearance, you can stack several routers in a cabinet that has sufficient usable vertical space. Each router requires 2 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Industry Association (http://www.eia.org). • With adequate cooling air and airflow clearance, you can stack multiple MX5, MX10, MX40, and MX80 routers in a cabinet with a four-post rack. In all cases, the rack must meet the strength requirements to support the weight. • The minimum total clearance inside the cabinet is 30.7 in. (780 mm) between the inside of the front door and the inside of the rear door.

Table 22: Cabinet Requirements and Specifications for an MX5, MX10, MX40, and MX80 Router *(continued)*

Cabinet Requirement	Guidelines for the MX80 Router
Cabinet airflow requirements	When 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: • Airflow must always be from front to back with respect to the rack. If the device has side to rear airflow, then provisions must be made to ensure that fresh air from the front of the rack is supplied to the inlets, and exhaust exits the rear of the rack. The device must not interfere with the cooling of other systems in the rack. Fillers must be used as appropriate in the rack to ensure there is no recirculation of heated exhaust air back to the front of the rack. Care must also be taken around cables to ensure no leakage of air in situations where recirculation may result. • 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 28 on page 49. • Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router. • Route and dress all cables to minimize the blockage of airflow to and from the chassis. • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the router and rack as specified in "MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance" on page 47. • Install the router as close as possible to the front of the cabinet so that the chassis just clears the inside of the front door. This maximizes the clearance in the rear of the cabinet for critical airflow.

Figure 28: Airflow Through Chassis



Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

MX5, MX10, MX40, and MX80 Installation Summary

To install the router:

1. Prepare your installation site.

   See "MX5, MX10, MX40, and MX80 Site Preparation Checklist" on page 44.

2. Review the safety guidelines and warnings:

   - See "General Safety Guidelines for Juniper Networks Devices" on page 189.
   - See "General Safety Warnings for Juniper Networks Devices" on page 190.

3. Unpack the router and verify the parts:

   a. See "Unpacking MX5, MX10, MX40, and MX80 Routers" on page 83.

   b. See "Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received" on page 84.

4. Install the mounting hardware.

   See "Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers" on page 88.

5. Lift the router onto the rack.

   See "Installing MX5, MX10, MX40, and MX80 Chassis in the Rack" on page 93.

6. Connect cables to the network and external devices:

   - See "Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices" on page 105.
   - See "Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers" on page 107.

7. Connect the grounding cable.

   See "Grounding MX5, MX10, MX40, and MX80 Routers" on page 96.

8. Connect the AC power cord or DC power cables:

   - See "Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 97.
   - See "Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 99.

9. Power on the router:

   - See "Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 98.
   - See "Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 101.

10. Perform the initial system configuration.

    See "Initially Configuring MX5, MX10, MX40, and MX80 Routers" on page 109.

Related Documentation

- MX5, MX10, MX40, and MX80 Rack Requirements on page 46
- MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance on page 47
- MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications on page 48

CHAPTER 8

AC Power Specifications and Requirements

MX5, MX10, MX40, and MX80 Routers AC Power Specifications

Table 23 on page 53 lists the AC power system electrical specifications.

Table 23: AC Power System Electrical Specifications

Item	Specification
AC input voltage	Operating range: 90 to 264 VAC
AC input line frequency	50 to 60 Hz (nominal)
AC system current rating	6 A @ 110 VAC (7 A maximum per inlet at 90 VAC) or 3 A @ 220 VAC
AC system input power	610 W

Table 24 on page 53 lists the AC power supply electrical specifications.

Table 24: AC Power Supply Electrical Specifications

Item	Specification
Maximum output power	500 W
AC input voltage	Operating range: 90 to 264 VAC (nominal)
AC input line frequency	50 to 60 Hz (nominal)

Table 24: AC Power Supply Electrical Specifications *(continued)*

Item	Specification
AC input current rating	6 A @ 110 VAC or 3 A @ 220 VAC maximum

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 56
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56
- AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 220

Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router

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 6 A @ 110 VAC (660 W) or 3 A @ 220 VAC (660 W) for each input.

Table 25 on page 54 and Table 26 on page 55 list the power requirements for base AC-powered routers operating under typical voltage conditions.

If you do not plan to provision 6 A @ 110 VAC (660 W) or 3 A @ 220 VAC (660 W) for each input, you can use the information in Table 25 on page 54, Table 26 on page 55, and Table 27 on page 55 to calculate the power consumption and thermal output for your hardware configuration.

Table 25: AC Base Router Power Requirements for the Fixed MX5, MX10, MX40, and MX80 Routers

Fixed Chassis Configuration	Power Requirement (Watts)	Power Requirement (Watts) with 85% Efficiency
Chassis running at high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed	320 W	376 W

Table 26: AC Base Router Power Requirements for the Modular MX5, MX10, MX40, and MX80 Routers

Modular Chassis Configuration	Power Requirement (Watts)	Power Requirement (Watts) with 85% Efficiency
Chassis running at high activity, with four 10-Gigabit Ethernet XFPs, two MICs, and fans running at high speed	310 W	365 W

Table 27 on page 55 lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

Table 27: Component Power Requirements

Component	Power Requirement (Watts)	Power Requirement (Watts) with 85% Efficiency
MIC (generalized value)	35 W	41 W

These examples use generalized values per MIC. For exact MIC power requirements, see the *MX Series Interface Module Reference*.

The following calculations show the typical power consumption for modular AC-powered routers @ 220 V (includes 85% efficiency):

- Active AC-powered router with one MIC:

  Base router (high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed) + 1 MIC =
  282 W + 41 W = 323 W

- Active AC-powered router with two MICs:

  Base router (high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed) + 2 MICs
  282 W + 2(41 W)= 364 W

- Example of calculating system thermal output:

  Watts AC PEM * 3.41 = BTU/hr
  500 W * 3.41 = 1,705 BTU/hr

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 220
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56

- AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 56

AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router

We recommend that you use a dedicated customer site circuit breaker rated for 15 A (110 VAC) minimum or 10 A (220 VAC) minimum for each AC power feed, or as required by local code. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router on page 54
- AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 220
- AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 56

AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers

Each AC power supply has a single AC appliance inlet located on the power supply that requires a dedicated AC power feed. Most sites distribute power through a main conduit that leads to frame-mounted power distribution panels, one of which can be located at the top of the rack that houses the router. An AC power cord connects each power supply to the power distribution panel.

You can order detachable AC power cords, each approximately 8 ft (2.5 m) long that supply AC power to the router. The C13 appliance coupler at the female end of the cord inserts into the AC appliance inlet coupler, type C14 as described by International Electrotechnical Commission (IEC) standard 60320. The plug at the male end of the power cord fits into the power source receptacle that is standard for your geographic location.

Table 28 on page 56 provides specifications on the AC power cord provided for each country or region.

Table 28: AC Power Cord Specifications

Country	Model Number	Electrical Specification	Plug Type
Australia	CBL-JX-PWR-AU	250 VAC, 10 A, 50 Hz	AS/NZ 3112–1993
China	CBL-JX-PWR-CH	250 VAC, 10 A, 50 Hz	GB2099.1 1996 and GB1002 1996 (CH1-10P)
Europe (except Italy and United Kingdom)	CBL-JX-PWR-EU	250 VAC, 10 A, 50 Hz	CEE (7) VII

Table 28: AC Power Cord Specifications *(continued)*

Country	Model Number	Electrical Specification	Plug Type
Italy	CBL-JX-PWR-IT	250 VAC, 10 A, 50 Hz	CEI 23–16/VII
Japan	CBL-JX-PWR-JP	125 VAC, 12 A, 50 Hz or 60 Hz	JIS 8303
North America	CBL-JX-PWR-US	125 VAC, 10 A, 60 Hz	NEMA 5-15
United Kingdom	CBL-JX-PWR-UK	250 VAC, 10 A, 50 Hz	BS 1363A

WARNING: The AC power cord for the router is intended for use with the router only and not for any other use.

WARNING: The attached power cable is only for this product. Do not use the cable for another product. Translation in Japanese follows:

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

NOTE: In North America, AC power cords must not exceed approximately 14.75 ft (4.5 m) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). You can order AC power cords that are in compliance.

WARNING: The router is pluggable type A equipment installed in a restricted-access location. It has a separate protective earthing terminal (sized for SAE 10-32 ground screws) provided on the chassis in addition to the grounding pin of the power supply cord. This separate protective earthing terminal must be permanently connected to earth.

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

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35

- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers on page 220
- Power Consumption for an AC-Powered MX5, MX10, MX40, and MX80 Router on page 54
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56

CHAPTER 9

DC Power Specifications and Requirements

MX5, MX10, MX40, and MX80 Routers DC Power Specifications

Table 29 on page 59 lists the DC power system electrical specifications.

Table 29: DC Power System Electrical Specifications

Item	Specification
DC input voltage	Operating range: –40 to –72 VDC
DC system input current rating	13 A @ –48 VDC (maximum) (625 W DC)
DC system input power	13 A @ –48 VDC (625 W DC)

Table 30 on page 59 lists the DC power supply electrical specifications.

Table 30: DC Power Supply Electrical Specifications

Item	Specification
Maximum output power	500 W
DC input voltage	Minimum: –40 VDC Nominal: –48 VDC, –60 VDC Operating range: –40 to –72 VDC

Table 30: DC Power Supply Electrical Specifications *(continued)*

Item	Specification
DC input current rating	13 A @ –48 VDC

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 224
- Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router on page 60
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router

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 at least 13 A @ –48 VDC for each input.

Table 31 on page 60 and Table 32 on page 61 list the power requirements for base DC-powered routers operating under typical voltage conditions.

If you do not plan to provision at least 13 A @ –48 VDC per input, you can use the information in Table 31 on page 60, Table 32 on page 61, and Table 33 on page 61 to calculate the power consumption @ –48 VDC and thermal output for your hardware configuration.

Table 31: DC-Powered Base Router Power Requirements for the Fixed MX80 Router

Fixed Chassis Configuration	Power Requirement (Watts)	Current Requirement (Amps @ –48 VDC)
Chassis running at high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed	320 W	6.7 A (approximate)

Table 32: DC-Powered Base Router Power Requirements for the MX5, MX10, MX40, and Modular MX80 Router

Modular Chassis Configuration	Power Requirement (Watts)	Current Requirement (Amps @ –48 VDC)
Chassis running at high activity, with four 10-Gigabit Ethernet XFPs, two MICs, and fans running at high speed	310 W	6.5 A (approximate)

Table 33 on page 61 lists the power requirements for various hardware components when the router is operating under typical voltage conditions.

Table 33: Component Power Requirements for DC-Powered Routers

Component	Power Requirement (Watts)	Current Requirement (Amps @ –48 VDC)
MIC (generalized value)	35 W	0.73 A

These examples show how to calculate typical power consumption for your DC-powered router configuration. The examples use generalized values for MICs. For exact MIC power requirements, see the *MX Series Interface Module Reference*.

Typical power consumption for modular DC-powered routers:

- Active DC-powered router with one MIC:

  Base router (high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed) + 1 MIC =
  5 A + 0.73 A = 5.73 A @ –48 VDC = 275 W DC

- Active DC-powered router with two MICs:

  Base router (high activity, with four 10-Gigabit Ethernet XFPs, and fans running at high speed) + 2 MICs
  5 A + 2(0.73 A) = 6.46 A @ –48 VDC = 310 W DC

- Input current from a DC source other than –48 VDC (based on maximum configuration; applies to DC power supply only):

  (–54 VDC input) * (input current X) = (–48 VDC input) * (input current Y)
  54 * X = 48 * 13 A
  X = 48 * 13 A/54 = 11.5 A

- Example of calculating system thermal output:

  Watts DC * 3.41 = BTU/hr
  500 * 3.41 = 1,705 BTU/hr

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161

- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 224
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers

Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated circuit breaker. We recommend that you use a dedicated customer site circuit breaker rated for 13 A (–48 VDC) minimum, or as required by local code. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

If you plan to operate a DC-powered router at less than the maximum configuration and do not provision a 13 A (–48 VDC) circuit breaker, we recommend that you provision a dedicated customer site circuit breaker for each DC power supply rated for at least 125 percent of the continuous current that the system draws at –48 VDC.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 224
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router on page 60
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers

The DC power supply in **PS0** must be powered by a dedicated power feed derived from feed **A**, and the DC power supply in **PS1** must be powered by a dedicated power feed derived from feed **B**. This configuration provides the commonly deployed **A/B** feed redundancy for the system.

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.

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

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 224
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router on page 60
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

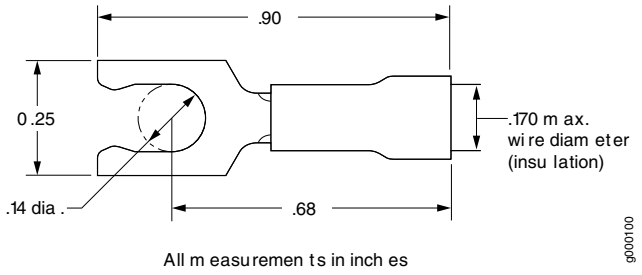
DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers

- DC Power Cable Lug Specifications on page 63
- DC Power Cable Specifications on page 64

DC Power Cable Lug Specifications

The accessory box shipped with the router includes the cable lugs that attach to the terminal of each power supply.

Figure 29: 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.

DC Power Cable Specifications

You must supply four DC power cables that meet the following specifications: 16-AWG (1.3 mm^2), minimum 60° C wire, or as required by the local code.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- MX5, MX10, MX40, and MX80 DC Power Electrical Safety Guidelines on page 224
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- Power Consumption for a DC-Powered MX5, MX10, MX40, and MX80 Router on page 60
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62

CHAPTER 10

Transceiver and Cable Specifications

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 66. 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 73
- Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 74

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

Table 34 on page 67 and Table 35 on page 71 list the transceivers supported by ACX, M, MX, and T Series 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 router.

- Table 34 on page 67 lists the supported Ethernet standards for each transceiver.
- Table 35 on page 71 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 34 on page 67 and Table 35 on page 71. 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 34 on page 67 is organized by transmission speed and then alphabetically by model number.

Table 34: 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*
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*

Table 34: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	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*
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*

Table 34: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	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*
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*

Table 34: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	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*
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*

Table 34: Supported Ethernet Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	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*
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*
CXP-100GBASE-SR10	CXP	24-fiber MPO	Yes	100GBASE-SR10	• *100-Gigabit Ethernet 100GBASE-R Optical Interface Specifications*

Table 35 on page 71 is organized by transmission speed and then alphabetically by model number.

Table 35: 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*

Table 35: Supported SONET Standards *(continued)*

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

Table 35: Supported SONET Standards *(continued)*

Model Number	Transceiver Type	Connector	Monitoring Available	Standard	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*

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 74 and "Supported Network Interface Standards by Transceiver for ACX, M, MX, and T Series Routers" on page 66 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 (HOL) 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 in time. The following two types of dispersion can affect an optical data link:

- Chromatic dispersion—Spreading of the signal in time resulting from the different speeds of light rays.
- Modal dispersion—Spreading of the signal in 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 66 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 74
2. Calculating Power Margin for Fiber-Optic Cable on page 75

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:

$P_M = P_B - LL$

A 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 (HOL), modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 36 on page 75 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 36: 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
Connector	0.5 dB
Splice	0.5 dB
Fiber attenuation	Single-mode—0.5 dB/km Multimode—1 dB/km

The following example uses the estimated values in Table 36 on page 75 to calculate link loss (LL) for a 2-km-long multimode link with a power budget (P_B) of 13 dB:

- Fiber attenuation for 2 km @ 1.0 dB/km = 2 dB
- Loss for five connectors @ 0.5 dB per connector = 5(0.5 dB) = 2.5 dB

- Loss for two splices @ 0.5 dB per splice = 2(0.5 dB) = 1 dB
- Higher-order mode loss = 0.5 dB
- Clock recovery module = 1 dB

The power margin (P_M) is calculated as follows:

$P_M = P_B – LL$

$P_M = 13 dB – 2 km (1.0 dB/km) – 5 (0.5 dB) – 2 (0.5 dB) – 0.5 dB [HOL] – 1 dB [CRM]$

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

$P_M = 6 dB$

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 36 on page 75 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 73

Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers

Table 37 on page 76 lists the specifications for the cables that connect to management ports.

Table 37: Cable Specifications for Routing Engine Management

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

Table 37: Cable Specifications for Routing Engine Management *(continued)*

Port	Cable Specification	Cable/Wire Supplied	Maximum Length	Router Receptacle
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

Related Documentation

- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162
- RJ-45 Connector Pinouts for the ETHERNET Port on MX5, MX10, MX40, and MX80 Routers on page 80
- RJ-45 Connector Pinouts for the AUX and CONSOLE Ports on MX5, MX10, MX40, and MX80 Routers on page 79

CHAPTER 11

Port Cable and Pinout Specifications

RJ-45 Connector Pinouts for the AUX and CONSOLE Ports on MX5, MX10, MX40, and MX80 Routers

The ports on the front panel 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 38 on page 79 describes the RJ-45 connector pinout.

Table 38: RJ-45 Connector Pinout for the AUX and CONSOLE Ports

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

- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162
- Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 76

- RJ-45 Connector Pinouts for the ETHERNET Port on MX5, MX10, MX40, and MX80 Routers on page 80

RJ-45 Connector Pinouts for the ETHERNET Port on MX5, MX10, MX40, and MX80 Routers

The port on the front panel labeled **ETHERNET** 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 39 on page 80 describes the RJ-45 connector pinout.

Table 39: RJ-45 Connector Pinout for the Routing Engine ETHERNET 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

- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21
- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162
- Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 76
- RJ-45 Connector Pinouts for the AUX and CONSOLE Ports on MX5, MX10, MX40, and MX80 Routers on page 79

PART 3

Initial Installation and Configuration

CHAPTER 12

Unpacking the MX5, MX10, MX40, and MX80 Routers

Tools and Parts Required to Unpack MX5, MX10, MX40, and MX80 Routers

To unpack the router and prepare for installation, you need the following tools:

- Blank panels to cover any slots not occupied by a component

Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Unpacking MX5, MX10, MX40, and MX80 Routers on page 83
- Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received on page 84

Unpacking MX5, MX10, MX40, and MX80 Routers

The router is shipped in a cardboard carton and secured with foam packing material. The carton also contains an accessory box and quick start instructions.

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

To unpack the router:

1. Move the shipping carton to a staging area as close to the installation site as possible, but where you have enough room to remove the router.
2. Position the carton so that the arrows are pointing up.
3. Open the top flaps on the shipping carton.

4. Remove the accessory box, and verify the contents against the parts inventory on the label attached to the carton.
5. Pull out the packing material holding the router in place.
6. Verify the contents of the carton against the packing list included with the router.
7. Save the shipping carton and packing materials in case you later need to move or ship the router.

Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Tools and Parts Required to Unpack MX5, MX10, MX40, and MX80 Routers on page 83
- Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received on page 84

Verifying the MX5, MX10, MX40, and MX80 Routers 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 40 on page 84, and an accessory box, which contains the parts listed in Table 41 on page 85. The parts shipped with your router can vary depending on the configuration you ordered.

Table 40: Parts List for a Fully Configured Router

Component	Quantity
Chassis	1
Air filter	1
MICs (modular chassis only)	Up to 2
DC power supplies	1 or 2
AC power supplies	1 or 2
Fan tray	1
Cable management brackets	2
Quick start installation instructions	1
Blank panels for slots without components installed	One blank panel for each slot not occupied by a component

Table 41: Accessory Box Parts List

Part	Quantity
Screws to mount chassis	4
Screws to secure the ground cable lug	2
Ground terminal lug, 14 AWG, sized for #10 screw	1
DC power fork terminal lugs, 16-14 AWG, sized for #6 screw	9
Label, “Small Parts Enclosed”	1
Label, “Accessories Contents”	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
Documentation addendum card, MX80	1
Document sleeve	1
3 in. x 5 in. pink bag	2
9 in. x 12 in. pink bag, ESD	2
Accessory box, 19 in. x 12 in. x 3 in.	1
Ethernet cable, RJ-45 to DB-9	1
ESD wrist strap with cable	1

Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Tools and Parts Required to Unpack MX5, MX10, MX40, and MX80 Routers on page 83
- Unpacking MX5, MX10, MX40, and MX80 Routers on page 83

CHAPTER 13

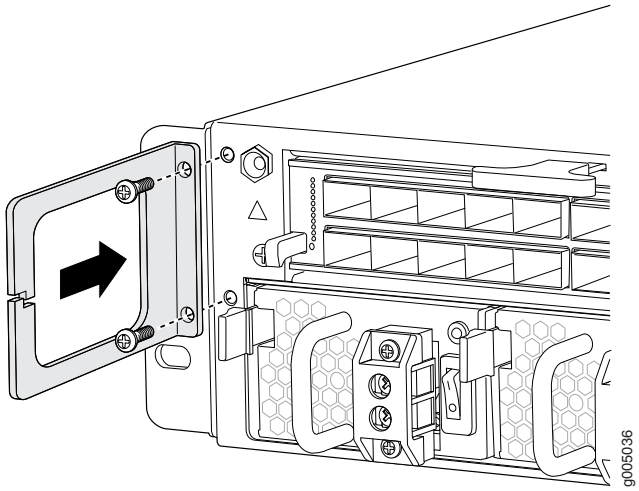
Installing the Mounting Hardware

Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket

The cable management bracket attaches to the left side of the router. To install the cable management bracket (see Figure 30 on page 87):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Position the cable management bracket on the left side of the front of the chassis.
3. Tighten the screws at the bottom and top of the bracket.

Figure 30: Installing the Cable Management Bracket



Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

- Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 105
- Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers on page 107

Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers

Two removable mounting brackets are attached to the mounting holes closest to the front of the chassis (see Figure 31 on page 88). You can move the pair of brackets to another position on the side of the chassis for center-mounting the router.

To move the mounting brackets from the front of the chassis toward the center of the chassis (see Figure 32 on page 89):

1. Remove the four screws at the top and bottom of the bracket.
2. Pull the bracket away from the chassis.
3. Align the bracket with the two sets of mounting holes located toward the center of the chassis.
4. Insert the four screws at the top and bottom of the bracket and tighten each partially.
5. Tighten the four screws completely.
6. Repeat the procedure for the other bracket.

Figure 31: Front-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers

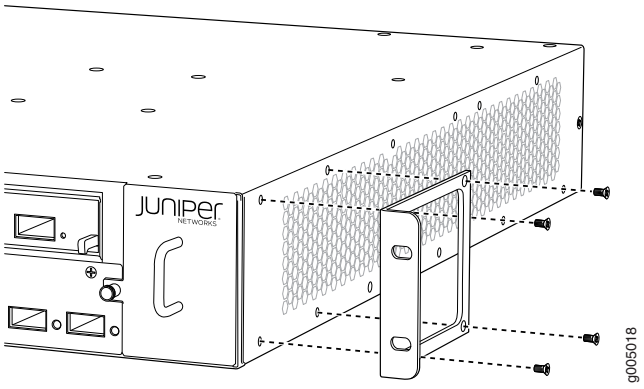
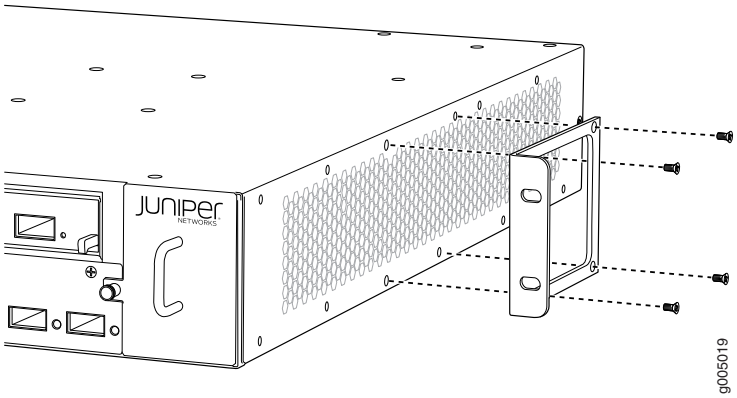


Figure 32: Center-Mounting the Brackets on MX5, MX10, MX40, and MX80 Routers



Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Unpacking MX5, MX10, MX40, and MX80 Routers on page 83
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

CHAPTER 14

Installing the MX5, MX10, MX40, and MX80 Routers

MX5, MX10, MX40, and MX80 Installation Summary

To install the router:

1. Prepare your installation site.

   See "MX5, MX10, MX40, and MX80 Site Preparation Checklist" on page 44.

2. Review the safety guidelines and warnings:

   - See "General Safety Guidelines for Juniper Networks Devices" on page 189.
   - See "General Safety Warnings for Juniper Networks Devices" on page 190.

3. Unpack the router and verify the parts:

   a. See "Unpacking MX5, MX10, MX40, and MX80 Routers" on page 83.

   b. See "Verifying the MX5, MX10, MX40, and MX80 Routers Parts Received" on page 84.

4. Install the mounting hardware.

   See "Moving the Mounting Brackets for Center-Mounting MX5, MX10, MX40, and MX80 Routers" on page 88.

5. Lift the router onto the rack.

   See "Installing MX5, MX10, MX40, and MX80 Chassis in the Rack" on page 93.

6. Connect cables to the network and external devices:

   - See "Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices" on page 105.
   - See "Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers" on page 107.

7. Connect the grounding cable.

   See "Grounding MX5, MX10, MX40, and MX80 Routers" on page 96.

8. Connect the AC power cord or DC power cables:

   - See "Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 97.
   - See "Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 99.

9. Power on the router:

   - See "Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router" on page 98.
   - See "Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router" on page 101.

10. Perform the initial system configuration.

    See "Initially Configuring MX5, MX10, MX40, and MX80 Routers" on page 109.

Related Documentation

- MX5, MX10, MX40, and MX80 Rack Requirements on page 46
- MX5, MX10, MX40, and MX80 Routers Clearance Requirements for Airflow and Hardware Maintenance on page 47
- MX5, MX10, MX40, and MX80 Routers Cabinet Requirements and Specifications on page 48

Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack

To install the router, you need the following tools and parts:

- Phillips (+) screwdriver, number 2
- ESD grounding wrist strap

Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93

Installing MX5, MX10, MX40, and MX80 Chassis in the Rack

To install the router in the rack (see Figure 33 on page 94 and Figure 34 on page 94):

CAUTION: If you are installing more than one router in a rack, install the lowest one first. Installing a router in an upper position in a rack or cabinet requires a lift.

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.

CAUTION: Lifting the chassis and mounting it in a rack requires two people (one person to hold the router in place and a second person to install the screws). The chassis weighs approximately 30 lb (13.6 kg).

1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance.
2. Position the router in front of the rack or cabinet.
3. Hold onto the bottom of the chassis and carefully lift it so that the mounting brackets contact the rack rails.

   WARNING: To prevent injury, keep your back straight and lift with your legs, not your back. Avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

4. Align the mounting brackets with the holes in the rack rails.
5. Install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.
6. 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.

Figure 33: Installing the Front-Mounted Router in the Rack

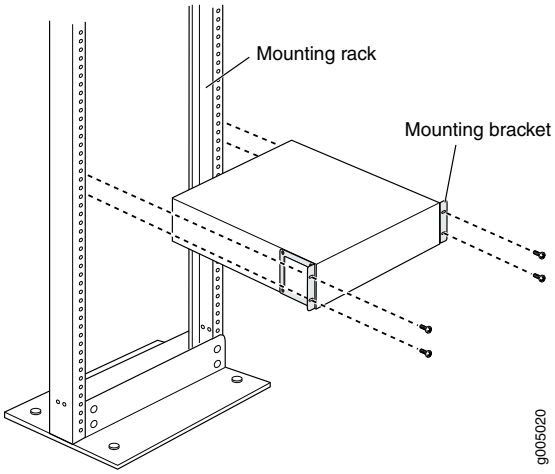
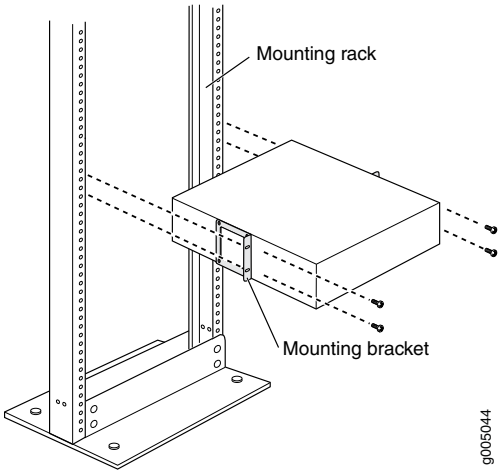


Figure 34: Installing the Center-Mounted Router in the Rack



Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- MX5, MX10, MX40, and MX80 Installation Summary on page 50
- Unpacking MX5, MX10, MX40, and MX80 Routers on page 83
- Tools Required to Install MX5, MX10, MX40, and MX80 Chassis in the Rack on page 92

CHAPTER 15

Connecting the MX5, MX10, MX40, and MX80 Routers to Power

Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections

To ground and provide power to the router, you need the following tools and parts:

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (–) screwdriver
- Torque-controlled driver, with a maximum torque capacity of 6 lb-in., for tightening screws to terminals on each power supply on a DC-powered router

CAUTION: The maximum torque rating of the terminal screws on the DC power supply is 6 lb-in. (0.7 Nm). The terminal screws may be damaged if excessive torque is applied. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately sized driver, with a maximum torque capacity of 6 lb-in. or less. 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.

- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

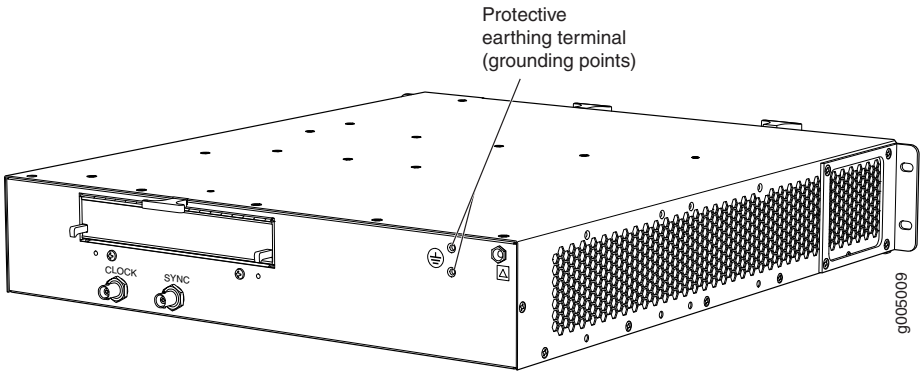
- Grounding MX5, MX10, MX40, and MX80 Routers on page 96
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43

Grounding MX5, MX10, MX40, and MX80 Routers

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points using two SAE 10-32 screws. You must provide the grounding cables (the cable lugs are supplied with the router). For grounding cable specifications, see "Grounding Cable Specifications" on page 44. To ground the router:

1. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.
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. Ensure that all grounding surfaces are clean and brought to a bright finish before grounding connections are made.
4. Connect the grounding cable to a proper earth ground.
5. Detach the ESD grounding strap from the site ESD grounding point.
6. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
7. Place the grounding cable lug over the grounding points on the upper rear of the chassis (see Figure 35 on page 96).
8. Secure the grounding cable lug with the screws. The holes are sized for SAE 10-32 screws.
9. Dress the grounding cable, and verify that it does not touch or block access to router components, and that it does not drape where people could trip on it.

Figure 35: Grounding Points on MX5, MX10, MX40, and MX80 Routers



Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95

- Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router on page 97
- Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router on page 99

Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router

CAUTION: Do not mix AC and DC power supplies within the same router. Damage to the router might occur.

You connect AC power to the router by attaching power cords from the AC power sources to the AC appliance inlets located on the power supplies.

To connect the AC power cords to the router for each power supply:

1. Locate power cords that have a plug appropriate for your geographic location. For more information, see "Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord" on page 143.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.
4. Connect the power cord to the power supply.
5. Insert the power cord plug into an external AC power source receptacle.

NOTE: Each power supply must be connected to a dedicated AC power feed and a dedicated customer site circuit breaker. We recommend that you use a dedicated customer site circuit breaker rated for 15 A (110 VAC) minimum, or as required by local code.

6. Route the power cord appropriately. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.
7. Repeat Step 1 through Step 6 for the remaining power supply.

Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95
- Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router on page 98
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43

Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router

To power on an AC-powered router:

1. Verify that the power supplies are fully inserted in the chassis.
2. Verify that each AC power cord is securely inserted into its appliance inlet.
3. Verify that an external management device is connected to one of the Routing Engine ports (**AUX**, **CONSOLE**, or **ETHERNET**).
4. Turn on the power to the external management device.
5. Switch on the dedicated customer site circuit breakers for the power supplies. Follow the instructions for your site.
6. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
7. Switch the AC input switch on each power supply to the on (**|**) position, and observe the status LED on each power supply faceplate. If an AC power supply is correctly installed and functioning normally, the status LED above each AC input switch lights steadily green.

   If the status LED on the power supply is lit red, the power supply is not functioning normally. Repeat the installation and cabling procedures.

   NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

   If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, first issue the CLI **request system halt** command.

   After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the power supply and the **show chassis** command display—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

8. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95
- Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router on page 97
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43
- *request system halt*

- *show chassis power*

Connecting Power to a DC-Powered MX5, MX10, MX40, and MX80 Router

CAUTION: Do not mix AC and DC power supplies within the same router. Damage to the router might occur.

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 on the power supply faceplate. You must provide the power cables (the cable lugs are supplied with the router). For power cable specifications, see "DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers" on page 63.

To connect the DC source power cables to the router for each power supply:

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 ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Switch the DC circuit breaker on the power supply faceplate to the off (**O**) position.
4. Remove the clear plastic cover protecting the terminal on the faceplate.
5. Verify that the DC power cables are correctly labeled before making connections to the power supply. 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 power supply.

6. Remove the screws from the terminals.
7. Secure each power cable lug to the terminal with the screw (see Figure 36 on page 101). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
   a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
   b. Secure the negative (–) DC source power cable lug to the **–48V** (input) terminal.

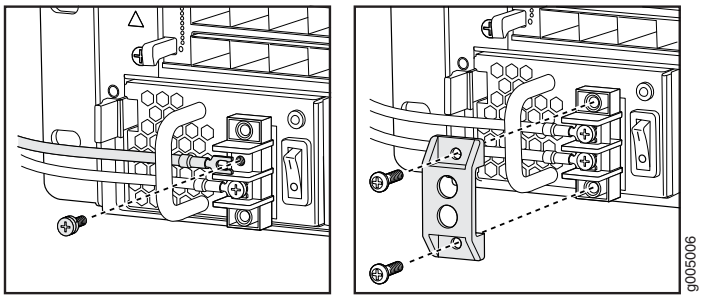
CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded may result in damage to the terminal.

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

NOTE: For information about connecting to DC power sources, see "MX5, MX10, MX40, and MX80 Routers DC Power Specifications" on page 59.

8. Replace the clear plastic cover over the terminals on the faceplate.
9. 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.
10. If you are installing two power supplies, repeat Steps 3 through 9 for the other power supply.

Figure 36: Connecting DC Power to the Router



Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95
- Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router on page 101
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43

Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router

To power on a DC-powered router:

1. Verify that an external management device is connected to one of the Routing Engine ports (**AUX**, **CONSOLE**, or **ETHERNET**).
2. Turn on the power to the external management device.
3. Verify that the power supplies 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**).
5. Switch on the dedicated customer site circuit breakers to provide power to the DC power cables.
6. Check that the status LED on the power supply faceplate is lit steadily blue to verify that power is present.
7. If power is not present:
   - Verify that the fuse is installed correctly, and turn on the breaker at the battery distribution fuse board or fuse bay.
   - Check the voltage with a meter at the terminals of the power supply for correct voltage level and polarity.
8. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
9. On each of the DC power supplies, 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 (O) position if you move the breaker too quickly.

Observe the status LED on each power supply faceplate. If a DC power supply is correctly installed and functioning normally, the status LED lights blue steadily.

If the status LED on the power supply is blinking red, the power supply is not functioning normally. Repeat the installation and cabling procedures.

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, first issue the CLI **request system halt** command.

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the power supply and the **show chassis** command display—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

10. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

Related Documentation

- Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Grounding and Power Connections on page 95
- Connecting Power to an AC-Powered MX5, MX10, MX40, and MX80 Router on page 97
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43
- *request system halt*
- *show chassis power*

Powering Off MX5, MX10, MX40, and MX80 Routers

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To power off the router:

1. On the external management device connected to the Routing Engine, issue the **request system halt** command.

   ```
   user@host> request system halt
   ```

2. 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.
3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
4. Switch the AC input switch on each AC power supply or the DC circuit breaker on each DC power supply to the off (**O**) position.

Related Documentation

- Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 143
- Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 151
- *request system halt*

CHAPTER 16

Connecting the MX5, MX10, MX40, and MX80 Routers to the Network

Tools and Parts Required for MX5, MX10, MX40, and MX80 Router Connections

To connect the router to management devices and line cards, no tools or parts are required.

Related Documentation

- Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 87
- Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 105
- Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers on page 107

Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices

Connecting the Router to a Network for Out-of-Band Management

To connect to the **ETHERNET** port on the Routing Engine:

1. Turn off the power to the management device.
2. Plug one end of the Ethernet cable (Figure 37 on page 106 shows the connector) into the **ETHERNET** port on the Routing Engine. Figure 38 on page 106 shows the port.
3. Plug the other end of the cable into the network device.

Figure 37: Routing Engine Ethernet Cable Connector

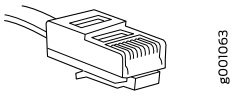
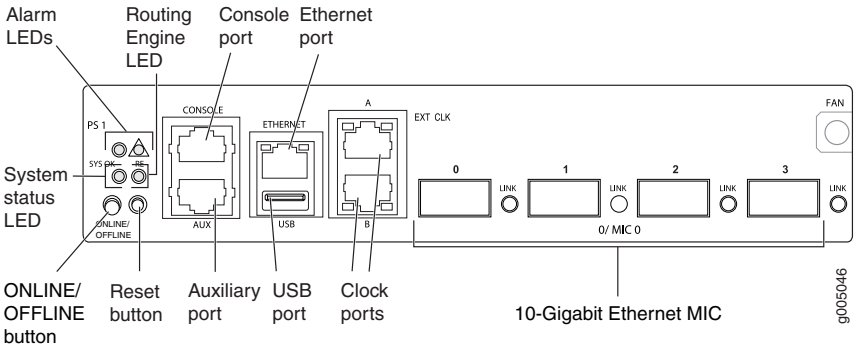


Figure 38: Ethernet Port



Connecting the Router to a Management 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 front panel. To use a laptop, modem, or other auxiliary device, connect it to the **AUX** port on the front panel. 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.

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 (Figure 39 on page 107 shows the connector) into the **AUX** port or **CONSOLE** port on the front panel. Figure 40 on page 107 shows the 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

WARNING: Do not connect Power over Ethernet (PoE) enabled cables to the console port. These cables are known to cause damage resulting in console port failure.

Figure 39: Routing Engine Console and Auxiliary Cable Connector

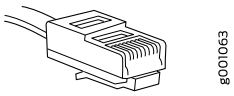
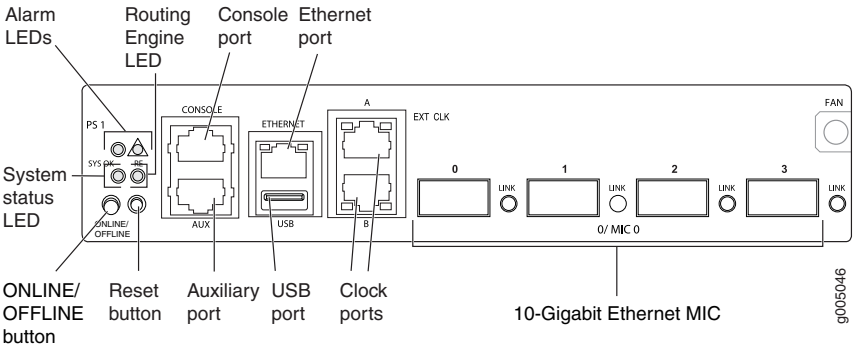


Figure 40: Auxiliary and Console Ports



Related Documentation

- Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 87
- Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers on page 107
- Initially Configuring MX5, MX10, MX40, and MX80 Routers on page 109

Connecting Interface Cables to MX5, MX10, MX40, and MX80 Routers

To connect the physical interfaces to the network (see Figure 41 on page 108):

1. Have ready a length of the type of cable used by the component. For MIC 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.

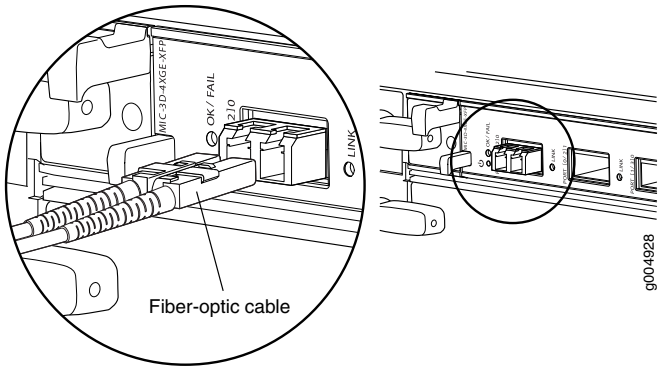
NOTE: The XFP cages and optics on the components are industry standard parts that have limited tactile feedback for insertion of optics and fiber. You need to insert the optics and fiber firmly until the latch is securely in place.

4. 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.

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 41: Attaching a Cable to a MIC



Related Documentation

- Installing the MX5, MX10, MX40, and MX80 Cable Management Bracket on page 87
- Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 105
- Initially Configuring MX5, MX10, MX40, and MX80 Routers on page 109

CHAPTER 17

Initially Configuring the MX5, MX10, MX40, and MX80 Routers

Initially Configuring MX5, MX10, MX40, and MX80 Routers

The MX5, MX10, MX40, and MX80 routers are shipped with the Junos operating system (OS) preinstalled and ready to be configured when the router is powered on. Two 4-GB internal NAND flash devices (**da0** and **da1**) are located on the baseboard. The USB storage device (**da2**) can be inserted into the slot in the front panel faceplate. The two NAND flash devices act as the primary boot device (**da0**) and hard drive (**da1**).

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 router or the attempt otherwise fails, the router next tries the primary boot device, and then tries the secondary boot device.

You configure the router by issuing Junos OS command-line interface (CLI) commands, either on a console device attached to the Routing Engine **CONSOLE** port on the front panel, or over a telnet connection to a network connected to the Routing Engine **ETHERNET** port on the front panel.

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 Administration Library for Routing Devices*.

```
[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>
    ```

Related Documentation

- Connecting MX5, MX10, MX40, and MX80 Routers to Management Devices on page 105
- Powering On an AC-Powered MX5, MX10, MX40, and MX80 Router on page 98
- Powering On a DC-Powered MX5, MX10, MX40, and MX80 Router on page 101

PART 4

Installing and Replacing Components

CHAPTER 18

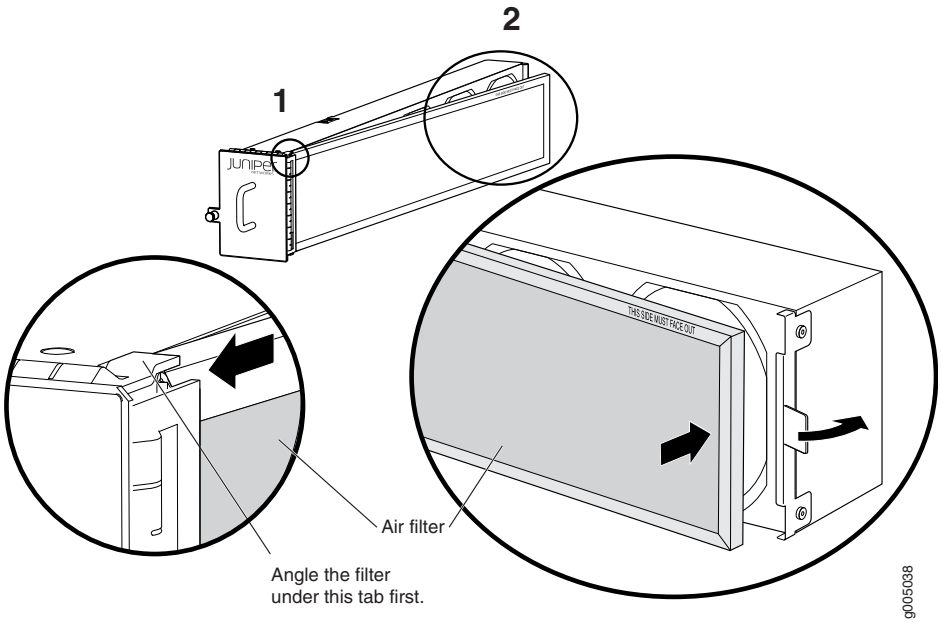
Replacing Cooling System Component

Installing an MX5, MX10, MX40, and MX80 Air Filter

The air filter installs on the right side of the fan tray. To install the air filter (see Figure 42 on page 116):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Locate the **THIS SIDE MUST FACE OUT** label, and ensure that the air filter is right side up.
3. Insert the air filter into the groove located toward the front of the fan tray.
4. Press the tab on the rear of the fan tray to allow the air filter to slide into place.
5. Release the tab to secure the air filter.

Figure 42: Installing the Air Filter



1—Inserting the air filter into the fan tray	2—Securing the air filter in the fan tray

Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Removing an MX5, MX10, MX40, and MX80 Air Filter on page 116
- Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 158
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Replacing an MX5, MX10, MX40, and MX80 Air Filter

- Removing an MX5, MX10, MX40, and MX80 Air Filter on page 116
- Installing an MX5, MX10, MX40, and MX80 Air Filter on page 117

Removing an MX5, MX10, MX40, and MX80 Air Filter

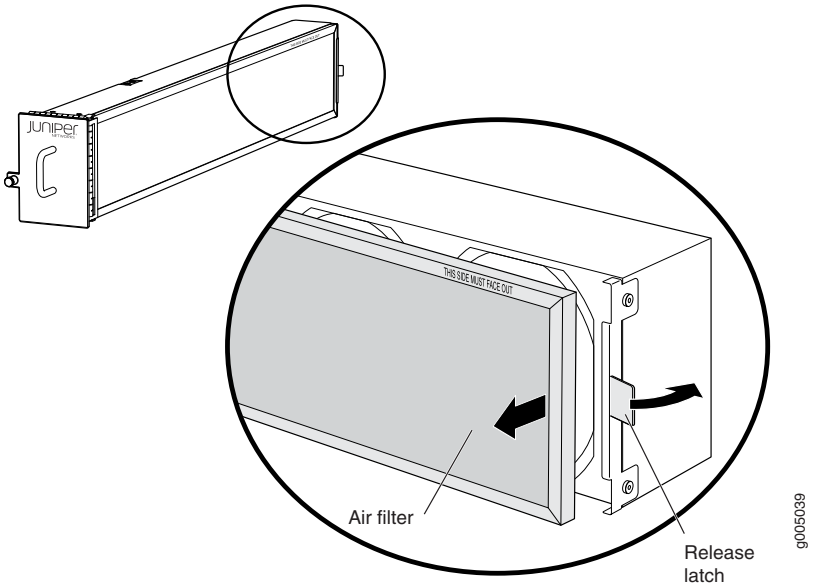
CAUTION: Do not run the router for more than a few minutes without the air filter in place.

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.

The air filter is installed on the right side of the fan tray. To remove the air filter (see Figure 43 on page 117):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Remove the fan tray as described in "Removing an MX5, MX10, MX40, and MX80 Fan Tray" on page 119.
3. Press the release tab on the rear of the fan tray to release the air filter.
4. Grasp the sides of the air filter, and slide it away from the fan tray faceplate.

Figure 43: Removing the Air Filter

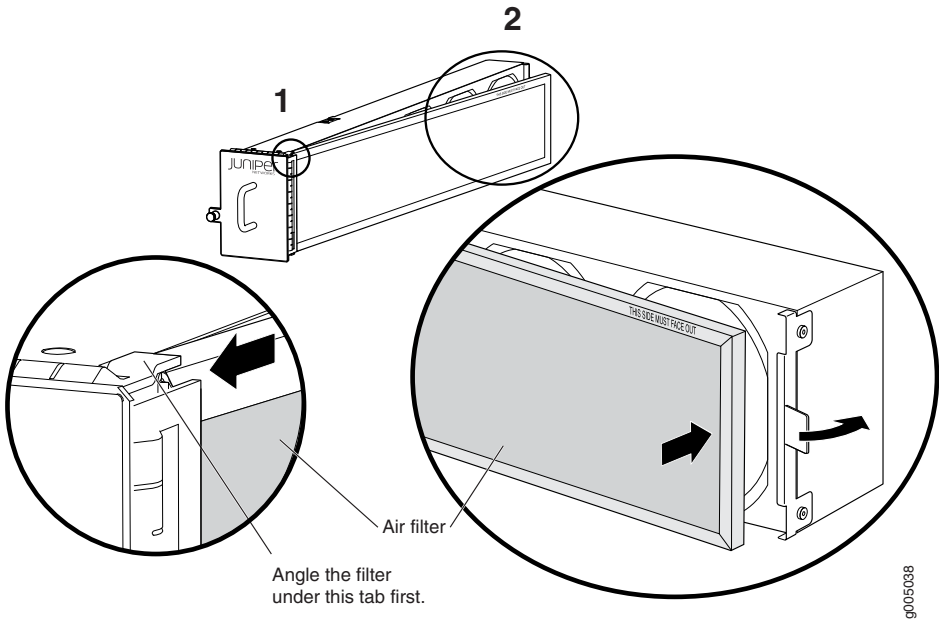


Installing an MX5, MX10, MX40, and MX80 Air Filter

The air filter installs on the right side of the fan tray. To install the air filter (see Figure 42 on page 116):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Locate the **THIS SIDE MUST FACE OUT** label, and ensure that the air filter is right side up.
3. Insert the air filter into the groove located toward the front of the fan tray.
4. Press the tab on the rear of the fan tray to allow the air filter to slide into place.
5. Release the tab to secure the air filter.

Figure 44: Installing the Air Filter



1—Inserting the air filter into the fan tray	2—Securing the air filter in the fan tray

Related Documentation

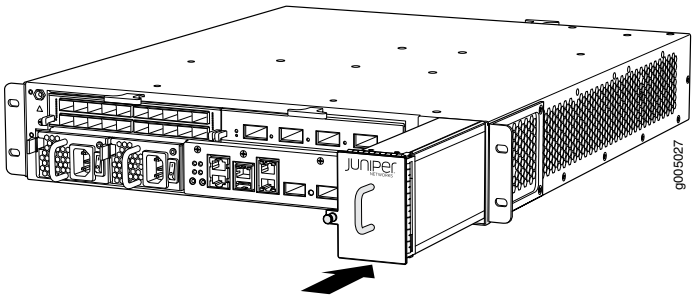
- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 158
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Installing an MX5, MX10, MX40, and MX80 Fan Tray

To install the fan tray (see Figure 45 on page 118):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray handle, and insert it straight into the chassis.
3. Tighten the captive screw on the fan tray faceplate to secure it in the chassis.

Figure 45: Installing the Fan Tray



Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Removing an MX5, MX10, MX40, and MX80 Fan Tray on page 119
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Replacing an MX5, MX10, MX40, and MX80 Fan Tray

Removing an MX5, MX10, MX40, and MX80 Fan Tray

NOTE: To prevent overheating, install the replacement fan tray immediately after removing the existing fan tray.

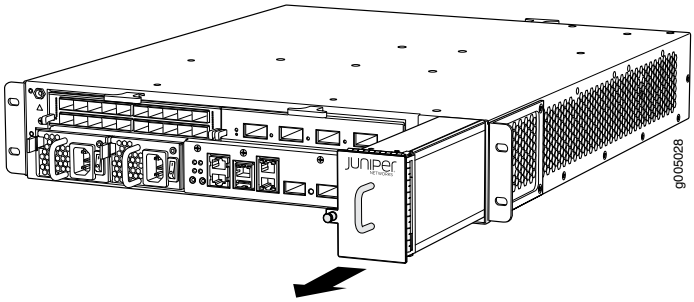
To remove the fan tray (see Figure 46 on page 119):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Loosen the captive screw on the fan tray faceplate.
3. Grasp the fan tray handle, and pull it out approximately 1 to 3 inches.

WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

4. Press the latch located on the inside of the fan tray to release it from the chassis.
5. Place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis.

Figure 46: Removing the Fan Tray

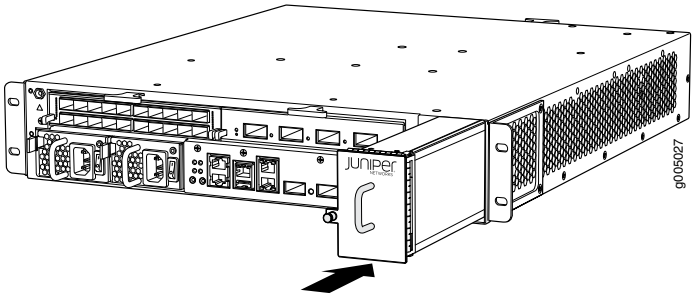


Installing an MX5, MX10, MX40, and MX80 Fan Tray

To install the fan tray (see Figure 45 on page 118):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray handle, and insert it straight into the chassis.
3. Tighten the captive screw on the fan tray faceplate to secure it in the chassis.

Figure 47: Installing the Fan Tray



Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Replacing an MX5, MX10, MX40, and MX80 Air Filter on page 116
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

CHAPTER 19

Replacing Line Card Components

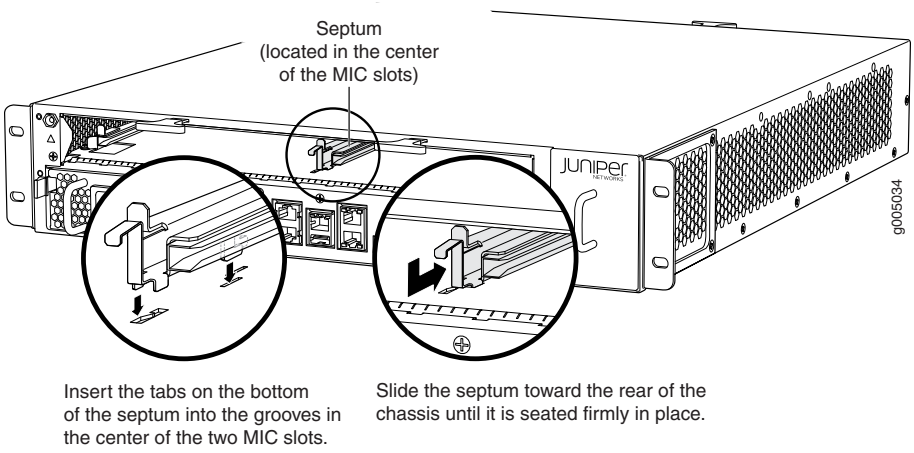
Installing an MX5, MX10, MX40, and MX80 MIC

To install a MIC (see Figure 49 on page 123):

NOTE: **The MIC can be installed in either the front slots or the rear slot.**

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. 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.
3. If you have used a dual-wide MIC and are now replacing it with two “single” MICs, install the septum (see Figure 48 on page 122):
   a. Align the bottom of the septum with the grooves in the center of the two MIC slots.
   b. Slide the septum toward the rear of the chassis until it is seated firmly in place.

Figure 48: Installing the Septum



4. Pull the ejector lever above the MIC slot 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 lever is engaged by pushing it 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 you are 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.

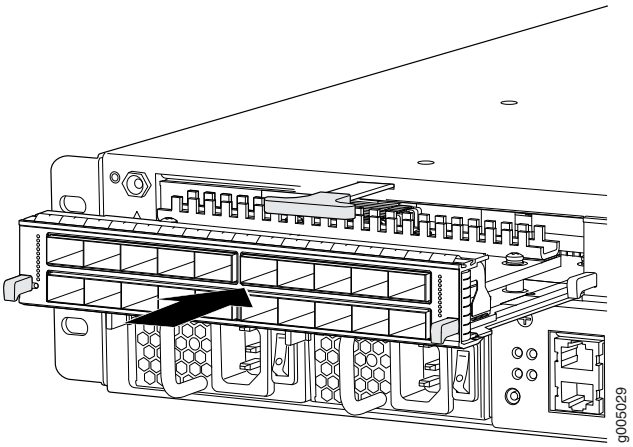
11. Use one of the following methods to bring the MIC online:

    - 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 slot-number mic-slot slot-number 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 the MX5, MX10, MX40, and MX80 MICs" on page 159.

Figure 49: Installing a MIC



Related Documentation

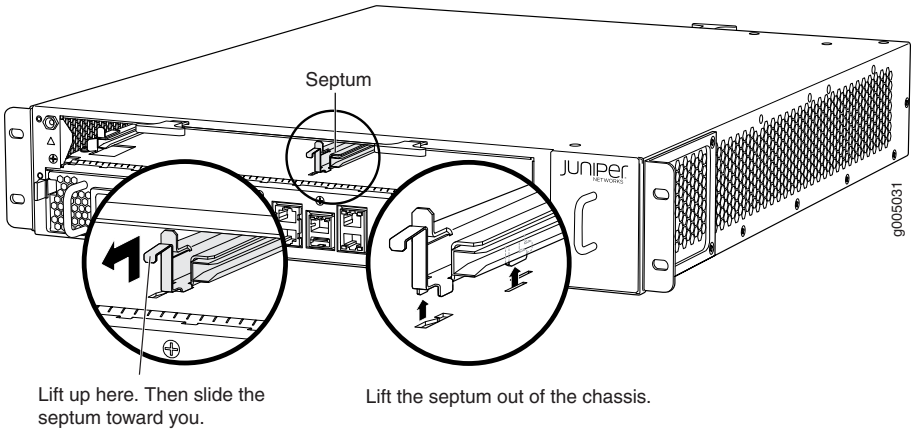
- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Removing an MX5, MX10, MX40, and MX80 MIC on page 126
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- *request chassis mic*
- *show chassis fpc*

Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC

To install a dual-wide MIC (see Figure 51 on page 125):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. 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.
3. Remove the septum, if necessary (see Figure 50 on page 124):
   a. Lift the latch in the center of the two MIC slots to disengage the septum from the chassis.
   b. Slide the septum toward you, and then lift the septum out of the slot.
   c. Store the septum for later use.

Figure 50: Removing the Septum



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 you are 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.

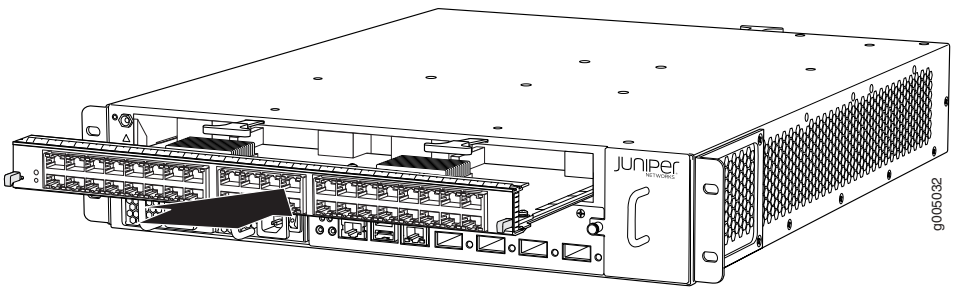
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

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 *slot-number* mic-slot *slot-number* 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 the MX5, MX10, MX40, and MX80 MICs" on page 159.

Figure 51: Installing a Dual-Wide MIC



Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Removing an MX5, MX10, MX40, and MX80 MIC on page 126
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- *request chassis mic*
- *show chassis fpc*

Replacing an MX5, MX10, MX40, and MX80 MIC

- Removing an MX5, MX10, MX40, and MX80 MIC on page 126
- Installing an MX5, MX10, MX40, and MX80 MIC on page 128
- Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC on page 130

Removing an MX5, MX10, MX40, and MX80 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.

In the MX5, MX10, MX40, and modular configuration of the MX80 router, the MICs can be installed in two slots in the front of the router. A MIC weighs less than 2 lb (0.9 kg).

To remove a MIC (see Figure 52 on page 127 and Figure 53 on page 128):

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 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 *slot-number* mic-slot *slot-number* offline**
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 you are 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. Pull the ejector lever above the MIC you are removing away from the router. Pulling the ejector lever disconnects the MIC from the chassis.

NOTE: To remove a dual-wide MIC that takes up both MIC slots, you must pull both ejector levers.

8. Grasp the handles on the MIC faceplate, and slide the MIC out of the chassis. 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 chassis card cage.

Figure 52: Removing a MIC

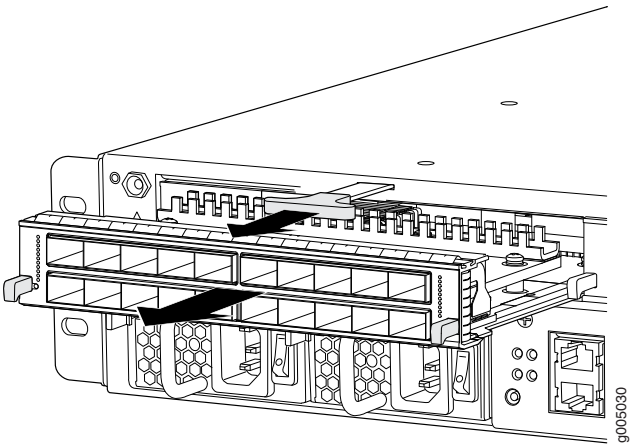
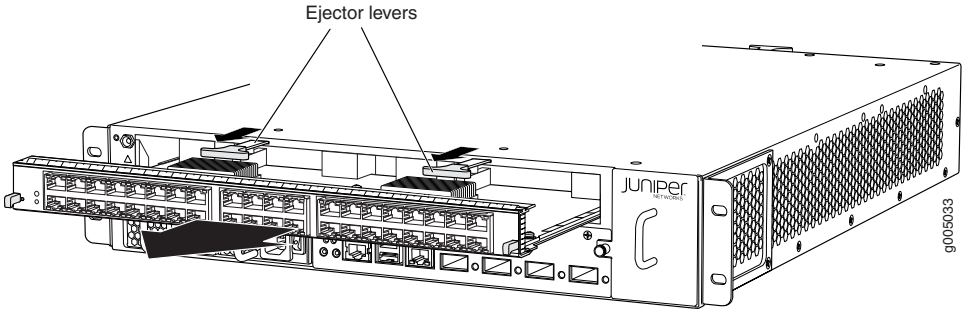


Figure 53: Removing a Dual-Wide MIC



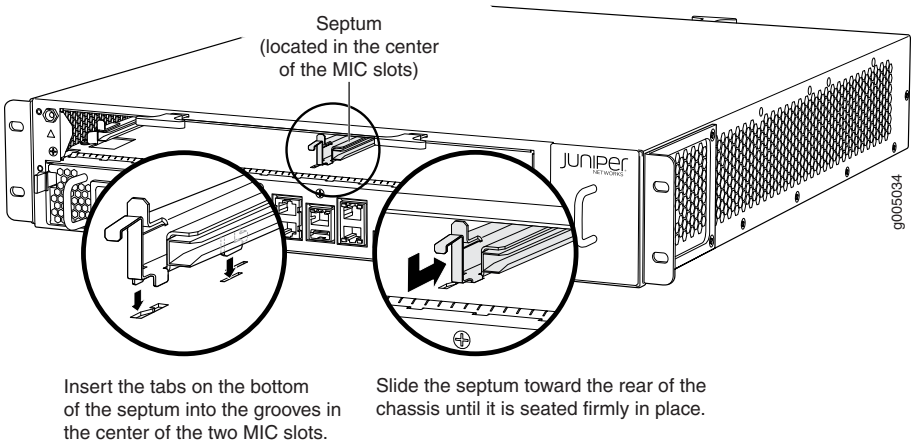
Installing an MX5, MX10, MX40, and MX80 MIC

To install a MIC (see Figure 49 on page 123):

NOTE: The MIC can be installed in either the front slots or the rear slot.

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. 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.
3. If you have used a dual-wide MIC and are now replacing it with two “single” MICs, install the septum (see Figure 48 on page 122):
   a. Align the bottom of the septum with the grooves in the center of the two MIC slots.
   b. Slide the septum toward the rear of the chassis until it is seated firmly in place.

Figure 54: Installing the Septum



4. Pull the ejector lever above the MIC slot 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 lever is engaged by pushing it 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 you are 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.

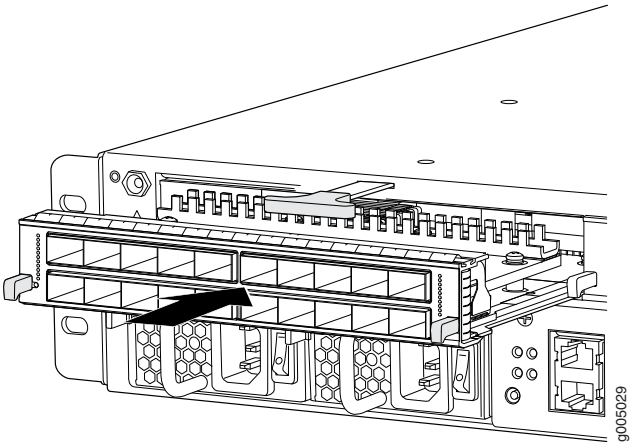
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

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** ***slot-number*** **mic-slot** ***slot-number*** **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 the MX5, MX10, MX40, and MX80 MICs" on page 159.

Figure 55: Installing a MIC

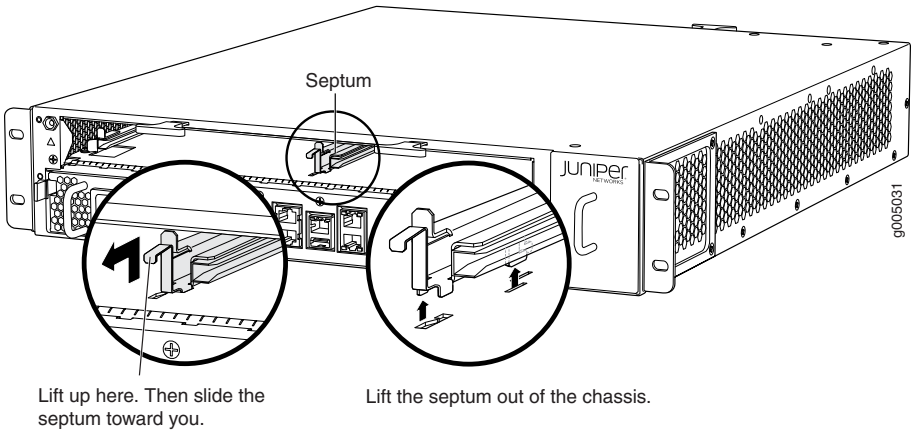


Installing an MX10, MX40, MX80, and MX104 Dual-Wide MIC

To install a dual-wide MIC (see Figure 51 on page 125):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. 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.
3. Remove the septum, if necessary (see Figure 50 on page 124):
   a. Lift the latch in the center of the two MIC slots to disengage the septum from the chassis.
   b. Slide the septum toward you, and then lift the septum out of the slot.
   c. Store the septum for later use.

Figure 56: Removing the Septum



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 you are 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.

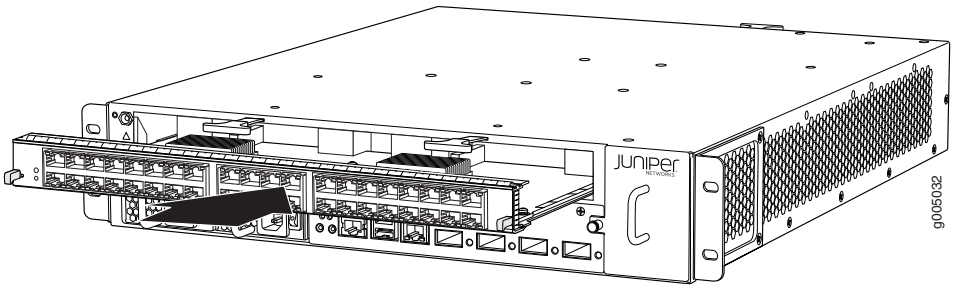
CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

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 *slot-number* mic-slot *slot-number* 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 the MX5, MX10, MX40, and MX80 MICs" on page 159.

Figure 57: Installing a Dual-Wide MIC



Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- MX5, MX10, MX40, and MX80 MIC Serial Number Label on page 178
- *request chassis mic*
- *show chassis fpc*

Replacing a Cable on an MX5, MX10, MX40, and MX80 MIC

- Removing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 132
- Installing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 133

Removing a Cable on an MX5, MX10, MX40, and MX80 MIC

Removing and installing cables on 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 MIC offline:
   - Press and hold the MIC offline/online button until the MIC LED goes off (about 5 seconds).
   - Issue the following CLI command:

     `user@host>` **request chassis mic fpc-slot *slot-number* mic-slot *slot-number* offline**
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 you are inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

4. Remove the cable from the cable management bracket, and detach it from the destination port.

Installing a Cable on an MX5, MX10, MX40, and MX80 MIC

To install a cable:

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 you are 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 MIC faceplate.
4. Arrange the cable in the cable management bracket 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 MIC is offline (its failure indicator LED is lit), use one of the following methods to bring it 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** *slot-number* **mic-slot** *slot-number* **online**

   The normal functioning indicator LED confirms that the component is online. You can also verify correct MIC functioning by issuing the **show chassis fpc pic-status** command.

Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs on page 160
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126
- Replacing an MX5, MX10, MX40, and MX80 SFP or XFP Transceiver on page 136
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- *request chassis mic*
- *show chassis fpc*

Installing a Cable on an MX5, MX10, MX40, and MX80 MIC

To install a cable:

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 you are 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 MIC faceplate.
4. Arrange the cable in the cable management bracket 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 MIC is offline (its failure indicator LED is lit), use one of the following methods to bring it 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** ***slot-number*** **mic-slot** ***slot-number*** **online**

   The normal functioning indicator LED confirms that the component is online. You can also verify correct MIC functioning by issuing the **show chassis fpc pic-status** command.

Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Removing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 132
- Replacing an MX5, MX10, MX40, and MX80 SFP or XFP Transceiver on page 136
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- *request chassis mic*
- *show chassis fpc*

Installing an MX5, MX10, MX40, and MX80 Transceiver

To install an SFP or XFP:

1. Attach an 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

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Replacing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 132
- Removing an MX5, MX10, MX40, and MX80 Transceiver on page 136
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Replacing an MX5, MX10, MX40, and MX80 SFP or XFP Transceiver

Small form-factor pluggable transceivers (SFPs) and 10-gigabit small form-factor pluggables (XFPs) are optical transceivers that are installed in a MIC. SFPs and XFPs are hot-insertable and hot-removable.

- Removing an MX5, MX10, MX40, and MX80 Transceiver on page 136
- Installing an MX5, MX10, MX40, and MX80 Transceiver on page 138

Removing an MX5, MX10, MX40, and MX80 Transceiver

Removing an SFP or XFP transceiver does not interrupt MIC functioning, but the removed SFP or XFP no longer receives or transmits data.

To remove an SFP or XFP transceiver (see Figure 58 on page 137):

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 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.

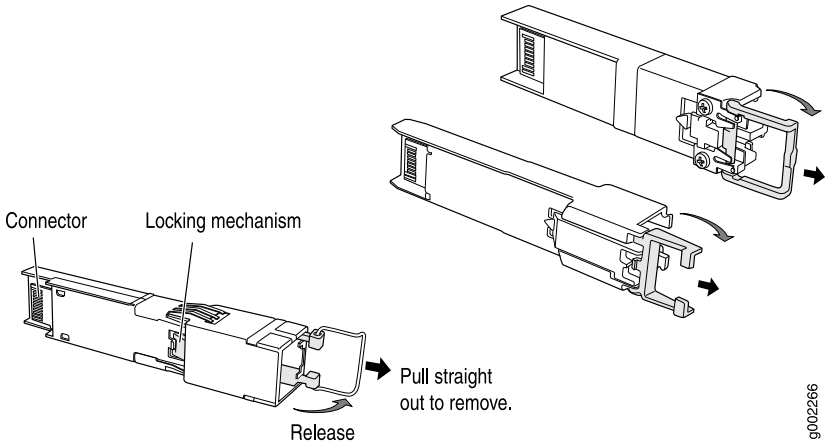
4. Remove the cable connector from the transceiver.
5. Pull the ejector handle out from the transceiver to unlock the transceiver.

CAUTION: Make sure that you open the ejector handle completely until you hear it click. This prevents damage to the transceiver.

Use needlenose pliers to pull the ejector handle out from the transceiver.

6. Grasp the transceiver ejector handle, and pull the transceiver approximately 0.5 in. (1.3 cm) out of the MIC.
7. Using your fingers, grasp the body of the transceiver, and pull it the rest of the way out of the MIC.

Figure 58: Removing SFPs or XFPs



8. Place a rubber safety cap over the transceiver.
9. 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 MX5, MX10, MX40, and MX80 Transceiver

To install an SFP or XFP:

1. Attach an 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

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Replacing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 132
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

CHAPTER 20

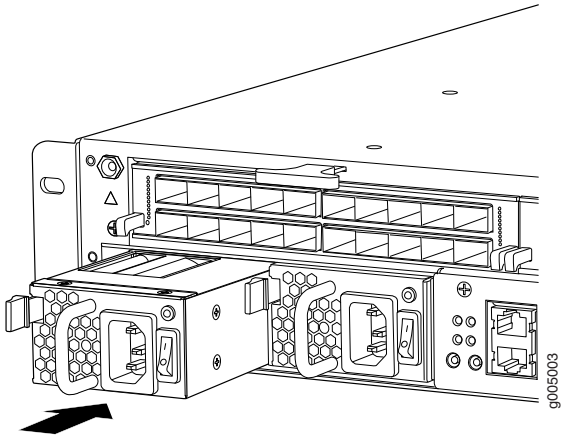
Replacing Power System Components

Installing an MX5, MX10, MX40, and MX80 AC Power Supply

To install an AC power supply (see Figure 59 on page 140):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.
3. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
4. Attach the power cord to the power supply.
5. Attach the power cord to the AC power source, and switch on the dedicated customer site circuit breaker. Follow the instructions for your site.
6. Move the AC input switch next to the appliance inlet on the power supply to the on (**|**) position and observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Figure 59: Installing an AC Power Supply



Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Removing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56
- AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 56
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Replacing an MX5, MX10, MX40, and MX80 AC Power Supply

Video: Replacing an MX5, MX10, MX40, and MX80 AC Power Supply

- Removing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- Installing an MX5, MX10, MX40, and MX80 AC Power Supply on page 141

Removing an MX5, MX10, MX40, and MX80 AC Power Supply

Before you remove a power supply, be aware of the following:

NOTE: The minimum number of power supplies must be present in the router at all times.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a

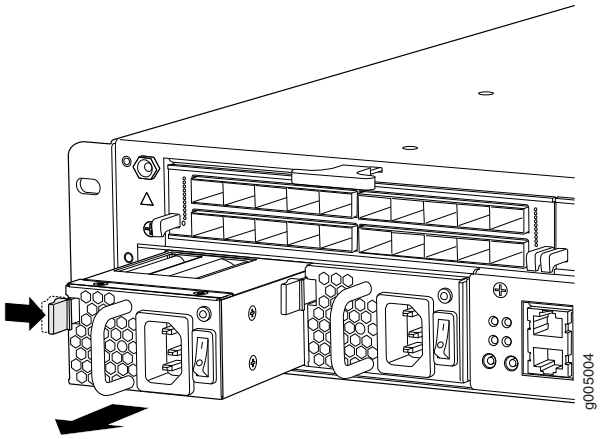
power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove an AC power supply (see Figure 60 on page 141):

1. Switch off the dedicated customer site circuit breaker for the power supply, and remove the power cord from the AC power source. Follow the instructions for your site.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.
4. Remove the power cord from the power supply.
5. Press the release latch on the left side of the power supply to disconnect the power supply from the chassis.
6. Pull the power supply straight out of the chassis.

Figure 60: Removing an AC Power Supply



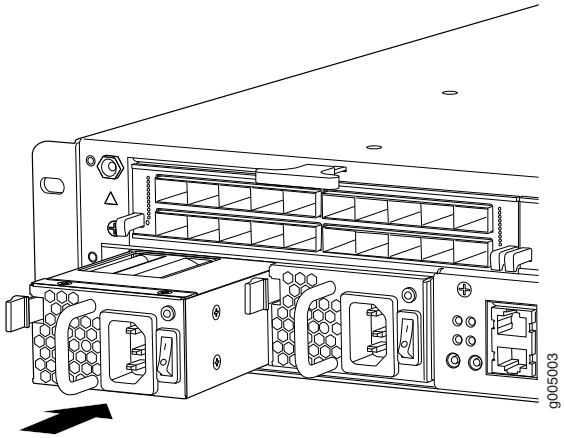
Installing an MX5, MX10, MX40, and MX80 AC Power Supply

To install an AC power supply (see Figure 59 on page 140):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.

3. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
4. Attach the power cord to the power supply.
5. Attach the power cord to the AC power source, and switch on the dedicated customer site circuit breaker. Follow the instructions for your site.
6. Move the AC input switch next to the appliance inlet on the power supply to the on (|) position and observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Figure 61: Installing an AC Power Supply



Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56
- AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers on page 56
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Replacing an MX5, MX10, MX40, and MX80 AC Power Supply Cord

- Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 143
- Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 143

Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord

To disconnect the AC power cord:

1. Switch off the dedicated customer site circuit breaker for the power supply, and remove the power cord from the AC power source. Follow the instructions for your site.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Move the AC input switch next to the appliance inlet on the power supply to the off (**O**) position.
4. Remove the power cord from the power supply.

Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord

To connect the AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographic location (see "AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers" on page 56).
2. Connect the power cord to the power supply.
3. Insert the power cord plug into an external AC power source receptacle.
4. Route the power cord appropriately. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.
5. Switch the AC input switch on the each power supply to the on (**|**) position, and observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Connecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord

To connect the AC power cord:

1. Locate a replacement power cord with the type of plug appropriate for your geographic location (see "AC Power Cord Specifications for MX5, MX10, MX40, and MX80 Routers" on page 56).
2. Connect the power cord to the power supply.
3. Insert the power cord plug into an external AC power source receptacle.
4. Route the power cord appropriately. Verify that the power cord does not block the air exhaust and access to router components, or drape where people could trip on it.
5. Switch the AC input switch on the each power supply to the on (**|**) position, and observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Installing an MX5, MX10, MX40, and MX80 AC Power Supply on page 139
- Disconnecting an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 143
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53
- AC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Router on page 56
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192

Installing an MX5, MX10, MX40, and MX80 DC Power Supply

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.**

To install a DC power supply (see Figure 62 on page 146):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Switch the DC circuit breaker on the DC power supply faceplate to the off (**O**) position.
4. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
5. Remove the clear plastic cover protecting the terminal on the faceplate.
6. Remove the screws from the terminals.
7. Secure each power cable lug to the terminal with the screw (see Figure 63 on page 146). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
   a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
   b. Secure 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 screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque**

to the screw when improperly threaded may result in damage to the terminal.

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

NOTE: For information about connecting to DC power sources, see "MX5, MX10, MX40, and MX80 Routers DC Power Specifications" on page 59.

8. Replace the clear plastic cover over the terminals on the faceplate.
9. Verify that the power cabling is correct, that the cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.
10. On each of the DC power supplies, 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 (O) position if you move the breaker too quickly.

NOTE: If more than one power supply is being installed, turn on all power supplies at the same time.

Figure 62: Installing a DC Power Supply

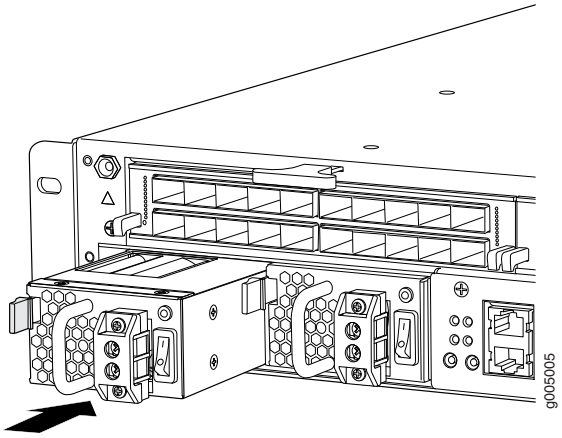
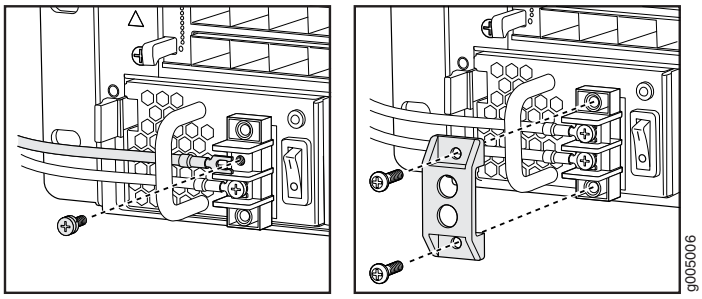


Figure 63: Connecting the DC Power Cables



Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Removing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

Replacing an MX5, MX10, MX40, and MX80 DC Power Supply

- Removing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- Installing an MX5, MX10, MX40, and MX80 DC Power Supply on page 148

Removing an MX5, MX10, MX40, and MX80 DC Power Supply

Before you remove a power supply, be aware of the following:

NOTE: The minimum number of power supplies must be present in the router at all times.

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.

CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a DC power supply (see Figure 64 on page 148):

1. Switch off the dedicated customer site circuit breaker for the power supply 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 status LED on the power supply is not lit.
4. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
5. Move the DC circuit breaker on the DC power supply faceplate to the off (**O**) position.
6. Remove the clear plastic cover protecting the terminal studs on the faceplate (see Figure 65 on page 148).
7. Remove the screw from each of the terminals. (Use a number 2 Phillips screwdriver.)
8. Remove the cable lugs from the terminals.
9. Carefully move the power cables out of the way.
10. Press the latch located on the left side of the power supply, to release it from the chassis.
11. Pull the power supply straight out of the chassis.

Figure 64: Removing a DC Power Supply

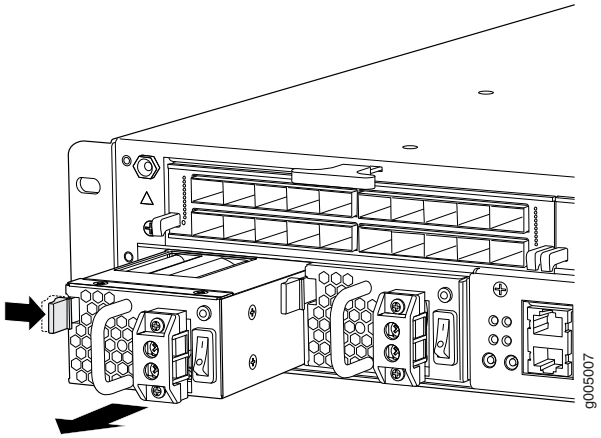
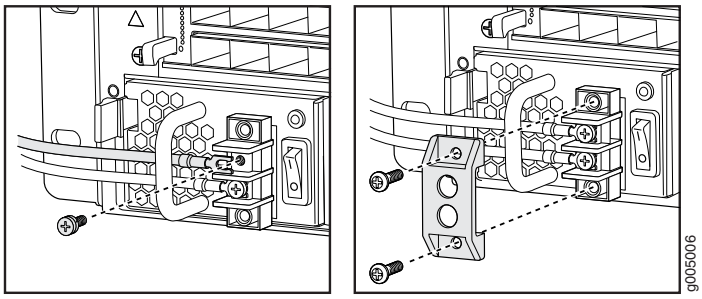


Figure 65: Disconnecting the DC Power Cables



Installing an MX5, MX10, MX40, and MX80 DC Power Supply

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.

To install a DC power supply (see Figure 62 on page 146):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Switch the DC circuit breaker on the DC power supply faceplate to the off (**O**) position.
4. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
5. Remove the clear plastic cover protecting the terminal on the faceplate.

6. Remove the screws from the terminals.
7. Secure each power cable lug to the terminal with the screw (see Figure 63 on page 146). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)
   a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
   b. Secure 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 screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded may result in damage to the terminal.

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

NOTE: For information about connecting to DC power sources, see "MX5, MX10, MX40, and MX80 Routers DC Power Specifications" on page 59.

8. Replace the clear plastic cover over the terminals on the faceplate.
9. Verify that the power cabling is correct, that the cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.
10. On each of the DC power supplies, 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 (O) position if you move the breaker too quickly.

NOTE: If more than one power supply is being installed, turn on all power supplies at the same time.

Figure 66: Installing a DC Power Supply

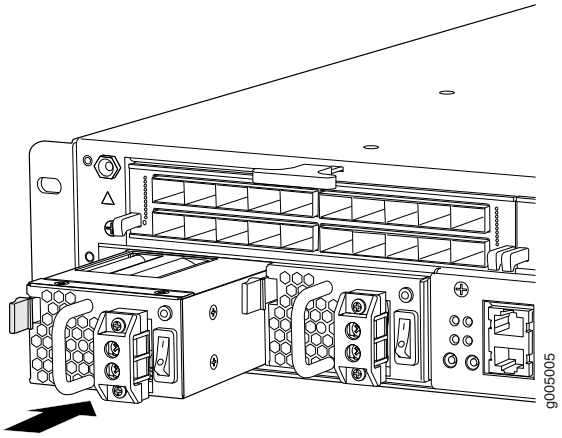
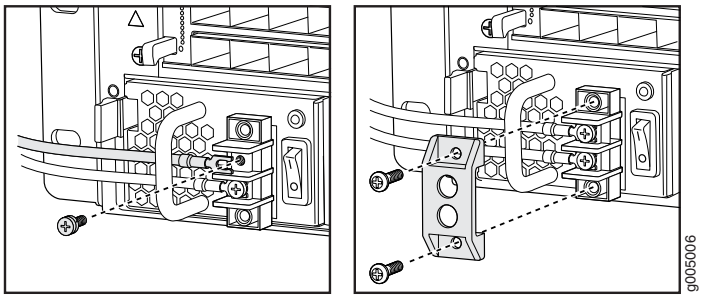


Figure 67: Connecting the DC Power Cables



Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

Replacing an MX5, MX10, MX40, and MX80 DC Power Supply Cable

- Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 151
- Connecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 151

Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable

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.**

To disconnect a power cable for a DC power supply:

1. Switch off the dedicated customer site circuit breaker for the power supply 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 status LED on the power supply is not lit.
4. Remove the power cable from the external DC power source.
5. Attach an 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 DC power supply faceplate to the off (**O**) position.
7. Remove the clear plastic cover protecting the terminal studs on the faceplate.
8. Remove the screw from each of the terminals. (Use a number 2 Phillips screwdriver.)
9. Remove the cable lugs from the terminals.
10. Carefully move the power cables out of the way.

Connecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable

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.**

To connect a power cable for a DC power supply:

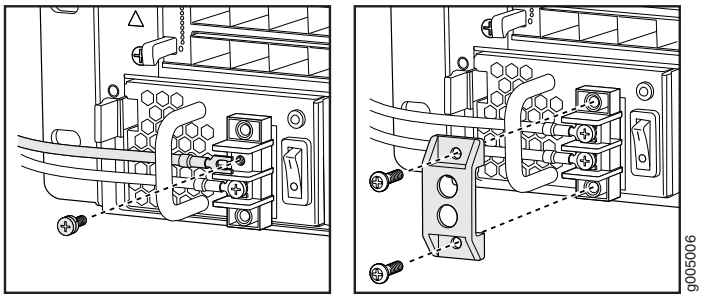
1. Locate a replacement power cable that meets the specifications.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the status LED is off.

4. Secure each power cable lug to the terminal with the screw (see Figure 68 on page 152). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)

CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded may result in damage to the terminal.

CAUTION: The maximum torque rating of the terminal screws on the DC power supply is 6 lb-in. (0.7 Nm). The terminal screws may be damaged if excessive torque is applied. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately-sized driver, with a maximum torque capacity of 6 lb-in. or less. 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.

Figure 68: Connecting Power Cables to the DC Power Supply



5. 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.
6. Replace the clear plastic cover over the terminals on the faceplate.
7. Attach the power cable to the DC power source.
8. Turn on the dedicated customer site circuit breaker to the power supply.
9. Verify that the status LED on the power supply is lit green steadily.
10. On each of the DC power supplies, 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 (O) position if you move the breaker too quickly.

Observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Connecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable

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.

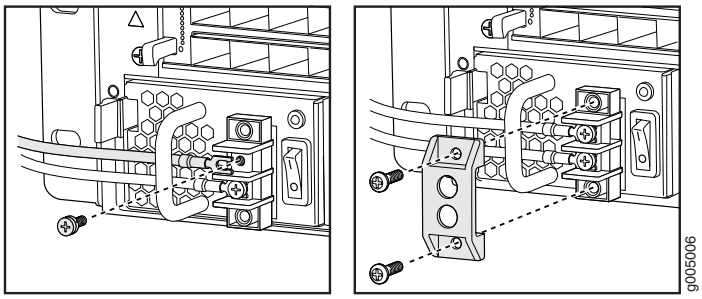
To connect a power cable for a DC power supply:

1. Locate a replacement power cable that meets the specifications.
2. Verify that a licensed electrician has attached a cable lug to the replacement power cable.
3. Verify that the status LED is off.
4. Secure each power cable lug to the terminal with the screw (see Figure 68 on page 152). Apply between 5 lb-in. (0.6 Nm) and 6 lb-in. (0.7 Nm) of torque to screw. Do not overtighten the nut. (Use a number 2 Phillips screwdriver.)

CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the screws. Ensure that each screw is properly threaded into the terminal. Applying installation torque to the screw when improperly threaded may result in damage to the terminal.

CAUTION: The maximum torque rating of the terminal screws on the DC power supply is 6 lb-in. (0.7 Nm). The terminal screws may be damaged if excessive torque is applied. Use only a torque-controlled driver to tighten screws on the DC power supply terminals. Use an appropriately-sized driver, with a maximum torque capacity of 6 lb-in. or less. 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.

Figure 69: Connecting Power Cables to the DC Power Supply



5. 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.
6. Replace the clear plastic cover over the terminals on the faceplate.
7. Attach the power cable to the DC power source.
8. Turn on the dedicated customer site circuit breaker to the power supply.
9. Verify that the status LED on the power supply is lit green steadily.
10. On each of the DC power supplies, 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 (O) position if you move the breaker too quickly.**

Observe the status LED on the power supply faceplate. If the power supply is correctly installed and functioning normally, the status LED lights green steadily.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Installing an MX5, MX10, MX40, and MX80 DC Power Supply on page 144
- Disconnecting an MX5, MX10, MX40, and MX80 DC Power Supply Cable on page 151
- Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 Router on page 192
- MX5, MX10, MX40, and MX80 Routers DC Power Specifications on page 59
- DC Power Circuit Breaker Requirements for the MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Source Cabling for MX5, MX10, MX40, and MX80 Routers on page 62
- DC Power Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 63

PART 5

Maintaining the Chassis and Components

CHAPTER 21

Maintaining Components

Tools and Parts Required to Maintain MX5, MX10, MX40, and MX80 Routers

To maintain hardware components, you need the following tools and parts:

- ESD grounding wrist strap

Related Documentation

- Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers on page 157

Routine Maintenance Procedures for MX5, MX10, MX40, and MX80 Routers

Purpose For optimum router performance, perform preventive maintenance procedures.

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 font panel—System alarms and LEDs.

Related Documentation

- Tools and Parts Required to Maintain MX5, MX10, MX40, and MX80 Routers on page 157
- Maintaining the MX5, MX10, MX40, and MX80 Air Filter on page 158
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161

- Maintaining the MX5, MX10, MX40, and MX80 Routing Engine on page 162

Maintaining the MX5, MX10, MX40, and MX80 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

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Replacing an MX5, MX10, MX40, and MX80 Air Filter on page 116

Maintaining the MX5, MX10, MX40, and MX80 Fan Tray

Purpose For optimum cooling, verify the condition of the fans.

Action

- Monitor the status of the fans. A fan tray contains multiple fans that work in unison to cool the router components. If one fan fails, the router adjusts the speed of the remaining fans to maintain proper cooling. A red alarm is triggered when a fan fails, and a yellow alarm and red alarm are triggered when a fan tray is removed.
- To display the status of the cooling system, issue the **show chassis environment** command. The output is similar to the following:

```
user@host> show chassis environment
Class Item                          Status     Measurement
Temp  PEM 0                           OK        45 degrees C / 113 degrees F
      PEM 1                           OK        45 degrees C / 113 degrees F
      RE 0 Intake                     OK        33 degrees C / 91 degrees F
      RE 0 Front Exhaust              OK        38 degrees C / 100 degrees F
      RE 0 Rear Exhaust               OK        38 degrees C / 100 degrees F
      Routing Engine                  OK        33 degrees C / 91 degrees F
      Routing Engine CPU              OK        54 degrees C / 129 degrees F
      TFEB 0 QX 0 TSen                OK        44 degrees C / 111 degrees F
      TFEB 0 QX 0 Chip                OK        47 degrees C / 116 degrees F
      TFEB 0 LU 0 TSen                OK        44 degrees C / 111 degrees F
      TFEB 0 LU 0 Chip                OK        50 degrees C / 122 degrees F
      TFEB 0 MQ 0 TSen                OK        44 degrees C / 111 degrees F
```

```
      TFEB 0 MQ 0 Chip            OK          49 degrees C / 120 degrees F
      TFEB 0 TBB PFE TSen         OK          37 degrees C / 98 degrees F
      TFEB 0 TBB PFE Chip         OK          50 degrees C / 122 degrees F
      TFEB 0 TFEB PCIE TSen       OK          45 degrees C / 113 degrees F
      TFEB 0 TFEB PCIE Chip       OK          68 degrees C / 154 degrees F
Fans  Fan 1                       OK          Spinning at intermediate-speed
      Fan 2                       OK          Spinning at intermediate-speed
      Fan 3                       OK          Spinning at intermediate-speed
      Fan 4                       OK          Spinning at intermediate-speed
      Fan 5                       OK          Spinning at intermediate-speed
```

Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 167
- Replacing an MX5, MX10, MX40, and MX80 Fan Tray on page 119
- *show chassis environment*

Maintaining the MX5, MX10, MX40, and MX80 MICs

Purpose For optimum router performance, verify the condition of the 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 router detects a MIC failure, the router generates an alarm message to be sent to the Routing Engine.
- Issue the CLI **show chassis fpc pic-status** command. The MIC slots in the MX5, MX10, MX40, and modular MX80 router are numbered **1/MIC 0** and **1/MIC 1**. The fixed MIC is numbered **0/MIC 0**.

```
user@host> show chassis fpc pic-status
Slot 0   Online
  PIC 0  Online       4x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 1   Online
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- MX5, MX10, MX40, and MX80 Modular Interface Card LEDs on page 33
- Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs on page 160
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126
- *show chassis fpc*

Maintaining Cables That Connect to MX5, MX10, MX40, and MX80 MICs

Purpose For optimum router performance, verify the condition of the cables that connect to the MICs.

Action On a regular basis:

- Use the cable management bracket to support cables and prevent cables from dislodging or developing stress points.
- Place excess cable out of the way in the cable management bracket. Do not allow fastened loops of cable to dangle from the connector or cable management bracket, 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

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- MX5, MX10, MX40, and MX80 Modular Interface Card LEDs on page 33
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Replacing a Cable on an MX5, MX10, MX40, and MX80 MIC on page 132

Maintaining the MX5, MX10, MX40, and MX80 Power Supplies

Purpose For optimum router performance, verify the condition of the power supplies.

Action On a regular basis:

- Check the status of the power supplies by issuing the **show chassis environment pem** command. The output is similar to the following:

```
user@host> show chassis environment pem
PEM 0 status:
  State                       Online
  Temperature                 OK
  DC Output:                  OK
PEM 1 status:
  State                       Online
  Temperature                 OK
  DC Output:                  OK
```

- 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 power supply faceplates and the front panel to determine if the power supplies are functioning normally.
- Check the alarm LEDs on the front panel. Power supply 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 **show chassis alarms** command:

```
user@host> show chassis alarms
1 alarm currently active
Alarm time               Class  Description
2010-02-03 13:46:31 PST  Major  PEM 0 Not OK
```

- 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

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- MX5, MX10, MX40, and MX80 Power Supply LED on page 38
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168
- *show chassis environment pem*
- *show chassis alarms*

Maintaining the MX5, MX10, MX40, and MX80 Routing Engine

Purpose On the MX5, MX10, MX40, and MX80 router, the Routing Engine is fixed inside the chassis. For optimum router performance, verify the condition of the Routing Engine.

Action On a regular basis:

- Check the LEDs on the front panel to view information about the status of the Routing Engine.
- To check the status of the Routing Engine, issue the **show chassis routing-engine** command. The output is similar to the following:

```
user@host> show chassis routing-engine
Routing Engine status:
    Temperature                 34 degrees C / 93 degrees F
    CPU temperature             52 degrees C / 125 degrees F
    DRAM                      2048 MB
    Memory utilization          18 percent
    CPU utilization:
      User                       1 percent
      Background                 0 percent
      Kernel                     3 percent
      Interrupt                  1 percent
      Idle                      95 percent
    Model                       RE-MX80
    Start time                  2010-02-05 10:05:17 PST
    Uptime                      18 minutes, 59 seconds
    Last reboot reason          Router rebooted after a normal shutdown.
    Load averages:              1 minute   5 minute  15 minute
                                    0.00       0.02       0.07
```

Related Documentation

- MX5, MX10, MX40, and MX80 Routing Engine Description on page 21
- Routing Engine Interface Cable Specifications for MX5, MX10, MX40, and MX80 Routers on page 76
- *show chassis routing-engine*

PART 6

Troubleshooting

CHAPTER 22

Troubleshooting Components

Troubleshooting Resources for MX5, MX10, MX40, and MX80 Routers

Command-Line Interface

The Junos OS command-line interface (CLI) is the primary tool for controlling and troubleshooting router hardware, the Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the **ping** and **traceroute** utilities.

You enter CLI commands on one or more external management devices connected to ports on the front panel.

For information about using the CLI to troubleshoot the Junos OS, see the appropriate Junos OS configuration guide.

Chassis and Interface Alarm Messages

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

```
user@host> show chassis alarms
```

There are two classes of alarm messages:

- Chassis alarms—Indicate a problem with a chassis component such as the cooling system or power supplies.

- Interface alarms—Indicate a problem with a specific network interface.

Front Panel LEDs

The front panel on the router contains LEDs and buttons that allow you to troubleshoot the router.

LEDs on the front panel include the following:

- Alarm LEDs—Two LEDs located on the left side of the front panel indicate critical and warning alarms on the router. The circular LED lights red to indicate a critical condition that can result in a system shutdown. The triangular LED lights yellow to indicate a less severe condition that requires monitoring or maintenance.
- System LED—One LED on the left side of the front panel indicates the status of the router. The LED is located below the **SYS OK** label. The LED lights steadily green when the router is functioning normally and blinks green when the router is transitioning online.
- Routing Engine LED—One bicolor LED on the left side of the front panel indicates the status of the Routing Engine. The LED is located below the **RE** label. The LED is lit steadily green when the Routing Engine is functioning normally and is lit red when the Routing Engine has failed.
- Link LEDs—Four LEDs, labeled **LINK**, indicate the status of the ports for the fixed 10-Gigabit Ethernet MIC. The LED is green when the link is up, and is off when there is no link. The **LINK** LEDs are located to the right of the port on the front panel.

Component LEDs

The following LEDs are located on various router components and display the status of those components:

- MIC LEDs—One LED, labeled **OK/FAIL**, on each MIC faceplate indicates the MIC's status. For more information, see the *MX Series Interface Module Reference*. On the fixed MX80 router, each RJ-45 port has an additional link LED. The LED is green when the link is up and is off when there is no link.
- Power supply LEDs—One bicolor LED, on each power supply faceplate indicates the status of that power supply. The LED is lit blue when the power supply is functioning normally and is blinking red when the power supply has failed.

Related Documentation

- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 167
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168
- *ping*
- *traceroute*
- *show chassis alarms*

Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray

Problem **Description:** The fans in the fan tray are not functioning normally.

Solution Follow these guidelines to troubleshoot the fans:

- Check the alarm LEDs on the front panel.
- Issue the **show chassis fan** command to get status information about the fans.

```
user@host> show chassis fan
      Item                      Status   RPM     Measurement
      Fan 1                     OK       4560    Spinning at intermediate-speed
      Fan 2                     OK       4560    Spinning at intermediate-speed
      Fan 3                     OK       4560    Spinning at intermediate-speed
      Fan 4                     OK       4560    Spinning at intermediate-speed
      Fan 5                     OK       4560    Spinning at intermediate-speed
```

- If the red alarm LED on the front panel lights, issue the **show chassis alarms** command to get information about the source of an alarm condition.

  If the CLI output lists only one fan failure, and the other fans are functioning normally, the fan is most likely faulty and you must replace the fan tray.
- Place your hand near the exhaust vents at the side of the chassis to determine whether the fans are pushing air out of the chassis.
- If a fan tray is removed, a yellow alarm and a red alarm occur.
- The following conditions automatically cause the fans to run at full speed and also trigger the indicated alarm:
  - A fan fails (red alarm).
  - The router temperature exceeds the “temperature warm” threshold (yellow alarm).
  - The temperature of the router exceeds the maximum “temperature hot” threshold (red alarm and automatic shutdown of the power supplies).

  To view the temperature threshold settings, issue the **show chassis temperature-thresholds** command.

```
user@host> show chassis temperature-thresholds
                         Fan speed        Yellow alarm         Red alarm
Item                   Normal   High    Normal   Bad fan    Normal   Bad fan
Chassis default            48     54        65        55        75        65
Routing Engine             55     60        75        65        85        70
```

Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Replacing an MX5, MX10, MX40, and MX80 Fan Tray on page 119
- *show chassis fan*
- *show chassis alarms*

- *show chassis temperature-thresholds*

Troubleshooting the MX5, MX10, MX40, and MX80 MICs

Problem **Description:** The MICs are not functioning normally.

Solution

- Check the status of each port on a MIC by looking at the LED located on the MIC faceplate. For information about the meaning of LED states on different MICs, see the *MX Series Interface Module Reference*.
- Check the status of a MIC by issuing the **show chassis fpc pic-status** CLI command. The MIC slots in the MX5, MX10, MX40, and modular MX80 router are labeled **1/MIC 0** and **1/MIC 1**. The fixed MIC is labeled **0/MIC 0**.

```
user@host> show chassis fpc pic-status
Slot 0   Online
  PIC 0  Online       4x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
Slot 1   Online
  PIC 0  Online       1x 10GE XFP
  PIC 1  Online       1x 10GE XFP
  PIC 2  Online       1x 10GE XFP
  PIC 3  Online       1x 10GE XFP
```

For further description of the output from the command, see the CLI Explorer.

Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126
- *show chassis fpc*

Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies

Problem **Description:** The power supply is not functioning normally.

Solution

- Check the LEDs on each power supply faceplate. If a power supply is correctly installed and functioning normally, the status LED on the power supply lights green steadily.
- Issue the CLI **show chassis environment pem** command to check the status of installed power supplies. As shown in the sample output, the value **Online** in the rows labeled **State** indicates that each of the power supplies is functioning normally:

```
user@host> show chassis environment pem
PEM 0 status:
  State                       Online
  Temperature                 OK
  DC Output:                  OK
PEM 1 status:
  State                       Online
```

```
Temperature                OK
DC Output:                 OK
```

- If a red alarm condition occurs, issue the **show chassis alarms** command to determine the source of the problem.
- If all power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down.

NOTE: If the system temperature exceeds the threshold, the Junos OS shuts down all power supplies so that no status is displayed.

The Junos OS also can shut down one of the power supplies for other reasons. In this case, the remaining power supplies provide power to the router, and you can still view the system status through the CLI or display.

- Check that the AC input switch or DC circuit breaker is in the on (**|**) position and is receiving power.
- Verify that the source circuit breaker has the proper current rating. Each power supply must be connected to a separate source circuit breaker.
- Verify that the AC power cord or DC power cables from the power source to the router are not damaged. If the insulation is cracked or broken, immediately replace the cord or cable.
- Connect the power supply to a different power source with a new power cord or power cables. If the power supply status LED indicates that the power supply is not operating normally, the power supply is the source of the problem. Replace the power supply with a spare.

Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- MX5, MX10, MX40, and MX80 Power Supply LED on page 38
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- *show chassis environment pem*
- *show chassis alarms*

PART 7

Contacting Customer Support and Returning the Chassis or Components

CHAPTER 23

Contacting Customer Support

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 181

CHAPTER 24

Locating Component Serial Numbers

Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the router or component. To display all of the router components and their serial numbers, enter the following command-line interface (CLI) command:

```
user@host> show chassis hardware
Hardware inventory:
Item             Version  Part number  Serial number     Description
Chassis                                                  MX80
Midplane         REV 01   711-031594   JR6922            MX80
Routing Engine            BUILTIN      BUILTIN           Routing Engine
TFEB 0                    BUILTIN      BUILTIN           Forwarding Engine
Processor
  QXM 0          REV 05   711-028408   JR6848            MPC QXM
FPC 0                     BUILTIN      BUILTIN           MPC BUILTIN
  MIC 0                   BUILTIN      BUILTIN           4x 10GE XFP
    PIC 0                 BUILTIN      BUILTIN           4x 10GE XFP
      Xcvr 0     REV 01   740-014289   AD0932M007L       XFP-10G-SR
      Xcvr 1     REV 01   740-014289   AD0932M009M       XFP-10G-SR
      Xcvr 2     REV 01   740-014289   AD0932M005N       XFP-10G-SR
      Xcvr 3     REV 01   740-014279   K9J02T2           XFP-10G-LR
  MIC 1          REV 02   750-028380   JR6552            3D 2x 10GE XFP
    PIC 2                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 01   740-014289   98S803A90363      XFP-10G-SR
    PIC 3                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 01   740-014289   98S803A90259      XFP-10G-SR
FPC 1                     BUILTIN      BUILTIN           MPC BUILTIN
  MIC 0          REV 02   750-028380   JG8544            3D 2x 10GE XFP
    PIC 0                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 01   740-014289   98S803A90421      XFP-10G-SR
    PIC 1                 BUILTIN      BUILTIN           1x 10GE XFP
      Xcvr 0     REV 01   740-014289   98S803A90260      XFP-10G-SR
  MIC 1          REV 02   750-028380   JR6544            3D 2x 10GE XFP
    PIC 2                 BUILTIN      BUILTIN           1x 10GE XFP
```

```
    Xcvr 0      REV 01   740-014279   K9J03BF           XFP-10G-LR
  PIC 3                  BUILTIN      BUILTIN           1x 10GE XFP
    Xcvr 0      REV 01   740-014279   K9J02UB           XFP-10G-LR
Fan Tray                                                Fan Tray
```

Most components also have a small rectangular serial number ID label (see Figure 70 on page 176) attached to the component body.

Figure 70: Serial Number ID Label

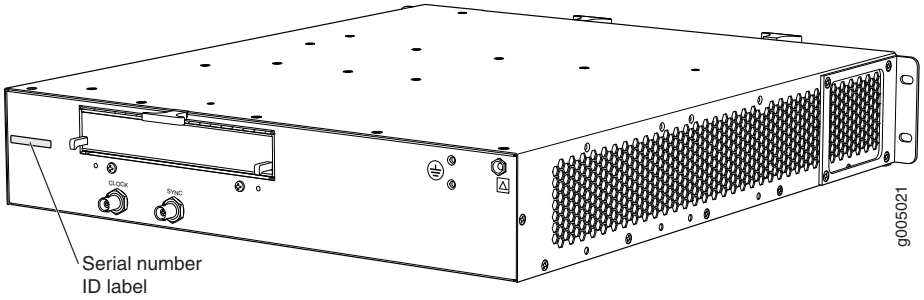
Related Documentation

- MX5, MX10, MX40, and MX80 Chassis Serial Number Label on page 176
- MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label on page 176
- MX5, MX10, MX40, and MX80 MIC Serial Number Label on page 178
- MX5, MX10, MX40, and MX80 Power Supply Serial Number Label on page 179
- Contacting Customer Support on page 173
- Returning a Hardware Component to Juniper Networks, Inc. on page 181

MX5, MX10, MX40, and MX80 Chassis Serial Number Label

The chassis serial number is located on the rear of the chassis (see Figure 71 on page 176).

Figure 71: MX5, MX10, MX40, and MX80 Chassis Serial Number Label



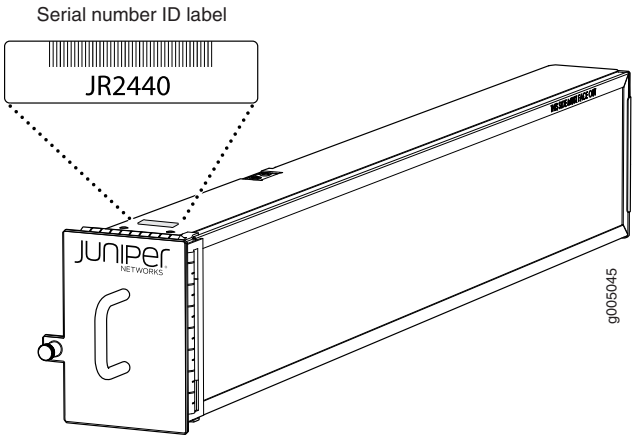
Related Documentation

- MX5, MX10, MX40, and MX80 Chassis Description on page 9
- Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers on page 175
- Contacting Customer Support on page 173
- Returning a Hardware Component to Juniper Networks, Inc. on page 181

MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label

The serial number label is located on the top of the fan tray toward the front (see Figure 72 on page 177).

Figure 72: MX5, MX10, MX40, and MX80 Fan Tray Serial Number Label



Related Documentation

- MX5, MX10, MX40, and MX80 Cooling System Description on page 19
- Maintaining the MX5, MX10, MX40, and MX80 Fan Tray on page 158
- Troubleshooting the MX5, MX10, MX40, and MX80 Fan Tray on page 167
- Replacing an MX5, MX10, MX40, and MX80 Fan Tray on page 119
- Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers on page 175
- Contacting Customer Support on page 173
- Returning a Hardware Component to Juniper Networks, Inc. on page 181

MX5, MX10, MX40, and MX80 MIC Serial Number Label

The exact location may be slightly different on different MICs, depending on the placement of components on the MIC board (see Figure 73 on page 178, Figure 74 on page 178, and Figure 75 on page 179).

Figure 73: 20-Port MIC Serial Number Label

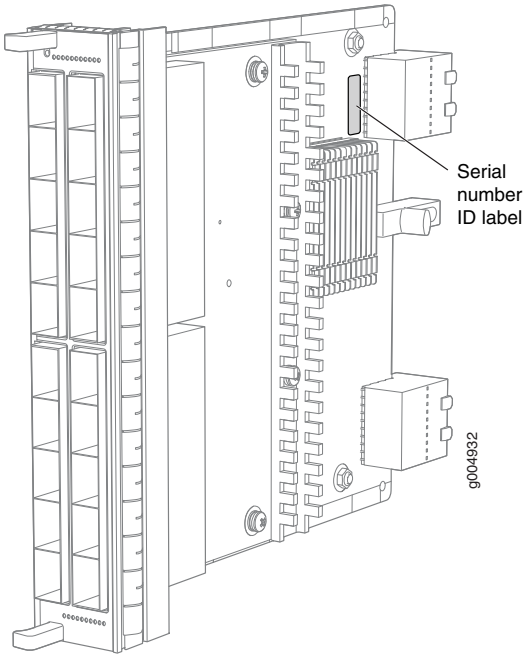


Figure 74: 40-Port MIC Serial Number Label

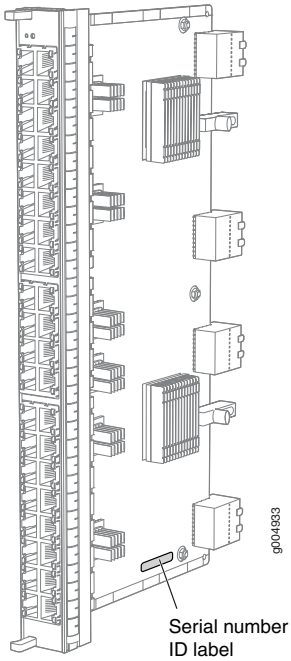
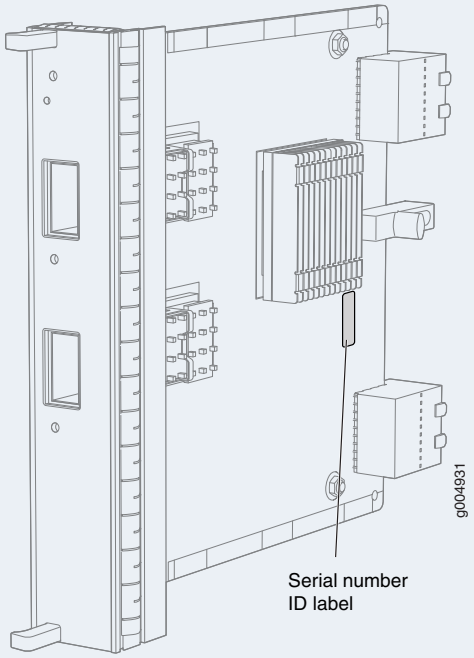


Figure 75: 2-Port MIC Serial Number Label



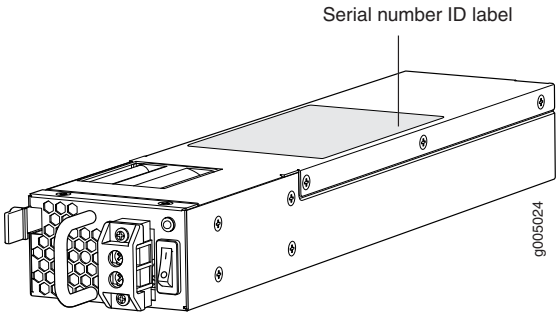
Related Documentation

- MX5, MX10, MX40, and MX80 Modular Interface Card Description on page 23
- Maintaining the MX5, MX10, MX40, and MX80 MICs on page 159
- Troubleshooting the MX5, MX10, MX40, and MX80 MICs on page 168
- Replacing an MX5, MX10, MX40, and MX80 MIC on page 126
- Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers on page 175
- Contacting Customer Support on page 173
- Returning a Hardware Component to Juniper Networks, Inc. on page 181

MX5, MX10, MX40, and MX80 Power Supply Serial Number Label

The serial number label is located on the top of the power supply (see Figure 76 on page 180).

Figure 76: Power Supply Serial Number Label



Related Documentation

- MX5, MX10, MX40, and MX80 Power System Description on page 35
- Maintaining the MX5, MX10, MX40, and MX80 Power Supplies on page 161
- Troubleshooting the MX5, MX10, MX40, and MX80 Power Supplies on page 168
- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply on page 140
- Replacing an MX5, MX10, MX40, and MX80 DC Power Supply on page 146
- Displaying MX5, MX10, MX40, and MX80 Components and Serial Numbers on page 175
- Contacting Customer Support on page 173
- Returning a Hardware Component to Juniper Networks, Inc. on page 181

CHAPTER 25

Packing and Returning Components

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 will be 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) 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 173
- Guidelines for Packing Router Components for Shipment on page 182

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 181
- Contacting Customer Support on page 173

Packing MX5, MX10, MX40, and MX80 Routers for Shipment

To pack the router for shipment:

1. Retrieve the shipping box 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 Routing Engine, enter CLI operational mode and issue the following command to shut down the router software.

   ```
   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 CLI Explorer.
3. Attach an 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 pressing the AC input switch or DC circuit breaker for all power supplies 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. Remove the router from the rack. One person should grasp the router while a second person unscrews and removes the mounting screws from the rack. One lifter can then move the router to the shipping container.
9. Place the router in the shipping container.
10. Cover the router with an ESD bag and place the packing foam on top of and around the router.
11. Replace the accessory box on top of the packing foam.
12. Securely tape the box closed.
13. Write the RMA number on the exterior of the box to ensure proper tracking.

Related Documentation

- Returning a Hardware Component to Juniper Networks, Inc. on page 181
- Contacting Customer Support on page 173

PART 8

Safety and Compliance Information

CHAPTER 26

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 190
- Installation Safety Warnings for Juniper Networks Devices on page 198
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 209
- General Electrical Safety Warnings for Juniper Networks Devices on page 215

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 220

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 190

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 198
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 209
- General Electrical Safety Warnings for Juniper Networks Devices on page 215
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 220

Preventing Electrostatic Discharge Damage to an MX5, MX10, MX40, and MX80 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 from 1 to 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 electrostatic discharge points on the chassis (see Figure 77 on page 192).
- 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 78 on page 193). If you are returning a component, place it in an electrostatic bag before packing it.

Figure 77: ESD Points on the MX5, MX10, MX40, and MX80 Chassis

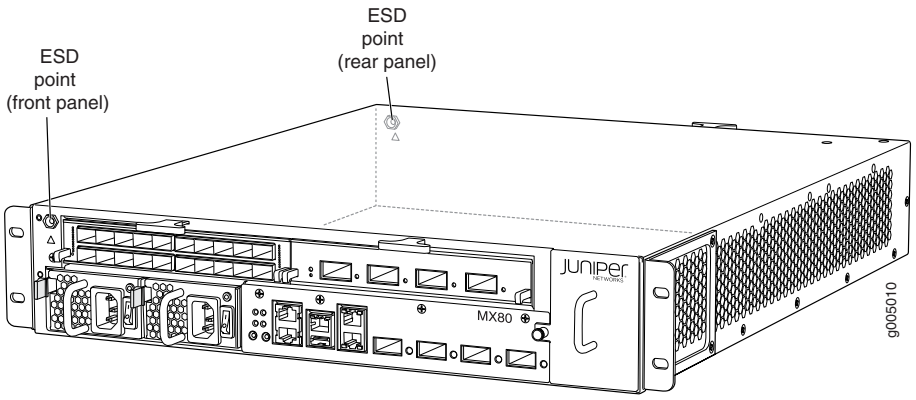
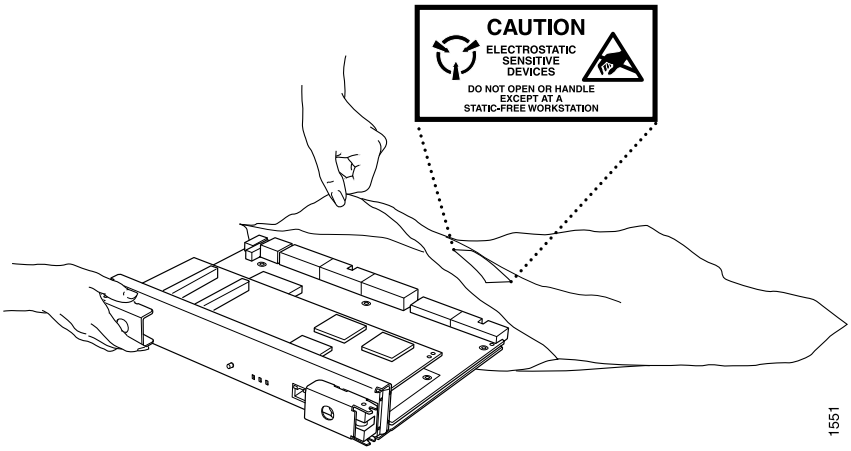


Figure 78: Placing a Component into an Electrostatic Bag



Related Documentation

- Grounding MX5, MX10, MX40, and MX80 Routers on page 96
- MX5, MX10, MX40, and MX80 Router Grounding Specifications on page 43

CHAPTER 27

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 189
- General Safety Warnings for Juniper Networks Devices on page 190
- General Electrical Safety Warnings for Juniper Networks Devices on page 215
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 220

CHAPTER 28

Installation Safety Guidelines and Warnings

MX5, MX10, MX40 and MX80 Chassis Lifting Guidelines

The weight of a fully configured chassis is about 30 lb (13.6 kg). Observe the following guidelines for lifting and moving the router:

- Before moving the router, read the guidelines in "MX5, MX10, MX40, and MX80 Site Preparation Checklist" on page 44 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Before lifting or moving the router, disconnect all external cables.

  To lift routing devices and components, use the following lifting guidelines:

  - Up to 39.7 lb (18 kg): One person.
  - 39.7 lb (18 kg) to 70.5 lb (32 kg): Two or more people.
  - 70.5 lb (32 kg) to 121.2 lb (55 kg): Three or more people.
  - Above 121.2 lbs (55 kg): Material handling systems (such as levers, slings, lifts and so on) must be used. When this is not practical, specially trained persons or systems must be used (riggers or movers).
- As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

Related Documentation

- MX5, MX10, MX40, and MX80 Site Preparation Checklist on page 44
- Installing MX5, MX10, MX40, and MX80 Chassis in the Rack on page 93
- General Safety Guidelines for Juniper Networks Devices on page 189
- General Safety Warnings for Juniper Networks Devices on page 190
- Installation Safety Warnings for Juniper Networks Devices on page 198

Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

Intra-Building Ports Warning

WARNING: The intra-building ports of the equipment or subassembly are suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building 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 intra-building 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 189

CHAPTER 29

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 205
- General Safety Warnings for Juniper Networks Devices on page 190

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 189
- General Safety Warnings for Juniper Networks Devices on page 190
- Installation Safety Warnings for Juniper Networks Devices on page 198

CHAPTER 30

Maintenance and Operational Safety 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 40° C. Per evitare che la circolazione dell'aria sia impedita, lasciate uno spazio di almeno 15.2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i router Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104° F). Sørg for at klaringen rundt lufteåpningene er minst 15,2 cm (6 tommer) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador router, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie router se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Varning! Förhindra att en router överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this 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 189
- General Safety Warnings for Juniper Networks Devices on page 190

CHAPTER 31

Electrical Safety Guidelines and Warnings

In Case of an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.
2. Disconnect power from the router.
3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, then call for help.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 189
- General Safety Warnings for Juniper Networks Devices on page 190

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 220

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 on page 215

AC Power Electrical Safety Guidelines and Warnings for MX5, MX10, MX40, and MX80 Routers

The following electrical safety guidelines apply to an AC-powered router:

- You can order three-wire electrical cords with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding should comply with local and national electrical codes.
- You must provide an external listed circuit breaker rated minimum 15 A (110 VAC) for each AC power supply.
- The cores in the mains lead are colored in accordance with the following code:
  - Green and yellow—Earth
  - Blue—Neutral
  - Brown—Live

WARNING: The attached power cable is only for this product. Do not use the cable for another product.

The power cable warning in Japanese is as follows:

注意

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

g017253

Related Documentation

- Replacing an MX5, MX10, MX40, and MX80 AC Power Supply Cord on page 142
- MX5, MX10, MX40, and MX80 Routers AC Power Specifications on page 53

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 221
- DC Power Disconnection Warning on page 221
- DC Power Wiring Terminations Warning on page 222

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 should be the appropriate size for the wires and should 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 190
- General Electrical Safety Warnings for Juniper Networks Devices on page 215

MX5, MX10, MX40, and MX80 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 13 A @ –48 VDC per input for each power supply. We recommend that the 48-VDC facility DC source should be equipped with a circuit breaker rated at 13 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 percent of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada.
- Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 13 A.
- 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.
- A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

  NOTE: **Primary overcurrent protection is provided by the building circuit breaker. This breaker 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.

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 189
- General Safety Warnings for Juniper Networks Devices on page 190

CHAPTER 32

Agency Approvals and Compliance Statements

Agency Approvals for MX5, MX10, MX40, and MX80 Routers

The MX5, MX10, MX40, and MX80 routers comply with the following standards:

- Safety
  - CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
  - UL 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements
  - EN 60950-1 European Norm, Safety of Information Technology Equipment

  - IEC 60950-1 Information Technology Equipment - Safety - Part 1: General Requirements (with country deviations)
  - EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EMC
  - EN 300 386 V1.3.3 Telecom Network Equipment - EMC Requirements
- EMI
  - FCC Part 15 Class A USA Radiated Emissions
  - EN 55022 Class A European Radiated Emissions
  - VCCI Class A Japanese Radiated Emissions
- Immunity
  - EN 55024 Information Technology Equipment Immunity Characteristics
  - 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 Conducted Disturbances Immunity
  - EN-61000-4-11 Voltage Dips and Sags

The router is designed to comply with the following standards:

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

Compliance Statements for NEBS for MX5, MX10, MX40, and MX80 Routers

- 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 (i.e. DC-I), as defined in GR-1089-CORE.
- For Juniper systems with AC power supplies, an external surge protective device (SPD) must be used at the AC power source.

Compliance Statements for EMC Requirements for MX5, MX10, MX40, and MX80 Routers

Canada

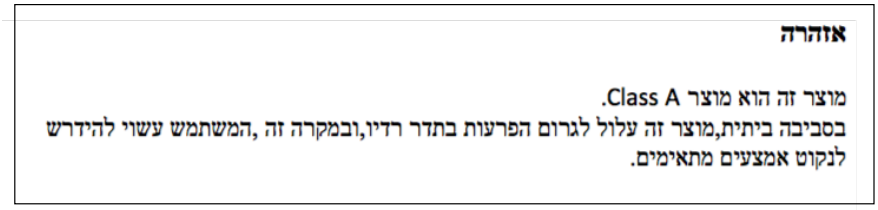
This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Community

This is a Class A product.

Israel



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

Japan

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

The preceding translates as follows:

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

United States

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide

reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, 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

Compliance Statements for Acoustic Noise for MX5, MX10, MX40, and MX80 Routers

- The emitted sound pressure is 70 dB(A) or less as per EN ISO 7779.
- Maschinenlärminformations-Verordnung - 3. GPSGV, der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäss EN ISO 7779